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FY 98 Project Proposals

Exxon Valdez Oil Spill Trustee Council

645 G Street, Suite 401, Anchorage, AK 99501-3451 907/278-8012 fax: 907/276-7178

MEMORANDUM

TO: Restoration Work Force
Coordinating Committee
Sherri Buretta and Eleanor Huffines, PAG

FROM: Sandra Schubert, Project Coordinator Sandra

RE: FY 98 Restoration Proposals

DATE: April 18, 1997

This set of binders contains the Detailed Project Descriptions and detailed budgets submitted in response to the Trustee Council's FY 98 *Invitation to Submit Restoration Proposals*. In all, 118 proposals totaling $23.5 million were received.

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, the project title, and the name of the individual or organization that submitted the proposed project.

2. A list of all proposals by research 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 98, 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 97 projection of the amount of funding needed in FY 98 (this column is labeled "FY 98 Expected"). Please note **that funding requests from non-Trustee agencies were 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 reminder: The meeting of the Executive Director, agency liaisons, Restoration Work Force, Coordinating Committee, and two PAG members to develop the Draft Work Plan will be held in the Restoration Office (4th floor conference room) at **9:00 a.m. Wednesday, May 21.** An updated schedule of other important dates is attached.

Schedule for Development of FY 98 Work Plan
** INDICATES TENTATIVE DATE*

April 21, Monday	DHL DPDs to Chief Scientist and core reviewers
May 19, Monday	Distribute Executive Director's draft recommendation to RWF
May 21, Wednes.	RWF meeting: Finalize draft recommendation
May 26, Monday	Memorial Day
* May 28, Wednes.	PAG meeting: Advise on draft recommendation
June 4, Wednes.	Draft FY 98 Work Plan to printer
June 9, Monday	Draft FY 98 Work Plan mailed out
June 25, Wednes.	Revised DPDs and budgets due
July 4, Friday	Fourth of July
July 9, Wednesday	Chief Scientist's review of revised DPDs complete
July 15, Tuesday evening	Public meeting on Draft Work Plan (teleconference from Anchorage); close of public comment period
July 16, Wednes.	PAG meeting: Advise on final recommendation
July 17, Thursday	RWF meeting: Finalize recommendation
* Week of August 4	Trustee Council meet to approve FY 98 Work Plan

INDEX OF RESTORATION PROPOSALS FOR FY 98 - NUMERIC LISTING

Proj.No.	Project Title	Proposer
98001-CLO	Recovery of Harbor Seals From EVOS: Condition and Health Status	M. Castellini/UAF
98007A	Archaeological Index Site Monitoring	D. Reger/ADNR
98007B	Site Specific Archaeological Restoration	L. Yarborough/USFS
98007C	Archaeological Documentation, New Habitat Areas	D. Reger/ADNR
98012A-BAA	Comprehensive Killer Whale Investigation in Prince William Sound, Alaska	C. Matkin/North Gulf Oceanic Society
98025	Mechanisms of Impact and Potential Recovery of Nearshore Vertebrate Predators (NVP)	L. Holland-Bartels, et al/DOI-BRD
98043B	Monitoring of Cutthroat Trout and Dolly Varden Habitat Improvement Structures	D. Gillikin/USFS
98052A	Community Involvement	P. Brown/CRRC
98052B	Traditional Ecological Knowledge	P. Brown-Schwalenberg/CRRC
98064	Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in PWS	K. Frost/ADFG
98076	Effects of Oiled Incubation Substrate on Straying and Survival of Wild Pink Salmon	A. Wertheimer/NOAA
98126	Habitat Protection and Acquisition Support	C. Fries/ADNR, D. Gibbons/USFS, G. Elison/DOI
98127	Tatitlek Coho Salmon Release	Tatitlek IRA Council
98131	Chugach Native Region Clam Restoration	P. Brown-Schwalenberg/CRRC
98139A1	Salmon Instream Habitat and Stock Restoration - Little Waterfall Barrier Bypass Improvement	S. Honnold/ADFG
98139A2	Port Dick Creek Tributary Restoration and Development	W. Bucher/ADFG
98139C1-CLO	Montague Riparian Rehabilitation Monitoring	D. Schmid/USFS
98142-BAA	Status and Ecology of Kittlitz's Murrelets in Prince William Sound	B. Day/ABR, Inc.
98144A	Common Murre Population Monitoring	D. Roseneau/DOI
98144B	Common Murre Population Monitoring: Manuscript Preparation	D. Roseneau/DOI
98145	Cutthroat Trout and Dolly Varden: Relation Among and Within Populations of Anadromous and Resident Forms	G. Reeves/USFS, Pacific Northwest Research Station
98149	Archaeological Site Stewardship	D. Reger/ADNR
98159	Surveys to Monitor Marine Bird Abundance in Prince William Sound during Winter and Summer 1998	S. Kendall and D. Irons/DOI

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Proj.No.	Project Title	Proposer
98161-CLO	Differentiation and Interchange of Harlequin Duck Populations Within the North Pacific	B. Goatcher/DOI
98162	Investigations of Disease Factors Affecting Declines of Pacific Herring Populations in Prince William Sound	G. Marty/UC Davis; R. Kocan/Univ. Wash., C. Kennedy & A. Farrell, Simon Fraser Univ.
98163	APEX: Alaska Predator Ecosystem Experiment in Prince William Sound and the Gulf of Alaska	D. Duffy/UAA
98165-CLO	Genetic Discrimination of Prince William Sound Herring Populations	J. Seeb, L. Seeb, S. Merkouris/ADFG
98166	Herring Natal Habitats	M. Willette/ADFG
98169-BAA	A Genetic Study to Aid in Restoration of Murres, Guillemots, and Murrelets in the Gulf of Alaska	V. Friesen/Queen's University, J. Piatt/DOI-BRD
98170	Isotope Ratio Studies of Marine Mammals in Prince William Sound	D. Schell/UAF
98180	Kenai Habitat Restoration & Recreation Enhancement	M. Kuwada/ADFG, A. Weiner/ADNR
98186-CLO	Coded Wire Tag Recoveries From Pink Salmon in Prince William Sound	T. Joyce/ADFG
98188	Otolith Thermal Mass Marking of Hatchery Reared Pink Salmon In Prince William Sound	T. Joyce/ADFG
98190	Construction of a Linkage Map for the Pink Salmon Genome	F. Allendorf/Univ. Montana
98191A	Field Examination of Oil-Related Embryo Mortalities in Pink Salmon Populations in PWS	M. Willette/ADFG J. Seeb/ADFG
98194-CLO	Pink Salmon Spawning Habitat Recovery	M. Murphy, S. Rice/NOAA
98195	Pristane Monitoring in Mussels	J. Short, P. Harris/NOAA
98196	Genetic Structure of Prince William Sound Pink Salmon	C. Habicht/ADFG
98210	Youth Area Watch	R. Sampson/Chugach School District
98220-CLO	Eastern PWS Wildstock Salmon Habitat Restoration	D. Schmid/USFS
98223-BAA	Analysis, Integration, and Publication of Pre- and Post-Spill Data on Damage to and Response of Sea Otters and the Nearshore Community	L. Rotterman/Enhydra Research
98225	Port Graham Pink Salmon Subsistence Project	E. Anahonak, Port Graham IRA Council
98236	Exhibits on Human Uses of Marine Resources for the Alaska SeaLife Center	Alaska Native Harbor Seal Commission
98239	Salmon Carcasses and Juvenile Chinook Salmon Production in the Kenai River Ecosystem	D. Schmidt/ADFG

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Proj.No.	Project Title	Proposer
98244	Community-Based Harbor Seal Management and Biological Sampling	M. Reidel/Alaska Native Harbor Seal Commission
98247	Kametolook River Coho Salmon Subsistence Project	Perryville Village Council
98252	Investigations of Genetically Important Conservation Units of Species Inhabiting the EVOS Area	J. Seeb, L. Seeb, S. Merkouris/ADFG
98254-CLO	Delight and Desire Lakes Restoration	G. Kyle/ADFG
98256B	Sockeye Salmon Stocking at Solf Lake	D. Gillikin, P. Shields/USFS
98263	Assessment, Protection and Enhancement of Salmon Streams in Lower Cook Inlet	W. Meganack, Jr./Port Graham Corporation
98269-BAA	Prince William Sound Rockfish Recovery	T. Kline/PWSSC
98270	Akalura Lake Sockeye Salmon Restoration	S. Honnold, C. Swanton/ADFG
98273	Surf Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knolwedge to Conserve the Resource	D. Rosenberg/ADFG
98274	Documentary Film on Subsistence Use of Herring, Herring Spawn, and Resources in the Nearshore Ecosystem in Prince William Sound	Tatitlek Village Council
98278	Development of an Ecological Characterization and Long-Term Environmental Monitoring Program for Kachemak Bay	G. Seaman/ADFG
98286	Elders/Youth Conference on Subsistence and the Oil Spill	B. Henrichs/Native Village of Eyak
98287-BAA	Seabird-Oceanographic Relationships in the Northern Gulf of Alaska: Integration with NSF Study "GLOBEC"	B. Day/ABR, Inc.
98288-BAA	Monitoring Population Status of Sea Otters from the Sex-age Structure of Winter-killed Carcasses	Garshelis & Johnson/ABR, Inc.
98289-BAA	Status of Black Oystercatchers in Prince William Sound	S. Murphy/ABR, Inc.
98290	Hydrocarbon Data Analysis, Interpretation, and Database Maintenance	J. Short, B. Nelson/NOAA
98291	Hydrocarbon Monitoring Before and After Chenega Area Beach Cleanup	C. Brodersen/NOAA
98292-BAA	Sea-Land Link: Salmon Carcasses and Forest Productivity	T. Vincent, T. Kline/PWSSC
98293-BAA	Bidarki and Gumboot Chitons: Recruitment and Habitat Selection	D. Scheel, T. Vincent/PWSSC
98294-BAA	Pinniped Response to Diet	D. Duffy/UAA
98296	Exhibit-quality Catalog of Spill-related Archaeological Artifacts	B. Knight/DOI-NPS
98297-BAA	Oceanography of Prince William Sound Bays and Fjords	S. Vaughan/PWSSC

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Proj.No.	Project Title	Proposer
98298-BAA	Public Brochure on Archaeology at the Alaska SeaLife Center	M. Yarborough
98302-CLO	Prince William Sound Cutthroat Trout, Dolly Varden Char Inventory	M. Schelske/USFS
98306	Ecology and Demographics of Pacific Sand Lance in Lower Cook Inlet	J. Piatt/DOI - BRD
98307	Exxon Valdez Oil Spill Recovery Computer System	R. Nuti
98308-BAA	Salmon - Predator Interactions Model Validation Experiment	T. Kline/PWSSC
98309	Ecosystem Synthesis Model Validation Using Natural Stable Isotope Tracers	T. Kline/PWSSC
98310	Distribution and Turnover in Juvenile Herring Populations	E. Brown, B. Norcross/UAF
98311	Pacific Herring Productivity Dependencies in the Prince William Sound Ecosystem Determined With Natural Stable Isotope Tracers	T. Kline/PWSSC
98312	Monitoring Shifts in Prince William Sound Food Webs Using Natural Isotope Tracers: A Time Series Approach	T. Kline/PWSSC
98314	Homer Mariner Park Habitat Assessment and Restoration Design Project	E. Bechtol/City of Homer
98315	Major Shellfish Conference: Qutekcak Tribe	E. Blatchford/Qutekcak
98319	Biology of Two Intertidal Crustaceans: An Isopod and a Lithodid Crab	B. Stevens/NOAA
98320	Sound Ecosystem Assessment (SEA)	T. Cooney, et al/UAF
98323-BAA	Modeling Differential Exxon Valdez Oil Spill Petroleum Hydrocarbon Impacts to Archaeological Resources	M. Cassell/IMA Consulting, Inc.
98324-BAA	Community-Based Harbor Seal Research	M. Reidel/Alaska Native Harbor Seal Commission
98325-BAA	Assessment of Injury to Intertidal and Nearshore Subtidal Communities: Preparation of Manuscripts	T. Dean/Coastal Resources Associates, Inc.
98327	Pigeon Guillemot Restoration Research at the Alaska SeaLife Center	D. Roby/Oregon State Univ.
98328	Synthesis of the Toxicological Impacts of the Exxon Valdez Oil Spill on Pacific Herring	M. Carls/NOAA
98329	Synthesis of the Toxicological Impacts on Pink Salmon	S. Rice/NOAA
98330-BAA	Mass-Balánce Model of Trophic Fluxes in Prince William Sound	D. Pauly/UBC, S. Pimm/U. Tenn
98331	Copper River Intertribal Fisheries Commission Development	B. Henrichs/Native Village of Eyak
98332	Eyak Subsistence Recovery Camp	B. Henrichs/Native Village of Eyak

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Proj.No.	Project Title	Proposer
98333	Sea Otter Population Monitoring	B. Henrichs/Native Village of Eyak
98334	Restoration of Prince William Sound Pink Salmon through Test Fishery Project	B. Henrichs/Native Village of Eyak
98335	Nanwalek Hatchery	V. Kvasnikoff, Nanwalek IRA Council
98336	Subsistence Restoration Through Community Participation	M. Roberts/Kodiak Tribal Council
98337	Archaeological Forage Fish	L. Yarborough/USFS
98338	Survival of Adult Murres and Kittiwakes in Relation to Forage Fish Abundance	J. Piatt/DOI-BRD
98339	Prince William Sound Human Use and Wildlife Disturbance Model	K. Murphy, L. Suring/USFS
98340	Toward Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem	T. Weingartner/UAF
98341	Harbor Seal Recovery: Controlled Studies of Health and Diet	M. Castellini/UAF
98342-BAA	Pilot Monitoring Program for Prince William Sound: Marine Assessment of Resources	G. Thomas, V. Patrick, K. Osgood/PWSSC
98343-BAA	Descriptive Oceanography of Glacial Fjords in Prince William Sound Used as Habitat by Kittlitz's Murrelets	S. Gay, K. Osgood/PWSSC
98344	Blowdown Effects on Salmon Habitat	M. Murphy/NOAA
98346	Publication of an Indexed Bibliography of the Genus Ammodytes (Sand Lance)	R. Armstrong/UAA, M. Willson/USFS, M. Robards/DOI
98347	Fatty Acid Profile and Lipid Class Analysis for Estimating Diet Composition and Quality at Different Trophic Levels	R. Heintz, M. Larsen/NOAA
98348	Responses of River Otters to Oil Contamination: A Controlled Study of Biological Stress Markers and Foraging Success	M. Ben-David, T. Bowyer, L. Duffy/UAF
98349	Permanent Archiving of Specimens Collected in Intertidal and Nearshore Habitats	N. Foster/UA Museum
98351	Harbor Seal Recovery: Fate of Pups	M. Castellini/UAF
98353	EVOS Restoration Public Access and Education Program	H. Tomingas/Ocean Explorers
98355	Bivalve Clam Literature Review, Clam Habitat Association Model and Field Investigation	P. Armato/DOI
98356	Sockeye Salmon Stocking Feasibility at Chucks Lake	D. Gillikin, P. Shields/USFS
98357-BAA	Ancient Salmonid Fish Bone and Bivalve Shells: Indicators of Oceanographic Conditions and Stock Abundances	D. Love/U of S. Dakota
98358	Tree-Rings in the Exxon Valdez Spill Area: Ecosystem Implications for Injured Resources	G. Juday, V. Barber/UAF, G. Jacoby, R. D'Arrigo/Columbia University

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Proj.No.	Project Title	Proposer
98359	Status and Evaluation of Factors Limiting Recovery of Black Oystercatchers	R. Lanctot/BRD-DOI
98363	Ecosystem Analysis at the Watershed Scale on Port Graham Corporation Lands on the Kenai Peninsula	W. Meganack/Port Graham Corp.
98364	Effects of Food Stress on Survival and Reproductive Performance of Seabirds	J. Piatt/DOI-BRD
98370	Effects of Harbor Seal Metabolism on Stable Isotope Ratio Tracers	D. Schell/UAF
98380	Effects of Restoration Projects Along the Kenai River on Juvenile Salmon Habitat	J. Dorova/USGS
98390	Monitoring of Oiled Mussel Beds in Prince William Sound	P. Harris, C. Brodersen/NOAA
98426	Harlequin Duck Population Dynamics-Patterns and Processes	D. Rosenberg/ADFG, D. Esler/DOI
98427-CLO	Harlequin Duck Recovery Monitoring	D. Rosenberg/ADFG

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Pink Salmon

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98076	Effects of Oiled Incubation Substrate on Straying and Survival of Wild Pink Salmon	A. Wertheimer/NOAA	NOAA	Cont'd 4th yr. 4 yr. project	$234.6	$272.2	$272.2

This project examines the effects of oil exposure during embryonic development on the straying, marine survival, and gamete viability of pink salmon. The objectives are to conduct a related series of controlled experiments on straying of pink salmon to determine the role of oil and other factors so that field studies of straying in Prince William Sound after the oil spill can be interpreted; to determine if the return rate of pink salmon to adult is reduced when they have been exposed to oiled gravel during embryonic development; and to continue investigations into whether such exposure causes heritable damage to reproductive fitness of pink salmon.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98139A1	Salmon Instream Habitat and Stock Restoration - Little Waterfall Barrier Bypass Improvement	S. Honnold/ADFG	ADFG	Cont'd 4th yr. 4 yr. project		$27.1	$41.1

This proposal will evaluate the barrier bypass improvement at Little Waterfall Creek, as indicated by pink and coho salmon use of the bypass. The renovation of the bypass (decreased grades and additional resting pools) was completed in FY 96 and is expected to facilitate increased spawning habitat use by pink and coho salmon populations, thus increasing salmon production to optimum levels in ensuing years. Studies in FY 97 will include bypass inspections to document salmon passage, spawner enumeration, and juvenile salmon abundance monitoring.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98139A2	Port Dick Creek Tributary Restoration and Development	W. Bucher/ADFG	ADFG	Cont'd 3rd yr. 7 yr. project	$49.7	$89.0	$239.8

This project will restore the native Port Dick Creek salmon stocks which were exposed to moderate to heavy oiling. Actual restoration of the spawning habitat took place in June 1996. Natural colonization rates were adequate to fully seed the newly restored spawning habitat. Water temperature, water level, salinity, and stream velocity will be monitored as these parameters are well correlated in the literature with spawning success and egg-to-fry survival. Additional sedimentologic parameters (bedload transport, accumulated sediments, and gravel/cobble transport rates) will also be analyzed. These activities as well as evaluation studies will be conducted annually from 1996 to 2000, with possible extension of minor monitoring through 2002 for streambed stability research.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98139C1-CLO	Montague Riparian Rehabilitation Monitoring	D. Schmid/USFS	USFS	Cont'd 5th yr. 4 yr. project		$2.3	$2.3

This project will close out Project /139C1. Originally the project was to have been finished in FY 97, but some structures needed to be rebuilt and monitored in 1997. This proposal seeks 10 days of funding in FY 98 to write the final report.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98186-CLO	Coded Wire Tag Recoveries From Pink Salmon in Prince William Sound	T. Joyce/ADFG	ADFG	Cont'd 10th yr. 10 yr. project	$279.4	$126.6	$126.6

Pink salmon play a major role in the Prince William Sound ecosystem as well as in the economy of Cordova and other local communities. There is evidence that the oil spill has been partially responsible for weak pink salmon returns. Pink salmon runs are dominated by hatchery populations, and efforts to restore injured wild populations through selective harvesting of hatchery fish depend upon the availability of data pertaining to the spatial and temporal abundance of wild fish in different fishing areas. This study provided real-time and post-season estimates of hatchery and wild contributions to commercial harvests by date and fishing district, and also to hatchery cost-recovery harvests. This information enabled fisheries managers to direct effort away from injured populations.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98188	Otolith Thermal Mass Marking of Hatchery Reared Pink Salmon In Prince William Sound	T. Joyce/ADFG	ADFG	Cont'd 4th yr. 5 yr. project	$108.4	$141.1	$324.0

This project develops otolith marking as a technology for identification of hatchery pink salmon returning to Prince William Sound. The otoliths of all pink salmon reared in Prince William Sound hatcheries will be thermally marked in the fall of 1998. A blind test will be conducted to determine the ability of otolith readers to successfully determine the origin of randomly selected otoliths. During the 1998 commercial fishery, approximately 100 otoliths will be processed from each fishery opening to estimate stock composition. A Bayesian approach will be used in the estimation of postseason contribution estimates, with a dynamic sample size allocation scheme being used to maximize sampling efficiency.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98190	Construction of a Linkage Map for the Pink Salmon Genome	F. Allendorf/Univ. Montana	ADFG	Cont'd 3rd yr. 5 yr. project		$211.6	$585.6

This project will construct a detailed genetic linkage map for pink salmon by analyzing the genetic transmission of several hundred DNA polymorphisms. The ability to genetically map the location of oil-induced lesions will allow the thorough identification, description, and understanding of oil-induced genetic damage. This research will also aid other recovery efforts with pink salmon, including estimation of straying rates, description of stock structure, and testing whether marine survival has a genetic basis. We will complete the linkage map ahead of schedule in this, the third year of Trustee Council support. We propose to begin efforts to achieve Objectives 5 and 6 of this project using Alaska SeaLife Center facilities.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98191A	Field Examination of Oil-Related Embryo Mortalities in Pink Salmon Populations in PWS	M. Willette/ADFG J. Seeb/ADFG	ADFG	Cont'd 10th yr. 11 yr. project	$164.2	$164.2	$222.9

Elevated embryo mortalities were detected in populations of pink salmon inhabiting oiled streams following the oil spill. These increased rates of mortality persisted annually through the 1993 field season, suggesting that genetic damage may have occurred as a result of exposure to oil during early developmental life-stages. The consequences of this putative genetic damage include physiological dysfunction of individuals and reduced reproductive capacity of populations. The 1994, 1995, and 1996 field results show no statistical difference in embryo mortality between oil-contaminated and reference streams. This project will continue to monitor the recovery of pink salmon embryos in the field. If there is again no difference in embryo mortality between oil-contaminated and reference streams, this project will be closed out in FY 99.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98194-CLO	Pink Salmon Spawning Habitat Recovery	M. Murphy, S. Rice/NOAA	NOAA	Cont'd 2nd yr. 2 yr. project		$53.2	$53.2

This proposal requests funds to close out Project /194, allowing publication of results and participation at the 1998 Restoration Workshop. Project 97194 examined the level of oil contamination in pink salmon streams in 1989-90 and 1995 by analyzing sediment samples collected in 1989-90 by ADFG and similar samples collected in 1995 by the Auke Bay Laboratory. Approximately 500 samples from 200 streams were analyzed by the Auke Bay Laboratory in 1997. Results will help to complete the understanding of the injury to pink salmon by documenting the initial exposure level and subsequent habitat recovery.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98196	Genetic Structure of Prince William Sound Pink Salmon	C. Habicht/ADFG	ADFG	Cont'd 5th yr. 6 yr. project	$130.0	$130.2	$180.2

Previous workers found that wild-stock pink salmon suffered direct lethal and sublethal injuries as a result of the oil spill. An understanding of the population structure of pink salmon in Prince William Sound is essential to assess the impact of these injuries on a population basis and to devise and implement management strategies for sustained conservation. Results to date from this study suggest gene flow between pink salmon spawning aggregates can be restricted both spatially (regional and upstream-tidal) and temporally (early-late) within the sound. This proposal increment covers the final year of laboratory analysis and the statistical analysis of year-three allozyme and mtDNA data.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98252	Investigations of Genetically Important Conservation Units of Species Inhabiting the EVOS Area	J. Seeb, L. Seeb, S. Merkouris/ADFG	ADFG	New 1st yr. 5 yr. project		$241.7	$1,495.7

This proposal consolidates an array of requests from the commercial fisheries industry for discrete stock research into a single proposal for work that ADFG would conduct at its Anchorage genetics laboratory. Also, ADFG proposes to develop experimental fish runs at the Alaska SeaLife Center; these are essential for study of genetics, physiology, or diseases of anadromous fish proposed by University of Montana, University of Alaska, or ADFG and other principal investigators seeking to conduct research at the Seward facility.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98329	Synthesis of the Toxicological Impacts on Pink Salmon	S. Rice/NOAA	NOAA	New 1st yr. 2 yr. project		$25.6	$77.4

This project will synthesize results of all Trustee Council sponsored studies related to the toxicological damage to pink salmon. Since 1989, seven separate Trustee-sponsored projects have individually advanced our understanding of the effects of the oil spill on pink salmon: past and present potential for oil exposure (Project 194), effects on egg/embryo survival (Project 191), juvenile feeding and growth (NRDA Project 4), marine survival and straying of returning adults (Projects 076 and 209), and the possibility that effects are heritable (Project 228). We will draw on data from these studies to construct synthetic conclusions regarding the injury to and subsequent recovery of pink salmon. The results of contracted studies by Exxon will be compared with the Trustee studies.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
Pacific Herring							
98162	Investigations of Disease Factors Affecting Declines of Pacific Herring Populations in Prince William Sound	G. Marty/UC Davis; R. Kocan/Univ. Wash., C. Kennedy & A. Farrell, Simon Fraser Univ.	ADFG	Cont'd 4th yr. 4 yr. project	$437.6	$517.4	$517.4
Field and controlled laboratory studies will focus on viral hemorrhagic septicemia virus (VHS) and *Ichthyophonus hoferi*, a pathogenic fungus, to determine their role in the disease(s) and mortality observed in Prince William Sound herring since 1993. Herring will be monitored for signs of disease and immune status, while specific pathogen-free herring will be used to determine the degree of mortality, blood chemical changes, and pathogenicity produced by these organisms alone and in combination with exposure to stressors such as petroleum hydrocarbons, temperature and crowding. Wild herring will be studied under laboratory conditions to determine the course of VHS infection associated with captivity and their immune status and susceptibility to reinfection.							
98165-CLO	Genetic Discrimination of Prince William Sound Herring Populations	J. Seeb, L. Seeb, S. Merkouris/ADFG	ADFG	Cont'd 4th yr. 4 yr. project	$56.0	$56.0	$56.0
Following the 1989 *Exxon Valdez* oil spill (EVOS), the Prince William Sound herring fishery underwent a catastrophic decline beginning in 1992. Alaska Department of Fish and Game recovery effort includes incorporating a knowledge of genetically-derived population structure into harvest management. In this close-out project we delineate the structure of Prince William Sound population(s) and related North Pacific populations using both nuclear and mitochondrial DNA analyses. Results of year-one DNA analysis indicate very limited genetic exchange between the Bering Sea/Kodiak Island populations and the PWS populations, and there is evidence of significant levels of genetic divergence within PWS.							
98166	Herring Natal Habitats	M. Willette/ADFG	ADFG	Cont'd 5th yr. 6 yr. project		$189.7	$212.1
The PWS herring spawning population has drastically declined since 1993, and pathology studies have implicated viral hemorrhagic septicemia (VHS) and *ichthyophonus* as potential sources of mortality as well as indicators of stress. The current project will monitor the abundance of the injured herring resource in PWS using spawn deposition techniques. Normal agency funding will be used to conduct acoustic biomass survey. In addition, we will evaluate the precision, accuracy, and cost of each technique with the intent to employ either spawn deposition or hydroacoustics using normal agency funding after FY98.							
98310	Distribution and Turnover in Juvenile Herring Populations	E. Brown, B. Norcross/UAF	ADFG	New 1st yr. 3 yr. project		$151.7	$685.0
Estimates of pacific herring survival and population size are confounded by fish movement and migration. Results from this project will refine current EVOS research and the Prince William Sound stock definition. In FY98, a pilot study using herring collected in 1995-1997 by SEA (320T) will be completed. Samples will be processed for size, fatty acid composition, and isotopes. Otoliths will be extracted for pattern and chemical analysis. These results, when combined with appropriate distribution and habitat data, will be interpreted as tracers if distinctive for each area. In the future, seasonal investigations, including tagging, will be done within a defined nursery region of Prince William Sound in order to properly interpret tracer results.							

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98311	Pacific Herring Productivity Dependencies in the Prince William Sound Ecosystem Determined With Natural Stable Isotope Tracers	T. Kline/PWSSC	ADFG	New 1st yr. 2 yr. project		$119.3	$205.5

Research of the Sound Ecosystem Assessment (SEA) program has shown that Pacific herring (*Clupea pallasi*) have significant dependence on Gulf of Alaska (GOA) carbon. Accordingly, herring are subject to changes in carbon flow occurring between GOA and Prince William Sound (PWS). The first step in understanding of how this fundamental environmental process affects herring recruitment is to isotopically analyze a time series of herring for which energetic data have been collected. This will expand upon the data series available from SEA providing a total four-year time period corresponding to one period in the cyclicity of herring population abundance in PWS.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98328	Synthesis of the Toxicological Impacts of the Exxon Valdez Oil Spill on Pacific Herring	M. Carls/NOAA	NOAA	New 1st yr. 2 yr. project		$36.1	$104.1

This project would synthesize results of Trustee-sponsored studies related to the toxicological damage to Pacific herring, and compare them to results published by Exxon contractors. State and federal researchers concluded that exposure to oil caused egg mortality, morphological and cytogenetic abnormalities, reduced growth, and immunosuppression in adults, but that the effects on the population level were unknown. These results would be compared to those reached by Exxon contractors, who concluded that the spill had a minor impact on herring eggs, and that the population biomass was not reduced (Pearson et al. 1996). A monograph for publication would be prepared, and presented at the 10th Anniversary *Exxon Valdez* Oil Spill Symposium.

SEA and Related Projects

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98195	Pristane Monitoring in Mussels	J. Short, P. Harris/NOAA	NOAA	Cont'd 3rd yr. 5 yr. project	$115.0	$114.9	$304.9

This project will continue to monitor pristane in mussels as an indirect index of potential year-class strength for pink salmon and herring and to identify critical juvenile pink salmon and herring marine habitat in Prince William Sound.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98292-BAA	Sea-Land Link: Salmon Carcasses and Forest Productivity	T. Vincent, T. Kline/PWSSC	NOAA	New 1st yr. 4 yr. project		$168.3	$609.4

Both pink and sockeye salmon and the services they provide were injured by the oil spill. Because these salmon are anadromous, they may supply an important marine-terrestrial link between production in both systems. While it has been shown that carcasses of salmon contribute significant nutrients to streams, it is not known to what extent these nutrients may also be important to terrestrial plants adjacent to these streams. Funding is requested to determine whether this link is important to the productivity and composition of adjacent forest in the EVOS-impacted area. Should a link be established, new management and EVOS settlement decisions might have to be made for forest plant species.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98297-BAA	Oceanography of Prince William Sound Bays and Fjords	S. Vaughan/PWSSC	NOAA	New 1st yr. 1 yr. project		$94.2	$94.2

Eaglek Bay, Whale Bay, Simpson Bay, and Zaikof Bay are the focus of the Sound Ecosystem Assessment (SEA) Herring group (320T) because of historical observations of large numbers of juvenile Pacific herring. Hydrographic surveys and current velocity measurements from October 1995 to November 1996 show significant differences in water mass properties and circulation patterns between these four bays in Prince William Sound. SEA Physical Oceanography (320-M) has provided support for SEA Herring in the past, but support in FY98 will not be possible because of scheduled funding cuts. Without continued funding, physical data will not be available for the SEA Herring project in its third and final winter sampling period. The goal of this research is to identify physical factors that control the production of Pacific herring in Prince William Sound.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98308-BAA	Salmon - Predator Interactions Model Validation Experiment	T. Kline/PWSSC	NOAA	New 1st yr. 3 yr. project		$368.9	$838.7

This project will use closed-circuit rebreather scuba technology to conduct *in situ* model validation experiments in support of the SEA project Nekton Model. We will determine the occurrence and timing of movements and interactions of the model's principal prey and principal predator species, pink salmon fry and adult pollock, respectively, for comparison with that predicted in the model. Direct observation will be used to solve the pink salmon "predation gap" that presently exists because of limitations imposed by the conventional techniques used to date.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98312	Monitoring Shifts in Prince William Sound Food Webs Using Natural Isotope Tracers: A Time Series Approach	T. Kline/PWSSC	NOAA	New 1st yr. 5 yr. project		$178.3	$777.7

Time-series measurements of natural stable isotopes of fishes and their forage when combined with pertinent data on fish populations and oceanographic measurements being collected in sibling projects will enable a new understanding of how fundamental environmental processes affect fish recruitment and interaction. The large herbivorous copepods of the genus *Neocalanus*, which have had distinctive 13C/12C signatures when sampled in the northern GOA compared to those from PWS, will be used as a carbon source proxy. Validation of the signature gradient will enable us to assess shifts in the source of carbon of fishes, as well as shifts in source signatures in the long-term. Shifts in GOA carbon affinity will be tracked with fish recruitment and oceanographic processes to assess the effects on fishes at interannal and decadal time scales.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98320	Sound Ecosystem Assessment (SEA)	T. Cooney, et al/UAF	ADFG	Cont'd 5th yr. 6 yr. project	$1,947.2	$2,436.0	$3,206.1

This project is an integrated, multi-component study of processes influencing the annual survival of juvenile pink salmon and herring rearing in Prince William Sound. An emerging understanding of mechanisms of loss at this life stage is being captured by linked numerical simulations of ocean state, plankton dynamics, fish energetics, and prey/predator relationships. This proposal requests funding for the final fully-funded year of SEA, a period of reduced field work but accelerated data analysis and application of results to management models.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98342-BAA	Pilot Monitoring Program for Prince William Sound: Marine Assessment of Resources	G. Thomas, V. Patrick, K. Osgood/PWSSC	NOAA	New 1st yr. 1 yr. project		$300.2	$300.2

The complaint that pink salmon, herring and other pelagic resources in the spill-area suffered long-term impacts from the spill has been repeatedly voiced by residents of the Sound. The SEA program has developed the first generation of models, a physical-biological model (/320) and a nekton model, for pink salmon to simulate population changes as a result of natural causes so that they can be separated from anthropogenic impacts. This pilot monitoring program will systematically measure weather conditions, physical conditions and plankton for input to the physical-biological model, and macrozoolankton and pelagic nekton as input to the nekton model.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98357-BAA	Ancient Salmonid Fish Bone and Bivalve Shells: Indicators of Oceanographic Conditions and Stock Abundances	D. Love/U of S. Dakota	NOAA	New 1st yr. 3 yr. project		$78.1	$170.1

We propose to acquire paleoecological data from four Prince William Sound archeological midden sites in PWS. The research plan includes: 1) radiocarbon dating of stratigraphic units from each midden, 2) measuring annual growth increments of intact molluscan shells, 3) stable isotope analyses of molluscan shells to determine seasonal and annual temperature patterns, and 4) reconstruction of fish size and growth rates from preserved fish remains. Results will be used to reconstruct historic climate patterns in PWS, relate changes in those patterns to changes in fish and molluscan growth, and relate the historical variations in climate and species abundances to changes in growth and abundance of species impacted by the spill.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98358	Tree-Rings in the Exxon Valdez Spill Area: Ecosystem Implications for Injured Resources	G. Juday, V. Barber/UAF, G. Jacoby, R. D'Arrigo/Columbia University	ADFG	New 1st yr. 2 yr. project		$148.3	$260.7

A new project is proposed to apply conventional ring-width and unconventional isotope and x-ray density techniques of tree-ring analysis to develop a long-term (at least 250-year) record of the climate of the spill area in relation to some of the key injured resources. Preliminary data indicate that tree-rings correlate well with temperature and Alaska salmon catch. Tree-ring techniques should help determine the likelihood of sustaining a given population of injured resources. This project would help overcome the lack of pre-spill monitoring data. The project is needed because not enough tree-ring sites have been sampled, not all the techniques have been used in the spill area, and correlation of tree-rings with injured resources has not been investigated.

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Sockeye Salmon

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98239	Salmon Carcasses and Juvenile Chinook Salmon Production in the Kenai River Ecosystem	D. Schmidt/ADFG	ADFG	New 1st yr. 2 yr. project		$166.6	$266.6

This project will investigate the role sockeye salmon carcasses play in primary and secondary production within the Kenai River and the potential symbiotic role sockeye salmon escapements have on nutrients and secondary productivity. An ecosystem approach to restoration of this system requires examination of the role salmon carcasses play in freshwater life history of other species. This project will focus on determining if measurable benefits to chinook salmon growth can be attributed to salmon carcasses in general, and more specifically, sockeye salmon. The question to be addressed the first year is whether there is a sufficient marine-derived nutrient component that can be measured in a large glacial river. An important feature of the project is to ascertain if there are significant benefits to chinook salmon juveniles with increased escapements.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98254-CLO	Delight and Desire Lakes Restoration	G. Kyle/ADFG	ADFG	Cont'd 2nd yr. 2 yr. project		$11.7	$11.7

This project is evaluating the quality of the rearing habitat and the feasibility of lake fertilization in Delight and Desire Lakes. Limnological and fisheries data were collected during 1997; FY98 funds are for report preparation. Nutrient enrichment has increased the forage base for rearing sockeye salmon fry in other Alaskan lakes. The expected result of nutrient enrichment is larger/more numerous sockeye smolts and a corresponding increase in adult returns. An enrichment program in Delight and/or Desire Lakes would increase lake fertility, which in turn should accelerate the recovery of the currently depressed sockeye salmon runs in these two lakes.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98270	Akalura Lake Sockeye Salmon Restoration	S. Honnold, C. Swanton/ADFG	ADFG	New 1st yr. 5 yr. project		$355.0	$1,565.0

This project will restore natural production of Akalura Lake sockeye salmon through: 1) assessment of the lake rearing environment and determination of juvenile and adult life history parameters limiting sockeye salmon production; and 2) use of established restoration techniques to increase juvenile sockeye salmon abundance, survival, and adult production. This project will be contingent upon the estimated number of sockeye salmon smolt emigrating from Akalura Lake in 1997. Akalura Lake sockeye salmon stock will be considered in the natural recovery phase if approximately 200,000 or more sockeye smolt are estimated in 1997. We propose that this project proceed if less than 200,000 smolt are estimated in 1997.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
Cutthroat Trout, Dolly Varden and Rockfish							
98043B	Monitoring of Cutthroat Trout and Dolly Varden Habitat Improvement Structures	D. Gillikin/USFS	USFS	Cont'd 5th yr. 7 yr. project	$8.0	$24.0	$50.4
	This project monitors habitat improvement structures and their effects on cutthroat trout and Dolly Varden populations. These structures were installed in 1995. There has been concern raised that habitat structures may inadvertently increase coho salmon populations, and thereby increase competition stress on Dolly Varden and cutthroat trout populations. Preliminary data collected in 1995 and 1996 could be interpreted to support this assumption, with regard to cutthroat trout. Additional monitoring seeks to address these questions, and provide solid results to base our conclusions on the effectiveness of these types of improvements to benefit Dolly Varden and cutthroat trout.						
98145	Cutthroat Trout and Dolly Varden: Relation Among and Within Populations of Anadromous and Resident Forms	G. Reeves/USFS, Pacific Northwest Research Station	USFS	Cont'd 3rd yr. 4 yr. project	$100.0	$222.7	$262.7
	This project will determine the relation between resident and anadromous forms of Dolly Varden and cutthroat trout within the same watershed and between watersheds in Prince William Sound. We will conclude analysis of genetic, meristic, and life-history features of each group which were sampled in FY96 and FY97. Results from this study will allow development of a longterm, comprehensive and ecologically sound restoration strategy for these fish. Additionally, we are proposing to examine fish that we have collected to compare growth rates of those from oiled areas with those from unoiled areas. This proposed new objective increases the FY98 cost by $102,000 and the FY99 cost by $40,000.						
98269-BAA	Prince William Sound Rockfish Recovery	T. Kline/PWSSC	NOAA	New 1st yr. 5 yr. project		$475.1	$1,942.9
	This project will assess recovery of rockfish species and communities in Prince William Sound occurring from natural recruitment using demographic data. The investigation will include a synthesis of local/traditional knowledge and published information. Non-destructive observation, measurement, and photographic recordings of rockfishes will avoid the limitations imposed by the conventional techniques that have a large-fish bias. Double sampling will be used to acquire length-age relations of rockfish with sampling emphasis on pre-recruits to the fisheries. We propose to use closed-circuit rebreather scuba technology to conduct an *in situ* investigation. Assessment of post-spill recruitment will indicate how or if natural restoration is taking place, which will enable resource managers to implement prudent conservation measures.						

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98302-CLO	Prince William Sound Cutthroat Trout, Dolly Varden Char Inventory	M. Schelske/USFS	USFS	Cont'd 2nd yr. 2 yr. project		$4.1	$4.1

This proposal requests funds for report writing to close out Project 97302. So far in FY97, the main researcher has interviewed local residents and other knowledgeable persons and conducted literature searches to document the locations of cutthroat trout and Dolly Varden char populations. A number of previously undocumented populations have been discovered. Additional work and some field sampling will occur during the rest of FY97 to verify unsubstantiated reports.

Marine Mammals

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98001-CLO	Recovery of Harbor Seals From EVOS: Condition and Health Status	M. Castellini/UAF	ADFG	Cont'd 4th yr. 4 yr. project	$48.1	$51.1	$51.1

Project 98001 will provide the final analysis for three years of field work that sampled harbor seals for condition and health status. It will close out 95-97001 and provide analysis of late arriving samples, completion of analytical and statistical tests, the production of final reports, and publication of research papers.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98012A-BAA	Comprehensive Killer Whale Investigation in Prince William Sound, Alaska	C. Matkin/North Gulf Oceanic Society	NOAA	Cont'd 6th yr. 9 yr. project		$166.8	$362.6

This project continues to monitor the damaged AB pod and other Prince William Sound killer whales to analyze a GIS database on killer whales. We propose in FY 98 to identify critical habitats for transient whales in Prince William Sound using these data. Year round residency of killer whales will be assessed using a remote hydrophone system. Environmental contaminant levels in the blubber of specific whales will be determined and potential effects on recovery evaluated. An updated catalog of individual killer whales that use Prince William Sound will be constructed and incorporated in a popular book detailing research results (FY99).

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98064	Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in PWS	K. Frost/ADFG	ADFG	Cont'd 4th yr. 6 yr. project	$150.0	$307.5	$667.5

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

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98170	Isotope Ratio Studies of Marine Mammals in Prince William Sound	D. Schell/UAF	ADFG	Cont'd 3rd yr. 3 yr. project	$110.0	$111.2	$111.2

This project uses natural stable isotope ratios to assess trophic structure and food webs in Prince William Sound and contributes to the studies by ADFG personnel to determine the reasons for the decline of harbor seal populations. Through a mix of captive animal studies and a comparison of isotope ratios in prey species and archived and current marine mammal tissues, insight into environmental changes causing the decline may be possible. Preliminary data point strongly toward a major decline in the carrying capacity of the northern Pacific Ocean in the past two decades. This decline is evident in the abundance and distribution of marine biota and is reflected in the carbon isotope ratios of marine mammals of the region.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98294-BAA	Pinniped Response to Diet	D. Duffy/UAA	NOAA	New 1st yr. 3 yr. project			$0.0

This project tests a hypothesis that high-lipid diets lead to greater mitochondrial functioning in muscle. Additional work will use fatty acids to assess diet and whether the metabolisms of juvenile pinnipeds handle lipids differently than do adults, or whether well-fed animals do so differently than do starving animals. Initial field work will involve samples from existing projects in the Pribilofs and in Prince William Sound, on fur seals and harbor seals. Analysis of these samples will test for differences in mitochondrial activity, diet, and lipid pathways. If these are found within species, reflecting age or body condition, then the second year of the study will use non-lethal sampling and controlled diets to measure the response of captive harbor seals and sealions at the Alaska SeaLife Center. Budget incomplete; FY98 cost would exceed $172.7.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98341	Harbor Seal Recovery: Controlled Studies of Health and Diet	M. Castellini/UAF	ADFG	New 1st yr. 4 yr. project		$132.8	$482.1

This program begins a long-term study that quantifies the impact of feeding controlled fish diets on the health and body condition of harbor seals. Even though health status biomarkers for marine mammals in Prince William Sound were established during field trials, the critical test on how each marker varies in an individual seal fed differing prey diets has not been conducted. The ability to test these markers directly, under controlled conditions, is now available at the Alaska SeaLife Center. This project proposes to conduct those experiments on harbor seals, but the approach would apply to any of the injured top predators, whether bird or mammal.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98351	Harbor Seal Recovery: Fate of Pups	M. Castellini/UAF	ADFG	New 1st yr. 4 yr. project		$128.5	$467.2

All previous work on the recovery of harbor seals after the oil spill focused on adult animals. Predictions of population decline, ecological relationships, and health and body condition in those adults suggest that a key factor in the poor recovery of the species is the fate of pups. This project begins a field and laboratory based examination on the biology of harbor seal pups. Field work will determine whether pups are born compromised and laboratory work at the Alaska SeaLife Center will focus on detailed health and survivorship studies.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98370	Effects of Harbor Seal Metabolism on Stable Isotope Ratio Tracers	D. Schell/UAF	ADFG	New 1st yr. 3 yr. project		$90.2 *	$282.8

Specific amino acids from food proteins will be compared in seals and to identify essential amino acids useful as habitat or prey markers. Specific amino acids labeled with 15N and 13C will be used to follow transamination and carbon relocation during metabolic processes in the seals. Year 1 will be used to establish laboratory and animal handling protocols and to analyze the amino acid composition and isotope ratios from prey species and existing marine mammal blood samples obtained from wild-caught seals and seals held at existing facilities. Years 2 and 3 will employ captive harbor seals at the Alaska SeaLife Center and will expand the compounds studied to include fatty acid composition and the isotope ratios in specific fatty acids.

Nearshore Ecosystem

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98025	Mechanisms of Impact and Potential Recovery of Nearshore Vertebrate Predators (NVP)	L. Holland-Bartels, et al/DOI-BRD	DOI	Cont'd 4th yr. 5 yr. project	$1,669.4	$1,689.2	$2,139.2

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

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98161-CLO	Differentiation and Interchange of Harlequin Duck Populations Within the North Pacific	B. Goatcher/DOI	DOI	Cont'd 3rd yr. 3 yr. project	$9.5	$36.1	$36.1

This project will close-out previous two years of field and laboratory work.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98223-BAA	Analysis, Integration, and Publication of Pre- and Post-Spill Data on Damage to and Response of Sea Otters and the Nearshore Community	L. Rotterman/Enhydra Research	NOAA	New 1st yr. 1 yr. project		$71.4	$71.4

Extensive new analysis, integration, and publication of pre- and post-spill data on sea otter movements, rehabilitation, carcasses, and habitat use, as well as data from repeated pre- and post-oil multi-species marine mammal surveys, will be undertaken so as to: (1) understand EVOS damage to marine mammals and related natural communities, (2) evaluate sea otter population processes affecting recovery, (3) evaluate future response and restoration strategies, and (4) generate benchmarks of sea otter population status.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98288-BAA	Monitoring Population Status of Sea Otters from the Sex-age Structure of Winter-killed Carcasses	Garshelis & Johnson/ABR, Inc.	NOAA	New 1st yr. 2 yr. project		$131.7	$260.5

This project will assess the feasibility of monitoring the population status of sea otters from the sex-age structure of winter-killed carcasses collected on beaches. Monitoring of winter-killed carcasses currently is done at one site in western Prince William Sound, and from those results it appeared that otters had recovered from the oil spill by 1992; however, these results conflict with those from other studies of otters. We will attempt to reconcile these conflicts by investigating geographic and habitat-related variation in the sex-age structure of carcasses, factors that have not been accounted for in the current monitoring program. We will identify sources of variation, estimate the proportion of carcasses found, and recommend improvements of the monitoring effort.

98289-BAA	Status of Black Oystercatchers in Prince William Sound	S. Murphy/ABR, Inc.	NOAA	New 1st yr. 2 yr. project		$134.6	$366.5

Black oystercatchers currently are considered to be "injured with recovery unknown." Because most of the unresolved issues for this species pertain to impacts to the breeding population in Prince William Sound, this study is designed to assess phenology and productivity of the same population of breeding oystercatchers that was studied during 1989 - 1993. Year 1 will entail an examination of the reproductive parameters that were identified by previous researchers as having been negatively impacted by the oil spill and an evaluation of whether these birds have recovered from the previously identified impacts. Data analyses will focus on comparisons of previously oiled sites with unoiled sites and among-year analyses.

98290	Hydrocarbon Data Analysis, Interpretation, and Database Maintenance	J. Short, B. Nelson/NOAA	NOAA	Cont'd 7th yr. 11 yr. project	$74.8	$75.7	$375.7

This project is a continuation of the NRDA and restoration database management, sample storage, and interpretive service. New data will continue to be incorporated into the Trustee Council hydrocarbon database. Updated summary reports for investigators and managers will be produced along with an electronic copy of the data for all data queries.

98319	Biology of Two Intertidal Crustaceans: An Isopod and a Lithodid Crab	B. Stevens/NOAA	NOAA	New 1st yr. 2 yr. project		$47.9	$54.5

Intertidal communities were heavily impacted by the oil spill. Lack of knowledge concerning the biology of intertidal organisms hampers assessment of their recovery from the EVOS or future disturbance. This project will study the biology of two common intertidal crustaceans (an isopod and a lithodid crab) which are good indicator species because they live in close association with understory substrates. Monthly sampling and selective videography will be used to determine size at maturity, fecundity, reproductive season, and a range of "normal" behaviors including mating and foraging. Results will enable assessment of population differences between impacted and non-impacted populations.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98325-BAA	Assessment of Injury to Intertidal and Nearshore Subtidal Communities: Preparation of Manuscripts	T. Dean/Coastal Resources Associates, Inc.	NOAA	New 1st yr. 3 yr. project		$111.4	$210.7

This project will prepare manuscripts for publication in scientific journals based on previous Trustee Council funded evaluations of injury to, and restoration of, coastal habitats (intertidal and subtidal communities).

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98348	Responses of River Otters to Oil Contamination: A Controlled Study of Biological Stress Markers and Foraging Success	M. Ben-David, T. Bowyer, L. Duffy/UAF	ADFG	New 1st yr. 2 yr. project		$236.0	$412.2

This project will explore the effects of oil contamination on physiological and behavioral responses in river otters experimentally. Fifteen captive otters will be exposed to two levels of oil contamination under controlled conditions in captivity. Samples of blood, tissues, and feces will be collected for analysis of biomarkers and immunological examinations. In addition, behavioral observations on foraging behavior will be conducted to explore the effects of oil contamination on foraging success.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98349	Permanent Archiving of Specimens Collected in Intertidal and Nearshore Habitats	N. Foster/UA Museum	ADFG	New 1st yr. 3 yr. project		$158.5	$467.1

The large zoological and botanical collections resulting from various oil spill-related surveys in the Gulf of Alaska are a unique scientific resource, but no provision has been made for their final deposition. This project will incorporate these specimens into the aquatic collection of the University of Alaska Museum so that they will be available for further biological studies.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98355	Bivalve Clam Literature Review, Clam Habitat Association Model and Field Investigation	P. Armato/DOI	DOI	New 1st yr. 3 yr. project		$28.5	$58.5

The paucity of Trustee Council sponsored studies documenting the extent and persistence of injury to bivalve clams throughout the oil spill zone suggests that researchers may have: (1) overlooked the importance of documenting the injury to clams, (2) lacked the expertise to conduct such studies, or (3) had little interest in studying this area of injury and recovery. Because little work has been conducted in the area of clam injury and recovery, conducting a literature review, constructing a clam injury and recovery model, and conducting field studies are crucial for developing and understanding of EVOS-related clam injury and recovery in the spill zone.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98359	Status and Evaluation of Factors Limiting Recovery of Black Oystercatchers	R. Lanctot/BRD-DOI	DOI	New 1st yr. 4 yr. project		$94.2	$384.8
Black oystercatcher populations were damaged both directly and indirectly by the oil spill and their recovery status is unknown. This proposal presents a plan of action for improved monitoring of the black oystercatcher and an investigation into several factors (e.g., demography, oil, toxicity, food, population sub-structuring) that may be limiting recovery. The species' unique role as an apex predator in the nearshore environment demands an ecosystem approach to our study that will reveal interactions among predator and prey.							
98390	Monitoring of Oiled Mussel Beds in Prince William Sound	P. Harris, C. Brodersen/NOAA	NOAA	New 1st yr. 2 yr. project		$160.4	$218.4
Oiled mussel beds on soft substrates were the sites of the highest oil concentrations in sediment and in tissues in the years following the oil spill. This project will monitor the progress of natural restoration of 13 oiled mussel beds last sampled in 1995, and 12 cleaned mussel beds last sampled in 1996. Documentation of recovery is of interest to subsistence villagers in Prince William Sound, and to the Nearshore Vertebrate Predator project. Further monitoring in 1998 is needed to evaluate the long term effectiveness of natural cleaning and restoration in both sets of oiled mussel beds.							
98426	Harlequin Duck Population Dynamics-Patterns and Processes	D. Rosenberg/ADFG, D. Esler/DOI	ADFG	New 1st yr. 5 yr. project		$257.0	$1,875.5
This program is designed to document patterns of harlequin duck population structure and numerical fluctuation in oiled and unoiled parts of Prince William Sound and determine the processes underlying population dynamics. Core data collection includes yearly assessment of population numbers, population structure, and annual survival rates. In addition, we propose a series of specific research objectives designed to fill in data gaps necessary to build a comprehensive population dynamics model of Prince William Sound harlequin ducks. Ultimately, we intend to understand the relationships between oiling history, individual variation, demographic parameters, and population dynamics.							
98427-CLO	Harlequin Duck Recovery Monitoring	D. Rosenberg/ADFG	ADFG	Cont'd 5th yr. 5 yr. project		$86.3	$87.3
This project will complete the harlequin duck recovery monitoring project (/427). A final report and manuscripts will be prepared, reporting on the findings of this four-year project.							

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
Seabird/Forage Fish and Related Projects							
98142-BAA	Status and Ecology of Kittlitz's Murrelets in Prince William Sound	B. Day/ABR, Inc.	NOAA	Cont'd 3rd yr. 3 yr. project		$331.7	$331.7
We propose to conduct a third (and final) year of investigations on the status and ecology of Kittlitz's murrelet, a rare seabird breeding in glaciated fjords of Prince William Sound. Our study will continue to evaluate the distribution and abundance, habitat use, productivity, and trophic position of this little-known seabird in northwestern Prince William Sound. Given uncertainty about the effects of the *Exxon Valdez* oil spill on this species, a better understanding of its status and ecology is required to ensure its long-term conservation.							
98144A	Common Murre Population Monitoring	D. Roseneau/DOI	DOI	Cont'd 3rd yr. 5 yr. project		$50.5	$72.5
This project will collect common murre population data at the Chiswell Islands nesting colonies, which have not been censused since 1992. Data will be statistically compared with counts made at these colonies during the 1989-1991 common murre damage assessment studies and counts obtained during the 1992 common murre restoration monitoring project. Results of the analyses (e.g., differences among years, presence/absence of trends) will be used in combination with 1989-1997 Barren Islands information to evaluate and refine the overall recovery status of the common murre.							
98144B	Common Murre Population Monitoring: Manuscript Preparation	D. Roseneau/DOI	DOI	New 1st yr. 2 yr. project	$50.0	$12.2	$13.2
The proposed project consists of preparation of a scientific publication on the 1989-1997 postspill trends in murre population numbers, nesting chronology, and productivity at the Barren Islands colonies (the nesting location with the most complete data history in the spill area).							
98159	Surveys to Monitor Marine Bird Abundance in Prince William Sound during Winter and Summer 1998	S. Kendall and D. Irons/DOI	DOI	Cont'd 5th yr. 9 yr. project		$237.0	$767.0
We propose to conduct small boat surveys to monitor abundance of marine birds and sea otters (*Enhydra lutris*) in Prince William Sound, Alaska during March and July 1998. Five previous surveys have monitored population trends for more than 65 bird and 8 marine mammal species in Prince William Sound. We will use data collected in 1998 to continue to examine trends from summer 1989-98 and from winter 1990-98 by determining whether populations in the oiled zone changed at the same rate as those in the unoiled zone. We will also examine overall population trends for the Sound from 1989-98. In addition to monitoring the status of injured species, continued monitoring would confirm possible oil spill effects on species not previously considered injured.							

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98163	APEX: Alaska Predator Ecosystem Experiment in Prince William Sound and the Gulf of Alaska	D. Duffy/UAA	NOAA	Cont'd 4th yr. 6 yr. project	$1,800.0	$2,024.4	$4,200.8

This study uses seabirds as probes of the trophic (foraging) environment of Prince William Sound, comparing their reproductive and foraging biologies, including diet, with similar measurements from Cook Inlet, an area with apparently a more suitable food environment. These measurements are compared with hydroacoustic and net samples of fish to calibrate seabird performance with fish distribution and abundance to determine the extent to which food limits the recovery of seabirds from the spill. We sample fish to compare diet, energetics and reproductive parameters of the different forage-fish species, to determine whether competitive and predatory interactions or different responses to the environment may favor the abundance of one fish species over another. In FY98, a new sub-project (/163S-BAA) to study jellyfish is included.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98169-BAA	A Genetic Study to Aid in Restoration of Murres, Guillemots, and Murrelets in the Gulf of Alaska	V. Friesen/Queen's University, J. Piatt/DOI-BRD	DOI	Cont'd 2nd yr. 4 yr. project	$78.1	$88.3	$188.3

Populations of common murres, pigeon guillemots, and marbled and Kittlitz's murrelets from the Gulf of Alaska are failing to recover from the oil spill. We propose to continue our genetic analyses to aid in their restoration by 1) determining the geographic limits of the populations affected by the oil spill, 2) identifying sources and sinks, and 3) identifying appropriate reference or control sites for monitoring. As incidental results, this study will also reveal cryptic species and subspecies, indicate the role of inbreeding and small effective population sizes in restricting recovery, and suggest suitable source colonies for translocations.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98287-BAA	Seabird-Oceanographic Relationships in the Northern Gulf of Alaska: Integration with NSF Study "GLOBEC"	B. Day/ABR, Inc.	NOAA	New 1st yr. 3 yr. project		$143.1	$558.5

We propose to conduct a 3-year study of seabirds in the Northern Gulf of Alaska (Resurrection Bay to Montague Island) by using a ship-of-opportunity sampling platform of the NSF project "GLOBEC" (Global Ocean Ecosystem Dynamics), which also will provide access to an extensive series of oceanographic data. This proposed study is designed to identify ecological processes affecting temporal and geographic variation in the distribution and abundance of seabirds, including species that were injured by the *Exxon Valdez* oil spill. It also will provide valuable information to the restoration program by providing data on the year-round status of seabird populations and the processes that influence their variation.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98306	Ecology and Demographics of Pacific Sand Lance in Lower Cook Inlet	J. Piatt/DOI - BRD	DOI	Cont'd 2nd yr. 4 yr. project	$30.0	$32.8	$82.8

The purpose of this project is to characterize the basic ecology, distribution, and demographics of sand lance in lower Cook Inlet. Recent declines of upper trophic level species in the Northern Gulf of Alaska have been linked to decreasing availability of forage fishes. Sand lance is the most important forage fish in most nearshore areas of the northern Gulf. Despite its importance to commercial fish, seabirds, and marine mammals, little is known or published on the basic biology of this key prey species.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98327	Pigeon Guillemot Restoration Research at the Alaska SeaLife Center	D. Roby/Oregon State Univ.	DOI	New 1st yr. 3 yr. project		$119.7	$119.7

This project will test the feasibility of direct restoration techniques for pigeon guillemots (e.g., installation of artificial nest sites, use of social attractants, captive propagation and release). While raising young guillemots in captivity it will also be possible to conduct controlled experiments crucial to two other restoration objectives: (1) development of nondestructive biomarkers of petroleum hydrocarbon contamination, and (2) understanding how dietary factors (prey species composition, prey size, lipid content, feeding frequency) constrain growth, development, and condition at fledging in guillemots.

98337	Archaeological Forage Fish	L. Yarborough/USFS	USFS	New 1st yr. 1 yr. project		$143.1	$143.1

Funding is requested for processing bulk samples from archaeology site SEW-430 on Eleanor Island to separate, identify, and quantify forage fish skeletal remains. Preliminary processing of one such sample from this rock shelter has yielded over 150 well-preserved skeletal elements of sand lance, small greenling and small sculpin. The identification process will include preparing modern comparative skeletal specimens, to reduce the need to travel to other locations to use comparative collections. The project goal is to provide identified, dated skeletal specimens of a variety of forage fish, representing populations from 500 to 4000 years old, to biologists seeking baseline ecological and climatic data for Prince William Sound.

98338	Survival of Adult Murres and Kittiwakes in Relation to Forage Fish Abundance	J. Piatt/DOI-BRD	DOI	New 1st yr. 3 yr. project		$76.1	$245.1

Some seabird populations damaged by the spill continue to decline or are not recovering. In order to understand the ultimate cause of seabird population fluctuations, we must measure productivity, recruitment, and adult survival. Current APEX studies are focused on measuring productivity only. Recruitment measurement demands an unrealistic study duration. We propose to augment current studies in lower Cook Inlet that relate breeding success and foraging effort to fluctuations in forage fish density by using radio telemetry (contingent on pilot work) and banding to quantify the survival of adult common murres and black-legged kittiwakes.

98343-BAA	Descriptive Oceanography of Glacial Fjords in Prince William Sound Used as Habitat by Kittlitz's Murrelets	S. Gay, K. Osgood/PWSSC	NOAA	New 1st yr. 1 yr. project		$165.2	$165.2

Descriptive oceanographic studies of glaciated fjords in Prince William Sound are limited mainly to research conducted in Port Valdez and Unakwik Inlet during the late 1960s and early 1970s. Recent work done under the Sound Ecosystem Assessment (SEA) Herring project in Unakwik Inlet and Icy Bay has confirmed previously measured patterns and has revealed the unique oceanographic characteristics that these fjords exhibit as habitats for marine fishes, birds, and mammals. The goal of this project is to describe the characteristics of four glaciated fjords used by Kittlitz's murrelets during the summer and to link these characteristics to the high biological productivity seen in these fjords.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98346	Publication of an Indexed Bibliography of the Genus Ammodytes (Sand Lance)	R. Armstrong/UAA, M. Willson/USFS, M. Robards/DOI	USFS	New 1st yr. 1 yr. project		$5.4	$5.4

Pacific sand lance is important in the diet of birds, fish, and sea mammals. Little is known about this species in Alaska. Much of the information is found in agency reports and gray literature, which are usually not attainable by library electronic searching methods. This project will review all studies of Pacific sand lance in Alaska and recommend further research. Studies done outside of Alaska will be integrated where local knowledge is lacking. The bibliography will cover all published and unpublished references on the genus *Ammodytes*. Key words and a summary of information will be provided for each reference. All references will be incorporated into a taxonomic, geographic and subject index.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98347	Fatty Acid Profile and Lipid Class Analysis for Estimating Diet Composition and Quality at Different Trophic Levels	R. Heintz, M. Larsen/NOAA	NOAA	New 1st yr. 3 yr. project		$110.7	$238.6

This project begins the systematic development of fatty acid profiles and lipid class analysis to identify diet differences and quality in predators on several trophic levels. Specifically we propose to relate the spatial variability of fatty acid profiles in herring and sandlance to their prey, and examine the nutritional consequences of high and low lipid diets in sea lions. Results of the fish studies will benefit APEX investigators by demonstrating the utility of fatty acid analysis for establishing dietary and energetic differences between aggregates of forage fish. Results of the sea lion study will address recent hypotheses concerning their declines in population size. Combined, the results of these two studies will provide a basis for future examinations of wild sea lion diets.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98364	Effects of Food Stress on Survival and Reproductive Performance of Seabirds	J. Piatt/DOI-BRD	DOI	New 1st yr. 4 yr. project		$88.1	$387.9

Traditional field methods of assessing effects of food stress on the survival and reproductive performance of seabirds may give equivocal results. This project will apply an additional tool--the rise in blood levels of stress hormones such as corticosterone in response to a standardized stressor: capture, handling and restraint. This well known response provides a strong assessment of whether or not a free-living population is chronically stressed. Thus the "field endocrinology" approach provides additional information of current stress status and the potential for stress. We will investigate seabirds breeding in Lower Cook Inlet and also use captive birds for controlled experiments at the Alaska SeaLife Center.

Archaeological Resources

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98007A	Archaeological Index Site Monitoring	D. Reger/ADNR	ADNR	Cont'd 4th yr. 8 yr. project	$135.0	$145.3	$718.3

Monitoring of archaeological sites on public land injured by vandalism and oiling will concentrate on a sample of index sites in the three regions of the spill. Oiled sites will be tested for reintroduced oil. This project will end in FY 99 if monitoring shows no continued injury.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98007B	Site Specific Archaeological Restoration	L. Yarborough/USFS	USFS	Cont'd 4th yr. 4 yr. project		$10.3	$10.3

Funding is requested for an additional phase of the Forest Service's archaeological restoration at sites SEW-440 and SEW-488. Project 98007B is a continuation of projects 97007B, 96007B, 95007B, and 94007B. The final report on the restoration project having been completed in FY97, this phase of the project will present the results of additional analysis to the professional and general public. The Principal Investigator will prepare a professional paper for publication, and a shortened version for presentation at the Alaska Anthropological Association annual meeting.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98007C	Archaeological Documentation, New Habitat Areas	D. Reger/ADNR	ADNR	Cont'd 1st yr. 2 yr. project		$80.0	$100.0

Habitat acquisition by the Trustee Council brought into public ownership sites vandalized during EVOS related activities. These sites, not accessible to the site restoration process because they were in private ownership, now will be documented to determine restoration needs. These sites will also be included in the continuing site monitoring program as necessary. Five sites on Kodiak Island, five sites on Shuyak Island, and five sites in Prince William Sound will be examined.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98149	Archaeological Site Stewardship	D. Reger/ADNR	ADNR	Cont'd 3rd yr. 4 yr. project	$66.3	$66.9	$81.9

The archaeological site stewardship program provides training and coordination for a cadre of volunteers to monitor vandalized sites in the oil spill area beyond the ability of agency monitoring. Volunteer site stewards are protecting damaged sites on the Kenai Peninsula, Kachemak Bay, Uganik Bay, Uyak Bay and the Chignik area of the Alaska Peninsula. Further protection will come from increased local awareness of harm from site vandalism.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98296	Exhibit-quality Catalog of Spill-related Archaeological Artifacts	B. Knight/DOI-NPS	DOI	New 1st yr. 1 yr. project		$107.0	$107.0

This project consists of publication of an exhibit-quality catalog that contains photographs of representative spill-related archaeological artifacts and an interpretation of their significance. Such a publication would give village residents, agencies, scholars, and the general public a sense of the entire spill-related artifact collection and what can be learned from the collection and also acknowledge villagers' heritage resources and ties to place.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98298-BAA	Public Brochure on Archaeology at the Alaska SeaLife Center	M. Yarborough	DOI	New 1st yr. 1 yr. project		$6.6	$6.6

Funding is requested for the publication of a public brochure describing archaeological research undertaken during construction of the Alaska SeaLife Center in Seward. The brochure will contain both historic photographs and maps of the Seward water front, and photographs and drawings from the archaeological investigations. It will focus on research at the Lowell Homestead, the earliest American settlement in Seward. This publication will give the general public a sense of what has been learned from archaeology at the SeaLife Center, and an understanding of the richness and importance of heritage resources in the oil spill area.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98323-BAA	Modeling Differential Exxon Valdez Oil Spill Petroleum Hydrocarbon Impacts to Archaeological Resources	M. Cassell/IMA Consulting, Inc.	NOAA	New 1st yr. 5 yr. project		$220.0	$299.2

The proposed project seeks to understand the nature of past, current, and future impacts of the *Exxon Valdez* oil spill and subsequent cleanup efforts on known and unknown archaeological resources in the spill area by assessing the potential for differential spill impacts based upon variability within and between locale-specific geomorphic settings. The proposed study integrates archaeology, geomorphology, geographic information systems, and geophysical techniques. The result will be a predictive model of impact severity useful for efficient allocation of resources in ongoing archaeological impact assessment and treatment.

Subsistence

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98052A	Community Involvement	P. Brown/CRRC	ADFG	Cont'd 4th yr. 8 yr. project	$250.0	$250.0	$1,250.0

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

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98052B	Traditional Ecological Knowledge	P. Brown-Schwalenberg/CRRC	ADFG	Cont'd 2nd yr.		$98.8	$98.8

This project would fund two TEK (Traditional Ecological Knowledge) specialists to (1) provide technical assistance to restoration project PIs who plan to use, or for whom it would be appropriate to use, TEK, (2) serve as a contact point for spill area communities, the community facilitators and spill-area-wide coordinator hired under Project /052A, and principal investigators on issues related to TEK, (3) based upon the results of the evaluation of the feasibility of developing a comprehensive TEK database conducted under 97052B, address this component, and (4) organize and coordinate synthesis workshops between PIs and community experts. The TEK specialist would work under the guidance of an advisory group.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98127	Tatitlek Coho Salmon Release	Tatitlek IRA Council	ADFG	Cont'd 4th yr. 5 yr. project	$12.0	$12.1	$24.2
This project will create a coho salmon return to Boulder Bay near Tatitlek village. Enough coho eggs to produce 50,000 smolt will be collected from an ADFG approved stream, incubated and reared to smolt at the Solomon Gulch Hatchery, transported, and held for two weeks in net pens in Boulder Bay before release. Release will produce a 2,000 to 3,000 adult return to Boulder Bay for harvest in a subsistence fishery.							
98131	Chugach Native Region Clam Restoration	P. Brown-Schwalenberg/CRRC	ADFG	Cont'd 4th yr. 5 yr. project	$365.0	$365.1	$730.1
Cost effective procedures for establishing safe, easily accessible subsistence clam populations near Native villages in the oil spill region will be established. The Qutekcak hatchery in Seward will annually provide about 800,000 juvenile littleneck clams and cockles. Historical information, local and agency expertise, and research will be used to identify areas to seed and what method to use. Total seeded area during the project will not exceed five hectares. Follow-up research on success of seeding will be conducted. Development work will be confined to areas near the Native villages of Eyak, Tatitlek, Nanwalek, and Port Graham.							
98210	Youth Area Watch	R. Sampson/Chugach School District	ADFG	Cont'd 3rd yr. 7 yr. project	$150.0	$150.2	$850.2
Youth Area Watch links students in the oil spill impacted area with research and monitoring projects funded through the Trustee Council. The goal is to involve students in the restoration process, and give these individuals the skills to participate in oil spill restoration activities now and in the years to come. Youth conduct research identified by principal investigators who have indicated interest in working with students in oil spill impacted communities. Youth Area Watch serves as a positive example of community investment in the restoration process. Participating communities are: Tatitlek, Chenega Bay, Cordova, Seward, Valdez, and a remote site.							
98220-CLO	Eastern PWS Wildstock Salmon Habitat Restoration	D. Schmid/USFS	USFS	Cont'd 3rd yr. 3 yr. project	$12.0	$11.9	$11.9
This project will close out Project /220. It consists of monitoring the instream habitat structures built in FY 97, an analysis of the utilization of the structures by juvenile fish, an escapement count of coho salmon in October 1997, and a final report by September 1998.							

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98225	Port Graham Pink Salmon Subsistence Project	E. Anahonak, Port Graham IRA Council	ADFG	Cont'd 3rd yr. 5 yr. project	$75.0	$76.5	$232.2
	This project will provide pink salmon for subsistence use in the Port Graham area while maintaining the Port Graham hatchery's broodstock development schedule. Because local runs of coho and sockeye salmon, the more traditional salmon subsistence resource, are at low levels, pink salmon are being heavily relied on for subsistence. This project will help ensure that pink salmon remain available for subsistence use until the more traditional species are rejuvenated. Two strategies are being employed; increased fisheries management surveillance to maximize use of adult pink salmon return and increasing marine survival of hatchery produced pink salmon.						
98236	Exhibits on Human Uses of Marine Resources for the Alaska SeaLife Center	Alaska Native Harbor Seal Commission	ADFG	New 1st yr. 1 yr. project		$84.6	$84.6
	Alaska Native residents of the oil spill impacted area have expressed the opinion that it is important that information on their harvest and use of marine resources, including marine mammals, seabirds, invertebrates and fish, be incorporated into the exhibits presented at the Alaska SeaLife Center. This project proposes to produce educational exhibits on the human uses of the various marine animals on display at the SeaLife Center.						
98244	Community-Based Harbor Seal Management and Biological Sampling	M. Reidel/Alaska Native Harbor Seal Commission	ADFG	Cont'd 3rd yr. 3 yr. project	$85.0	$87.2	$87.2
	This project continues work supported through previous harbor seal restoration projects. A biological sample collection program, implemented in FY96 and expanded in FY97, in Prince William Sound, lower Cook Inlet, and Kodiak Island will continue. Village-based technicians will be selected by the Alaska Native Harbor Seal Commission (ANHSC) and trained to collect samples and transport these samples to Anchorage or Kodiak for further sampling and analysis. The ANHSC will organize a two-day workshop, produce and distribute a newsletter, and coordinate the biological sampling program.						
98247	Kametolook River Coho Salmon Subsistence Project	Perryville Village Council	ADFG	Cont'd 2nd yr. 6 yr. project	$13.8	$14.5	$75.5
	Subsistence users from the Alaska Peninsula Native Village of Perryville have noted significant declines in the coho salmon run in the nearby Kametolook River since the oil spill. The criminal settlement funded the first year of the project (1996) to determine what method would best restore the river's coho salmon stock to historic levels. This project will provide funding through FY 2002 for ADFG to try conservative and safe restoration methods. Instream incubation boxes will be evaluated. Habitat improvements for spawning and rearing habitat will also be considered. Ultimately, some combination of both may be the best approach to restoring coho (or possibly chum) salmon as a subsistence resource.						

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98256B	Sockeye Salmon Stocking at Solf Lake	D. Gillikin, P. Shields/USFS	USFS	Cont'd 3rd yr. 7 yr. project	$143.5	$95.5	$359.1

This project is designed to benefit subsistence users of Prince William Sound and especially residents of Chenega Bay. Habitat improvements were made in 1978, 1980 and 1981 to provide access to Solf Lake for anadromous fish. Investigations suggest that the lake is fishless and has adequate zooplankton biomass to support a salmon population. There are two phases to this project. The feasibility phase, which began in FY 96, has verified the ability of Solf Lake to support a sustainable population of sockeye salmon. Phase 2 plans to initially stock the lake with 400,000 sockeye salmon fry in 1998 and ensure access to Solf Lake for returning adult sockeye salmon.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98263	Assessment, Protection and Enhancement of Salmon Streams in Lower Cook Inlet	W. Meganack, Jr./Port Graham Corporation	ADFG	Cont'd 2nd yr. 3 yr. project	$115.0	$153.1	$218.1

This project will replace lost subsistence services resulting from the oil spill by constructing enhancement projects on the major salmon streams in the Lower Cook Inlet spill area. Protection and enhancement will be implemented using instream fisheries habitat improvement techniques, primarily creation of spawning channels, removal of natural barriers to spawning, and construction of wall-based rearing structures. Local subsistence users will be employed as technical assistants during field surveys and construction.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98273	Surf Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knolwedge to Conserve the Resource	D. Rosenberg/ADFG	ADFG	New 1st yr. 3 yr. project		$179.4	$651.4

This project will study the life history and ecology of surf scoters wintering in Prince William Sound and lower Cook Inlet, and integrate this information with traditional ecological knowledge. Scoter populations in Alaska are declining for unknown reasons. Local residents harvest scoters for subsistence purposes. Scoters will be marked with surgically implanted satellite transmitters to define the breeding areas, molting areas, and wintering areas. Local participation will be solicited and information will be conveyed to local residents through the Chugach School District and Youth Area Watch programs.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98274	Documentary Film on Subsistence Use of Herring, Herring Spawn, and Resources in the Nearshore Ecosystem in Prince William Sound	Tatitlek Village Council	ADFG	New 1st yr. 1 yr. project		$116.1	$116.1

This project would produce a 50 minute film on the subsistence use of herring, herring spawn, and nearshore ecosystem resources in Prince William Sound. Historically, the nearshore ecosystem produced critical resources for subsistence users including herring spawn, octopus, clams, mussels, sea otters, harlequin ducks, and chitons. In the harbor seal documentary (project 96214) Tatitlek residents discussed their view of the relationship between the oil spill, Pacific herring populations, harbor seal populations, and their ability to pursue subsistence. This film will expand on this discussion by documenting all facets of herring and nearshore ecosystem resource use including the ecological and biological knowledge people use to harvest those resources.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98286	Elders/Youth Conference on Subsistence and the Oil Spill	B. Henrichs/Native Village of Eyak	DOI	Cont'd 2nd yr. 2 yr. project	$111.1	$108.0	$108.0
Building on the recommendations from the Community Conference on Subsistence and the Oil Spill sponsored by the Trustee Council in October 1995, this project will bring together elders and youth from all of the oil spill-affected communities to focus on the positive outcomes of the first conference's action items. Funds were provided in FY 97 for preliminary planning. Funds requested in FY 98 will be for holding the conference itself, which is scheduled to be held in Cordova in March 1998. [NOTE: This proposal was submitted as an idea; a DPD and detailed budget need to be prepared.]							
98291	Hydrocarbon Monitoring Before and After Chenega Area Beach Cleanup	C. Brodersen/NOAA	NOAA	Cont'd 2nd yr. 3 yr. project		$56.7	$70.0
Eight Chenega-area beach segments that are still visibly oil-contaminated are scheduled to be cleaned in June and July of 1997, using PES-51. We plan to monitor the success of the process at removing hydrocarbons from the sediment by sampling sediments before, just after, and one year after cleaning. We will also test biological availability of hydrocarbons released by the cleaning process by sampling mussels and chitons at the same time, and more completely at one beach by sampling caged mussels anchored in the vicinity. Mussels will be tested because they filter huge quantities of water and are a useful water-sampling device, and chitons will be tested because they are harvested from these beaches by local residents.							
98293-BAA	Bidarki and Gumboot Chitons: Recruitment and Habitat Selection	D. Scheel, T. Vincent/PWSSC	NOAA	New 1st yr. 4 yr. project		$196.7	$629.4
Bidarki (*Katharina tunicata*) and gumboot (*Cryptochiton stelleri*) chitons are important intertidal subsistence resources in spill-area villages. The complaint that chitons are harder to find following the oil spill has been repeatedly voiced by village residents over at least the past five years. No EVOS study has examined bidarki and gumboot populations with the goal of identifying whether densities are depressed on oiled/treated beaches or with the intent to design enhancement methods. This project will examine recruitment and retention of chitons in intertidal and nearshore subtidal habitats, experimentally test factors affecting chiton use of intertidal habitats, and design methods to enhance densities of these chitons in the intertidal.							
98315	Major Shellfish Conference: Qutekcak Tribe	E. Blatchford/Qutekcak	ADFG	New 1st yr. 1 yr. project			$0.0
This project will provide funding to the Qutekcak Native Tribe to facilitate a major shellfish conference (and related follow-up) to increase the potential for clam and oyster production and harvesting in the region.							

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98324-BAA	Community-Based Harbor Seal Research	M. Reidel/Alaska Native Harbor Seal Commission	NOAA	New 1st yr. 5 yr. project		$307.4	$1,400.9

This project aids restoration of harbor seals and subsistence by developing fundamental data sets needed to (1) evaluate factors affecting the harbor seal decline, (2) document potentially sensitive harbor seal habitats during fall-winter-spring, and (3) document local marine occurrences, such as concentrations of schooling fishes that may be associated with the decline or recovery of harbor seals. This project involves the knowledge and expertise of subsistence users and other community members to: survey seasonal changes in harbor seal distribution during fall-winter-spring; develop detailed annotated harbor seal distribution maps; and record observations of local marine occurrences and summarize observations in regional newsletters.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98331	Copper River Intertribal Fisheries Commission Development	B. Henrichs/Native Village of Eyak	DOI	New 1st yr. 5 yr. project		$411.4	$2,935.5

This project will assist with the formation of a Copper River Inter-Tribal Fisheries Commission to protect and enhance the salmon runs on the Copper River to replace the lost subsistence resources in Prince William Sound. The project will also install modern automated run-monitoring and data collection equipment on the Copper River tributaries and will develop a Tribal Fisheries Management Plan using data collected over a five year period. The Copper River fishery is at risk because of a shift in resource use from subsistence and commercial fishing to urban sport and personal use fishing. An inter-tribal fisheries commission is needed to protect the Copper River fishery.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98332	Eyak Subsistence Recovery Camp	B. Henrichs/Native Village of Eyak	DOI	New 1st yr. 1 yr. project		$50.0	$50.0

This project will establish a subsistence recovery camp for Alaska Native substance abusers affected by the *Exxon Valdez* oil spill. As identified by Picou and Gill (1992), Post-traumatic Stress Syndrome is directly linked to the environmental damage done by the oil spill and the subsistence way of life that Alaska Native people have used for thousands of years. With the results of the oil spill still being felt by the communities through lack of or reduced abundance of specific species (i.e., harbor seal, herring, herring spawns) there has been an upsurge of addictive behaviors exhibited. As in the case of harbor seal, the research scientists have asked for a voluntary reduced harvest. This may be warranted from the scientific viewpoint, but is extremely frustrating to the subsistence user and increases the emotional and psychological trauma that they have experienced.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98333	Sea Otter Population Monitoring	B. Henrichs/Native Village of Eyak	DOI	New 1st yr. 5 yr. project		$269.6	$818.0

This project will involve the Native Village of Eyak in monitoring the sea otter population in Prince William Sound. While sea otters appear to have been recovering region wide, localized populations appear to be experiencing trouble. During the past two years, the sea otter population in the Cordova area has experienced reduced population viability. Initial inquiries by the United States Fish and Wildlife Service indicated Native hunting may be a cause. However, the Native hunters believe the sea otter population is likely experiencing problems because of reduced resource availability. This project will use regular boat surveys to assess population distribution and abundance.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98334	Restoration of Prince William Sound Pink Salmon through Test Fishery Project	B. Henrichs/Native Village of Eyak	DOI	New 1st yr. 3 yr. project		$500.0	$1,500.0

Pink salmon egg mortality attributed to oiling of anadromous streams has contributed to a reduction in adult pink salmon returns. Natural populations of pink salmon are harvested with large numbers of hatchery pink salmon in mixed stock fisheries, which may limit escapement to damaged streams and thereby delay recovery. This project will evaluate the feasibility of changes in hatchery production to reduce exploitation of injured wild stocks. Specific projects will focus on changing the location and timing of hatchery returns in western Prince William Sound.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98335	Nanwalek Hatchery	V. Kvasnikoff, Nanwalek IRA Council	ADFG	New 1st yr. 1 yr. project		$81.0	$81.0

This project will provide construction funds to renovate a building in Nanwalek to be used as a hatchery for the incubation of sockeye salmon eggs. This hatchery would be able to hatch and care for up to 1.5 million sockeye salmon eggs taken from local stock. The English Bay River sockeye salmon has been depleted from approximately 45,000 return adult salmon to a low of about 3,500.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98336	Subsistence Restoration Through Community Participation	M. Roberts/Kodiak Tribal Council	ADFG	New 1st yr. 1 yr. project		$107.3	$107.3

This project will provide funds for instruction on responsible resource use and development of local management plans to protect and manage injured resources. The project has four phases: (1) hunting classes in each Kodiak Island community, (2) instruction in safe food preservation techniques, (3) instruction in the use of subsistence resource by-products by local traditional artists, and (4) a round table meeting to discuss co-management issues affecting subsistence resources. [NOTE: This proposal was submitted as a letter; a DPD and detailed budget need to be prepared.]

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98353	EVOS Restoration Public Access and Education Program	H. Tomingas/Ocean Explorers	ADFG	New 1st yr. 6 yr. project		$250.0	$1,750.0

This project will provide a feasible, manageable, marine science research operation and input program for traditional knowledge holders, educators, coastal communities, and administrators and will develop an educational coastal environmental awareness program.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98356	Sockeye Salmon Stocking Feasibility at Chucks Lake	D. Gillikin, P. Shields/USFS	USFS	New 1st yr. 5 yr. project		$41.0	$41.0

This project is intended to benefit subsistence users of northern Prince William Sound by establishing a sustainable sockeye salmon run within close proximity to the Village of Tatitlek. Chucks and Larae Lakes are connected clear water lakes within 20 boating miles and 12 air miles of Tatitlek. This system is currently not accessible to anadromous fish due to barrier falls at the lakes' outlet stream. There are two phases to this project: Phase 1 will determine the ability of the Chucks and Larae lakes system to support a sustainable population of sockeye salmon and at what level initial stocking should occur. Phase 2 will initiate a sockeye salmon stocking program at the lake, if found to be feasible, and provide access to the system for returning fish.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98363	Ecosystem Analysis at the Watershed Scale on Port Graham Corporation Lands on the Kenai Peninsula	W. Meganack/Port Graham Corp.	ADFG	New 1st yr. 3 yr. project		$178.1	$348.1

This project consists of an ecosystem analysis at the watershed scale for all watersheds on Port Graham Corporation lands from the Ailalik Peninsula near Seward to the Port Graham drainage in Kachemak Bay. The project will characterize all human, aquatic, riparian, and terrestrial features, conditions, processes, and interactions within these watersheds. This analysis will enhance the ability of land managers to estimate direct, indirect, and cumulative effects of corporation management activities and guide the general type, location, and sequence of management activities within each watershed.

Habitat Improvement

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98180	Kenai Habitat Restoration & Recreation Enhancement	M. Kuwada/ADFG, A. Weiner/ADNR	ADNR	Cont'd 3rd yr. 3 yr. project	$834.0	$864.4	$864.4

Adverse impacts to the banks of the Kenai River total approximately 19 miles of the river's 166-mile shoreline, including 5.4 river miles of public land. Riparian habitats have been impacted by trampling, vegetation loss and structural development. The project's objectives are to restore injured fish habitat, protect fish and wildlife habitat, enhance and direct recreation, and preserve the values and biophysical functions that the riparian habitat contributes to the watershed. Restoration/enhancement techniques will include revegetation, streambank restoration, elevated boardwalks, floating docks, access stairs, fencing, signs, and educational interpretive displays.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98314	Homer Mariner Park Habitat Assessment and Restoration Design Project	E. Bechtol/City of Homer	ADNR	New 1st yr. 1 yr. project		$102.0	$102.0

In its present state, Mariner Park is a highly stressed marine habitat in decline. The area is experiencing a dramatic reduction in marine biota and shorebird population while incompatible and environmentally destructive human uses flourish. From the results of a comprehensive feasibility study that includes botanical, biological, and hydrological field studies coupled to community information it is possible to develop a comprehensive habitat restoration and enhancement plan. This plan will establish the optimal hands-on restoration program to increase and diversify the intertidal fauna, which in turn will benefit migrating shorebirds and promote recreationally compatible use of the area by residents and tourists. immediately

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98339	Prince William Sound Human Use and Wildlife Disturbance Model	K. Murphy, L. Suring/USFS	USFS	New 1st yr. 2 yr. project		$144.2	$197.3

This project will use geographic information system (GIS) techniques to describe current human-use patterns in western Prince William Sound and to model potential changes in those use patterns as a result of additional development (e.g., increased access). GIS generated maps of present and projected human-use patterns will be incorporated with GIS maps of the distribution of resources injured as a result of the *Exxon Valdez* oil spill. This will provide a basis to identify areas where there may be existing and potential conflicts between human use and wildlife concentrations resulting in disturbance. Disturbance of injured wildlife may result in decreased productivity exacerbating the effects of the oil spill and prolonging the time to recover.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98344	Blowdown Effects on Salmon Habitat	M. Murphy/NOAA	NOAA	New 1st yr. 2 yr. project		$203.3	$313.3

High winds off the Gulf of Alaska in 1996 caused extensive blowdown in riparian buffer zones left for stream protection after timber harvest on Montague Island. Such large-scale blowdown is much greater than observed elsewhere, and effects on habitat of pink salmon, Dolly Varden, cutthroat trout, and other salmonids are unknown. This project will determine the distribution and amount of blowdown on Montague Island, evaluate its effects on habitat and fish populations, and use models to predict long-term trends in habitat condition. This information will help in evaluating current management of buffer zones, monitoring trends in habitat condition, and assessing the need for habitat restoration in streams in Prince William Sound.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98380	Effects of Restoration Projects Along the Kenai River on Juvenile Salmon Habitat	J. Dorova/USGS	DOI	New 1st yr. 3 yr. project		$142.3	$317.3

Following the *Exxon Valdez* Oil Spill (EVOS), fishing was diverted from Prince William Sound to the Kenai River in south-central Alaska. The salmon habitat along the river was affected by this increased fishing pressure. Considerable investment has been made by the EVOS Trustee Council to restore and protect this salmon habitat along the river. These restoration projects use biodegradable or natural materials and are designed according to the local hydraulic conditions. The projects should protect the bank from erosion and provide juvenile salmon with valuable habitat. However, without quantifying the improvement to the habitat or a positive response in the fishery, a valid restoration of the injured resource cannot be determined.

Habitat Protection

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98126	Habitat Protection and Acquisition Support	C. Fries/ADNR, D. Gibbons/USFS, G. Elison/DOI	ADNR	Cont'd 5th yr.	$770.0	$938.7	$1,468.7

This project provides negotiation support to the Trustee Council in order to reach closure on habitat protection priorities. This support includes title reports, appraisals, on-site inspections, hazardous materials surveys, surveys, timber cruises and reviews, and other services necessary for the successful completion of habitat protection negotiations. [NOTE: Funds for this project will be provided through the Trustee Council's habitat protection program, not through the regular FY 98 work plan of research, monitoring, and general restoration projects.]

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02

Ecosystem Synthesis

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98278	Development of an Ecological Characterization and Long-Term Environmental Monitoring Program for Kachemak Bay	G. Seaman/ADFG	ADFG	New 1st yr. 2 yr. project		$144.9	$144.9

Using scientific information, local knowledge, and traditional ecological knowledge, this project will develop, synthesize, and document the available ecological knowledge and status of Kachemak Bay. Based on this information and other sources, ADFG will develop a highly integrated ecological characterization including information on human, physical, and biological elements of the ecosystem which will be published on a compact computer disk. This information will be used to identify restoration opportunities, gaps in our knowledge of the ecosystem, and provide background information for the monitoring program.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98307	Exxon Valdez Oil Spill Recovery Computer System	R. Nuti	NOAA	New			

This proposal would build a computer simulation model for predicting future disasters and evaluating the excesses of damage.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98309	Ecosystem Synthesis Model Validation Using Natural Stable Isotope Tracers	T. Kline/PWSSC	ADFG	New 1st yr. 2 yr. project		$122.2	$213.2

The output of the Ecopath mass-balance model (proposed to the Trustee Council by Pauly and Pimm as an ecosystem synthesis tool) includes the trophic level (TL) of each modeled component. We will validate the model by using nitrogen stable isotope ratio as an independent method to assess TL. We seek to expand upon the number of taxa that have had their TL determined from 15N/14N which have been limited to the scope of the SEA project. We expect to include representatives of taxa and TLs that will facilitate model validation and which will fill significant data gaps.

Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98330-BAA	Mass-Balance Model of Trophic Fluxes in Prince William Sound	D. Pauly/UBC, S. Pimm/U. Tenn	NOAA	New 1st yr. 2 yr. project		$227.1	$440.8

This project would construct, validate, and disseminate two models of trophic interactions among the organisms of Prince William Sound, as required to synthesize the vast amount of information gathered before and after the *Exxon Valdez* spill, and to evaluate its impact at the ecosystem level. Project components are: 1) an initial workshop devoted to model specification by researchers from the Gulf of Alaska region, 2) an extended study by project staff, and 3) a dissemination phase, in year two, consisting of a training workshop for potential users of the software implementing the model, and the production of a CD-ROM for the public domain, incorporating an interactive graphic version of the software, and an extensive database on the biology and local/traditional knowledge on fishes of PWS.

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Proj.No.	ProjectTitle	Proposer	Lead Agency	New or Cont'd	FY98 Expected	FY98 Request	Total Request FY98-02
98340	Toward Long-Term Oceanographic Monitoring of the Gulf of Alaska Ecosystem	T. Weingartner/UAF	ADFG	New 1st yr. 4 yr. project		$85.4	$319.6

The 27-year time series of temperature and salinity data from hydrographic station GAK1 near Seward shows substantial interannual and interdecadal variability that could influence the Gulf of Alaska shelf ecosystem. This program will continue this time series and quantify the interannual and interdecadal variability of this shelf. A related goal is to resolve better the time and vertical structure of this variability at periods ranging from the tidal to the interannual. This information will aid in assessing progress in the recovery and restoration of organisms and services affected by the oil spill, and will aid in designing a long-term, cost-effective ecosystem monitoring program for this shelf.

	All Proposals	Work Plan Only
Total Continuing Projects FY 98 Expected:	$11,557.7	$10,787.7
Total Continuing Projects FY 98 Request:	$13,667.8	$12,729.1
Total All Projects FY 98 Request:	$23,499.5	$22,560.8
Total All Projects FY 98-02:	$53,362.6	$52,423.9

NOTE: 118 projects were received (52 continuing and 62 new).
The Work Plan Only column does not include Project 98126/Habitat Protection and Acquisition Support.

Recovery of Harbor Seals from EVOS: Condition and Health Status

Project Number:	98001 - Closeout
Restoration Category:	Research
Proposer:	University of Alaska Fairbanks
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	
Duration:	4th year, 4-year project
Cost FY 98:	$51,100
Geographic area:	Prince William Sound
Injured Resource:	Harbor seal

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ABSTRACT

Project 98001 will provide the final analysis for three years of field work that sampled harbor seals for condition and health status. It will close out 95–97001 and provide analysis of late arriving samples, completion of analytical and statistical tests, the production of final reports and publication of research papers.

INTRODUCTION

HISTORY OF PROGRAM. This project is the final year of a four year program that focused on quantifying the health and body condition of harbor seals both inside and outside of Prince William Sound (PWS). The central hypothesis of the program has been that given the declining population status of harbor seals in the impacted area, do these animals show signs of health, nutritional or body condition deterioration that could be contributing to their poor recovery?

This program was completed with significant logistical and scientific collaboration from project /064 which dealt with monitoring population levels, habitat use and trophic interactions of harbor seals. Project /064 provided access to the animals and a broad-based ecological view relevant to harbor seals in this geographic area. The goals of the combined collaborative projects were to investigate ecosystem-wide questions addressing the recovery of harbor seals. These issues included the direct impact of oil spills, human interactions, food, competition, climatic factors, disease and habitat loss. Beginning with 96001, we initiated a collaborative study with the Alaska Native Harbor Seal Commission (ANHSC) to obtain harbor seal blubber samples from Native hunters through projects /052A, /210 and /244. This BIOSAMPLING program has been extremely successful and we anticipate that new samples will be provided during late 1997 and early 1998 for inclusion in the close out year for 98001.

The initial year (95001) began our work on body condition and blood chemistry indicators of nutritional problems, disease, and food limitation for harbor seals. We took blood and blubber samples and measured and weighed seals. These samples were analyzed at UAF and models of body shape, blubber thickness and body condition were generated and tested. We set up identical sampling protocols in collaboration with ADF&G for harbor seals outside of PWS and collected samples from southeast Alaska and around Kodiak for comparative purposes.

Project 96001 was modified by combining it with 95117-BAA and therefore gained an additional component that examined blubber chemistry in harbor seals from contemporary samples and in historical samples of blubber collected from before the *Exxon Valdez* Oil Spill (EVOS). The central hypothesis was that because seals utilize fat and blubber as their primary energy source, then nutritional problems may be reflected by alterations in blubber chemistry. The collection of blubber samples has been the primary interface point with Alaska Native hunters.

The final year of field work, funded through 97001, is currently active. Its major components include blood and blubber sampling through various seasons, the capture of juvenile harbor seals in conjunction with 97064, expanded collaboration with the ANHSC and analytical tests on archived samples of blood and blubber. Brian Fadely, the primary Ph.D. student involved in this work, will graduate in the summer of 1997.

We anticipate that 98001 will focus mainly on the analysis of late arriving blubber samples collected through projects /052A, /210 and /244, the final writing and analysis of results from the three field seasons, production of reports, presentation of data and publication of peer-reviewed articles.

RESULTS FROM PREVIOUS SUPPORT. An annual report with detailed results of 95001 has been accepted by the Trustee Council. The annual report for 96001 is being prepared and project 97001 is currently active. The following major points should be stressed at this time.

We now have the largest data base of blood chemistry, body condition, morphometrics and blubber chemistry on a population of harbor seals ever collected. In some categories, we have over 800 samples. This has enabled us to make robust statistical comparisons of seasonal, regional and individual animal differences in several critical health parameters. Two papers have been published (1, 2), another is in review (3), a Ph.D. is essentially finished and we are now consulting with the National Marine Fisheries Service to assist in setting national health standards for seals and sea lions. The primary blood chemistry findings indicate significant distinctions between seals collected from different regions of PWS. These regional differences coincide with EVOS funded SEA results showing differences in forage fish availability. The results do not indicate that the harbor seals are "sick", but that there are relationships between what the seals are consuming and the corresponding biomarkers that we survey. However, we have also seen biomarkers that suggest adult seals inside PWS may be confronted with a chronic agent or stressor that induces a whole body inflammatory response (2). This pattern has been consistent over time and remains different from animals outside the Sound. This same marker can also be used to differentiate the declining population of Steller sea lions (2). New evidence also indicates that some seals in PWS may be faced with heavy metals or other agents that induce anti-oxidant reactions, but this information is very preliminary and not yet strong enough for further discussion.

There is a significant limitation to our interpretation that cannot be addressed using the current data set: all of our work has focused on adult harbor seals, not pups or juveniles. By design, projects /064 and /001 aimed to capture, sample and model adult harbor seals to test if they were healthy. We do not know if juvenile animals are food stressed or if pups are born healthy or compromised. This will be addressed during the last field season of 97001 as we modify the sampling date and methods in order to capture young pups. We will be submitting new proposals to examine pup biology in FY98, but the conclusions from /001 can only be applied to adult animals.

Given these limitations, the results from this project provide a substantial basis for interpreting the ecological relationships of adult harbor seals in PWS. Overall, our results indicate that adult harbor seals are not food stressed in PWS, but that there are natural variations in health indices that reflect environmental, seasonal and geographic differences.

NEED FOR THE PROJECT

A. Statement of Problem

Prince William Sound harbor seal populations have shown no signs of population recovery (4). The recovery of animals inside PWS is complicated by a general decline in all Alaskan harbor seals, but the decline in the Sound was accelerated after the EVOS event. Our contribution to the study of PWS harbor seals was to address the issue of whether adult animals were healthy, how they compared in body condition to animals outside the Sound — to animals collected before the spill and to other species. It should be noted that our laboratory conducts similar studies on many species of seals and sea lions around the world and that the harbor seal data are being used in models of general pinniped health issues.

B. Rationale

The rationale for this project has been the hypothesis that there may be a health and/or food problem that has inhibited the recovery of harbor seals in PWS. This hypothesis can be addressed by obtaining blood and tissue samples along with behavioral/feeding data (/064) and comparing the medical/physiological data to control populations both inside and outside of the Sound. A central point to our study has been that indices used to assess body condition may also vary with season, age, or sex (5–8) independent of foraging ability or prey availability. Therefore, normal ranges of body size, shape and blubber chemistry distribution must be quantified before useful inter-annual comparisons can be performed. Likewise, blood chemical and hematological parameters also change significantly in response to environmental or nutritional effects (9–13). Chemical profiles and complete blood counts can identify potential imbalances in organ systems or metabolic pathways if the effects of non-health related variation can be quantified (14–16). We have been extremely successful in modeling these types of ranges and variations in 95001 and 96001

C. Location

The field efforts supported directly by projects 95-97001 have taken place in PWS at many sites. Samples were also obtained through collaborative non-EVOS agreements with ADF&G from Kodiak and Southeast. Collaborative work with Native hunters provided samples from throughout PWS and other regions of Alaska.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

We have been very fortunate in our interactions with the Native community regarding the health of harbor seals. Through the BIOSAMPLING program, the Alaska Native Harbor Seal Commission and the Youth Area Watch, we have been able to obtain a tremendous number of carefully collected blubber specimens from harbor seals. We would never have been able to collect such a large and diverse sample through routine methods. In addition, by combining this work with analysis of TEK through the WHISKERS data base, we have been able to see patterns in harbor seal body condition that were previously impossible to model. On the basis of this work, we were invited to present our data both in 1996 and 1997 to the ANHSC and we hope to do so again in 1998.

PROJECT DESIGN

A. Objectives

The objectives of this program were initially determined in 95001 and 95117-BAA. They were modified when the two projects were combined and again when the BIOSAMPLING program was initiated. In 97001, we predicted that we would begin work on captive harbor seals during FY98 at the ASLC. We have removed this objective from 98001, but will propose it under a new submission.

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

2. Model changes in body condition using morphometric measurements.

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

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

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

6. Work in collaborative projects with Native hunters through the Alaska Native Harbor Seal Commission.

7. In FY98, to begin work on rehabilitated animals at the Alaska SeaLife Center. (Dropped from 98001)

B. Methods

Most of the field operations will be concluded during 97001. The methodologies required under 98001 relate mainly to analysis of blubber samples coming from the BIOSAMPLING program and to statistical analyses of our collected data. We have not encountered any unanticipated problems in our field, laboratory or analytical methods and feel that the final work should proceed smoothly. There was some concern in 97001 that the 20 year old archived blubber samples would not be of high enough quality for analysis. This was not the case however, as they were well preserved and proved extremely valuable.

Because the primary Ph.D. student involved in this work (Brian Fadely) will graduate in the summer of 1997, he will be available for the final field season of 97001, but not for the work to be done under 98001. His thesis will form the core of the final EVOS report, but we will need a new student to work in the laboratory and on the computer data base for the final reports and publications.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

As noted above, this project worked in close collaboration with /064 in the field efforts necessary to collect the animals and with the BIOSAMPLING program to collect blubber samples.

SCHEDULE

A. Measurable Project Tasks for FY98 (October 1,1997 – September 30, 1998)

There are five tasks for 98001.

October 1 - December 31:	Obtain and analyze final blubber samples through ANHSC
October 1 - January 31:	Final statistical analysis of health data
February 1 - April 15:	Production of Final Report
April 15 - June 30:	Submission of journal articles
July - September:	Close out project, archive data, publish articles.

B. Project Milestones and Endpoints

All the primary objectives of /001 will be completed by the end of 98001 including the tasks noted above. The milestones will include reports, manuscripts and professional presentations.

C. Completion Date

The /001 program will end on September 30, 1998.

PUBLICATIONS AND REPORTS

Papers currently submitted that will appear in FY98 if accepted:

Zenteno-Savin, T. and M.A. Castellini. Plasma angiotensin II, arginine vasopressin and atrial natriuretic peptide in free ranging and captive seals and sea lions. Submitted. Comparative Biochemistry and Physiology. Feb. 1997.

Planned FY98 submissions:

Fadely, B.S. and M.A. Castellini. Plasma chemistry and hematology ranges of Gulf of Alaska harbor seals. Canadian Journal of Zoology.

Fadely, B.S. and M.A. Castellini. Effects of body shape and blubber distribution on the performance of condition indices in harbor seals. Physiological Zoology.

Fadely, B.S., J.M. Castellini and M.A. Castellini. Compositional analysis of harbor seal blubber and implications for indexing condition. Comparative Biochemistry and Physiology.

PROFESSIONAL CONFERENCES

Travel has been requested for the PI to attend the ANHSC meetings in March of 1998 to present data on blubber samples collected through the BIOSAMPLING program. The PI is also working with the National Marine Fisheries Service on establishing national guidelines for seal and sea lion health, but travel for these workshops is paid by NOAA.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

As noted before in the body of the proposal, this project has worked closely with project \064 and with other ADF&G projects outside of PWS. Without \064, we would not have had access to seals and would not have had the ecological based data necessary for interpretation of our results. The work by other ADF&G projects outside of PWS has also been essential for our comparative work so that we can model changes in oiled vs. non-oiled areas. Collaboration with ADF&G to obtain the archived blubber samples was also essential to the project. Collaboration with the Alaska Native Harbor Seal Commission was vital for the exchange of information and samples.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The only changes in 98001 that were not in the original proposal are the alterations to include blubber samples brought in from the BIOSAMPLING program which was created after /001 was initiated and the decision to capture seal pups instead of adults in the last season. Otherwise, there are no alterations in the project.

PROPOSED PRINCIPAL INVESTIGATOR

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PRINCIPAL INVESTIGATOR

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

Publications by Dr. Castellini since 1990 relevant to the proposal include:

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

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

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

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

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

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

Castellini, J.M., H.J. Meiselman and M.A. Castellini. Understanding and interpreting hematocrit measurements in pinnipeds. Marine Mammal Science. 12: 251-264. 1996.

Zenteno-Savin, T., M.A. Castellini, L.D. Rea and B.S. Fadely. Plasma haptoglobin levels in threatened Alaskan pinniped populations. Journal Wildlife Diseases. 33(1): 64-[illegible] [illegible]

Rea, L.D., R. Groscolas, E. Mioskowski and M. Castellini. Changes in the fatty acid composition of plasma lipids indicate nutritional status in developing Weddell seal pups. Submitted. Polar Biology, Sept. 1996.

Rea, L.D., M.A. Castellini and B.S. Fadely. Health status of young Alaska Steller sea lions (*Eumetopias jubatus*) as indicated by blood chemistry and body condition. Canadian Journal of Zoology. Submitted. December 1996.

Zenteno-Savin, T. and M.A. Castellini. Plasma angiotensin II, arginine vasopressin and atrial natriuretic peptide in free ranging and captive seals and sea lions. Submitted. Comparative Biochemistry and Physiology. Feb. 1997

OTHER KEY PERSONNEL

J.M. Castellini, M.Sc., is a UAF Research Associate and has worked on marine mammal biochemistry/physiology projects since 1986. She is currently the laboratory director and provides daily project monitoring. She is in charge of day to day operations on the blubber project and will take over all aspects of the blubber work for 98001 after Brian Fadely graduates. Annual project reports are also under her supervision.

Master's student (TBA). There are several new students in the Castellini laboratory who would be capable of handling the data base, running statistical tests, helping with the blubber chemistry work and using this project as a base for their thesis research.

LITERATURE CITED

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

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel	$0.0	$0.0						
Travel	$0.0	$0.0						
Contractual	$179.4	$47.8						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$179.4	$47.8		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
General Administration	$12.6	$3.3						
Project Total	$192.0	$51.1						
Full-time Equivalents (FTE)	6.9	2.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

1998

Prepared: 9-Apr-97 4/15/97

Project Number: 98001-CLO
Project Title: Recovery of Harbor Seals from EVOS: Condition and Health Status
Agency: Alaska Dept. of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Budget Category:	Authorized FFY 1997	Proposed FFY 1998						
Personnel	$114.4	$32.7						
Travel	$5.8	$1.3						
Contractual	$13.4	$3.4						
Commodities	$17.3	$0.8						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$150.9	$38.2	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004
Indirect	$37.7	$9.6						
Project Total	$188.6	$47.8						
Full-time Equivalents (FTE)	3.9	1.3						
	Dollar amounts are shown in thousands of dollars.							
Other Funds								

Comments:

Indirect costs are 25% Total Direct Cost, the rate negotiated by the EVOS Trustee Council with the University of Alaska.

Publication costs for report writing are $250 and for other peer-reviewed publications are $1250.
The cost for workshop attendance is $600.
No increases have been made over the projections made in FY 97.

1998	Project Number: 98001-CLO Project Title: Recovery of Harbor Seals from EVOS: Condition and Health Status Name: University of Alaska, Fairbanks	FORM 4A Non-Trustee SUMMARY

Prepared: 7-Apr-97 4/15/97

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

Personnel Costs:			Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1998
Name	Position Description					
Mike Castellini	Principle Investigator		1.0	7.3		7.3
J.M. Castellini	Research Associate		2.0	3.7		7.4
Vacant	Master's Student		12.0	1.5		18.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		15.0	12.5	0.0	
					Personnel Total	$32.7

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1998
					0.0
EVOS workshop January 1998 - Principal Investigator - Fbks/Anch	0.2	1.0	4.0	0.1	0.6
					0.0
Alaska Native Harbor Seal Commission - Biossampling Report Fbks/Cordova	0.3	1.0	4.0	0.1	0.7
				Travel Total	$1.3

1998

Prepared: 7-Apr-97 4/15/97

Project Number: 98001-CLO
Project Title: Recovery of Harbor Seals from EVOS: Condition and Health Status
Name: University of Alaska, Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

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

Contractual Costs: Description	Proposed FFY 1998
Bomb calorimetry to analyze blubber - 50 samples @ $20	1.0
Long distance phone and communication	0.3
Package delivery, courier (FedEx, DHL, etc.)	0.3
Microscopy - 50 samples @ $5	0.3
Publication/page charges	1.5
Contractual Total	$3.4

Commodities Costs: Description	Proposed FFY 1998
Organic solvents for lipid extraction of blubber samples	0.2
Laboratory expendables necessary for chemical analysis of blubber samples	0.3
Computer supplies necessary for database management, analysis and publication preparation	0.3
Commodities Total	$0.8

1998

Project Number: 98001-CLO
Project Title: Recovery of Harbor Seal from EVOS: Condition and Health Status
Name: University of Alaska, Fairbanks

FORM 4B
Contractual &
Commodities
DETAIL

Prepared: 7-Apr-97 4/15/97

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1998
New Equipment Total			$0.0

Existing Equipment Usage: Description	Number of Units	

1998

Project Number: 98001-CLO
Project Title: Recovery of Harbor Seals from EVOS: Condition and Health Status
Name: University of Alaska, Fairbanks

FORM 4B
Equipment
DETAIL

Prepared: 7-Apr.-97 4/15/97

98007A

Archaeological Index Site Monitoring

Project Number:	98007a
Restoration Category:	Monitoring
Proposer:	ADNR- Office of History and Archaeology
Lead Trustee Agency:	ADNR
Cooperating Agencies:	DOI-FWS, USFS
Alaska SeaLife Center:	
Duration:	4th-year, 10-year project
Cost FY 98:	$145,300
Cost FY 99:	$151,500
Cost FY 00:	$135,000
Cost FY 01:	$151,500
Cost FY 02:	$135,000
Cost FY 03:	$151,500
Cost FY 04:	$135,000
Geographic Area:	Prince Willam Sound, Kenai Peninsula, Kodiak Island
Injured Resource:	Archaeological Resources

ABSTRACT

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

INTRODUCTION

Damage to archaeological sites as a result of cleanup activities after the Exxon Valdez Oil Spill has been amply documented in damage assessment studies performed since the spill. Damage from vandals has continued to be documented at several sites on public lands during the past several seasons. Damage at monitored sites continues and confirms that vandals are still active in the region and their level of depredations needs to be monitored. Monitoring of damaged sites as a gauge of vandal activities in the spill area was identified as a primary strategy for site restoration during 1995 and is being continued to provide a long term assessment of the problem. A consensus was reached among agency archaeologists and concurred with by the peer reviewer that the most efficient way to monitor vandalized sites would be to select "index" damaged sites to provide an indication of the level of vandal activity in the spill area. Additional land parcels containing additional damaged sites are currently being acquired by the Trustee Council. Documentation for damages to the new sites is contained in Exxon reports and damage assessment reports by agencies. Several sites in that category are included in proposed work during 1998.

The archaeological peer reviewer for the Trustee Council recommended during the 1995 science workshop that monitoring continue at oiled sites to check for new movement of buried oil into site deposits. His concern was that subsurface oil would move into archaeological deposits and compromise possible data recovery. That recommendation is followed in the 1998 work proposal.

Monitoring of archaeological sites injured by the spill or spill related activities will target a small number of sites on public lands which are determined to represent those that are most vulnerable to looting or oiling. Those index sites (Figure 1) are a gauge for levels of vandalism in the spill area. Index sites oiled during the early time immediately after the spill in March 1989 were monitored during 1995 and will be returned to again during 1998. Sites in Prince William Sound will include SEW-469 and SEW-440. Outer Kenai Peninsula sites are SEL-178 and SEL-215. In the Kodiak Island area sites AFG-098, AFG-082, and AFG-081 will be visited by the State. The U.S. Fish and Wildlife Service will re-visit KOD-171 and AFG-129.

NEED FOR THE PROJECT

A. Statement of Problem

Sites monitored under project 98007 are index archaeological sites thought to be representative of archaeological sites on the public lands in the spill area which have been oiled or are being vandalized. Some sites were oiled during the spill and are being monitored to check for recent movement of subsurface oil into site deposits.

Vandalism during cleanup appears to have been associated with people placed near sites while living on chartered boats. Circumstantial evidence indicates that some crew members, many of whom are residents of coastal communities, were involved in looting of sites. Agency resource managers fear that looting associated with cleanup continued on and spread to other sites of the area.

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

B. Rationale/Link to Restoration

Loss of sites to vandals and pollution of sites from remaining oil removes the ability of archaeologists to recover data about the prehistory from those sites. The number of sites in the area is finite and will not increase. Sites in the area continue to be lost to erosion, making loss from this human degradation more critical. Archaeological injuries will be considered restored under the EVOS Restoration Plan when vandalism has been reduced to pre-Spill levels.

C. Location

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

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The sites being monitored under this project are remote. Monitoring of the sites will not effect any resources other than archaeological resources. Reporting on findings will not involve significant use of traditional ecological knowledge.

PROJECT DESIGN

A. Objectives

The overall intent of the archaeological site monitoring program is to maintain a current assessment of the status of vandalized sites in the oil spill area and sites oiled during the spill. Continuing and current site status is required to protect the sites from degradation. The objectives of the FY97 project are:

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

The intent of the project at its conclusion is to have maintained a presence at the vandalized sites for a long enough period of time to gauge levels of vandalism and discourage that activity by our presence. The long range intent by FY2004 is to reduce that activity to zero. Oiled sites will be considered restored when they have remained oil free for the life of the project. Oil in surrounding sediments will be considered stable or immobile by that time.

B. Methods

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

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

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

SEW-440 The Chugach National Forest archaeologist will visit the site to monitor for vandalism. Testing of beach sediments collected during 1994 and 1995 proved positive on the beach which has been bioremediated. Additional sediment samples will be collected for further testing.

SEW-469 This site will be re-visited in 1998 to check for signs of vandalism. The location of vandal activity documented during 1990 will be re-examined and photographed with reference to established photo points.

SEL-178 The Port Dick Cabin Site, SEL-178 will be visited to monitor vandal damage to the site. During 1995, damage to a previously undocumented part of the site deposits was noted. Status of that damage will be documented with maps and photography. Areas of artifact exposure in other parts of the site, documented during 1991 will be re-checked and re-documented. Additional damage occurred during 1996.

SEW-004 This cave site was documented during the Spill cleanup period as being heavily vandalized at an earlier time. Crews were ordered to avoid that part of the island but were housed in the area. A visit needs to be made to determine whether vandalism has occurred since.

AFG-081 The AFG-081 will be re-visited during 1997 to monitor the location of 1991 vandalism. The damage was restored during 1994 by covering the area with fill and logs. The area was re-damaged during 1995 and 1996. Replacement of the restorative cover will be necessary during 1997. Site status will be re-checked during 1998 and documented through photography.

AFG-098 The site was visited during 1995 to document reported damage from the prior winter. Sediment samples from the intertidal zone tested negative for presence of petroleum hydrocarbons. The site will be re-visited during 1998 to monitor site condition through photography and mapping of any damage found.

AFG-129 This site was visited during 1993 and again during 1996. It is one of the sites periodically monitored for vandalism. Disturbance was originally noted while vessels of the cleanup fleet were anchored in the immediate area. Vandal injury of the middens occurred from tunneling and surface digging into the midden. The current status of the sites will be documented and compared with prior conditions.

KOD-171 The Chief Cove Site will be re-visited to monitor evidence for continuing disturbance of the midden. Slumpage in the midden deposits was documented during 1995 and in 1996. The agent of disturbance, however, was not established. Findings will be mapped on the existing map which is based on the field map created by the Dekin, et al., damage assessment study done in 1991.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

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

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

SCHEDULE

A. Measurable Project Tasks for FY 98 (October 1, 1997 - September 30, 1998)

Oct. 1, 1997 - Dec. 31, 1997:	Complete requirements for NEPA requirements and prepare draft report for FY 97 field activities.
April 15, 1998:	Submit annual report of FY 97 activities for peer review.
May 1, 1998 - June 1, 1998:	Finalize arrangements for fieldwork; make changes in FY 97 report for submission to OSPIC.
June 1, 1998 - Sept. 30, 1998:	Complete fieldwork and followup office work. Submit charcoal and sediment samples for analysis.

B. Project Milestones and Endpoints

This project is in the fourth year of a ten year project. The projected completion date is in FY2004. A progress evaluation is scheduled during the proposal year to determine the need to continue monitoring individual sites and of the program as a whole. The evaluation will be a review of past and current findings and revised projection of needs.

Dec. 31, 1997	Complete NEPA requirements (FONSI expected).
April 15, 1998	Complete FY 97 annual report, submit for review.
June 1, 1998	Complete fieldwork planning and begin fieldwork.
Sept. 30, 1998	Complete fieldwork and begin annual report.
Dec. 31, 1998	Draft annual report for FY98
April 15, 1998	Final report FY98 due.

C. Completion Date

The archaeological index site monitoring has been scheduled for completion in FY 2004. That is the time span which agency experience suggests a pattern of vandal activity will be demonstrated and EVOS related. Findings of negative results at specific sites for a period of at least three years will delete that index site from further monitoring. A report of cumulative findings is planned at the half way point of project duration in 1998.

PUBLICATIONS AND REPORTS

No formal publications are anticipated for this monitoring project. An annual report will be produced by April 15, 1998 as dictated in the submittal instructions for project proposals. At the end of the continuing project, a final closeout report will be prepared.

PROFESSIONAL CONFERENCES

No professional conferences will be attended nor papers presented in respect to this monitoring project. A report of findings is anticipated for the Annual EVOS Workshop in Spring, 1999.

NORMAL AGENCY MANAGEMENT

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

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

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

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

No major changes in methodology have been proposed from the 97007 detailed project description other than sites monitored. Part of the originally established procedure of using "index" sites was that monitored sites would vary between years to make coverage more efficient. That variation is reflected in the sites selected for FY 98.

PROPOSED PRINCIPAL INVESTIGATOR

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1981 PhD.- Anthropology, Washington State University

PROFESSIONAL EXPERIENCE:

1964	Field and museum assistant, Univ. of Alaska, Fairbanks
1965	Field assistant, Univ. of Alaska, Fairbanks
1966	Field assistant, Alaska Methodist Univ.
1966-67	Laboratory/research assistant, Alaska Methodist Univ.
1969	Short field surveys, Cordova and Katmai, AK
1970	Field School instructor, Alaska Methodist U., Tangle Lakes
1970-71	Excavated site 49KEN-029, near Kenai, AK
1971	Salvage archaeologist, Alyeska Pipeline Project
1971-74	Teaching assistant, Washington State Univ.
1972	Assistant Highways archaeologist, Washington State Univ.
1973	Project Archaeologist, Homer Society for Natural History
1974-75	Regional archaeologist, USDA Forest Service, Alaska Region
1975-82	Alaska State archaeologist, Alaska Division of Parks
1978-82	Deputy State Historic Preservation Officer, Alaska
1982-86	Archaeologist, Alaska Division of Geological and Geophysical Surveys
1986-	Archaeologist, Alaska Division of Parks and Outdoor Recreation

PUBLICATIONS/REPORTS:

1972	*An archaeological survey in the Utopia area, Alaska,* **Anthropological Papers of the University of Alaska**, 15(2), with R.D. Reger
1974	*Prehistory of the northern Kenai Peninsula,* In **Prehistory of the North American Subarctic: the Athapaskan Question**, edited by J.W. Helmer, S. VanDyke, and F.J. Kense, Univ. of Calgary, p. 16-21
1977	*An Eskimo Site near Kenai, Alaska,* **Anthropological Papers of the University of Alaska**, 18(2): 37-52
1983	*Norton: a changing southeastern boundary,* **Arctic Anthropology** 19(2): 93-99, with Joan B. Townsend
1987	*Archaeology of a late prehistoric subsistence locality, the Clam Gulch Site (49KEN-045),* **Anthropological Papers of the University of Alaska** 21:89-103
1992	Effect of crude oil contamination on some archaeological sites in the Gulf of Alaska, 1991 investigations. Office of History and Archaeology Report No. 30. Alaska Division of Parks and Outdoor Recreation, with J. David McMahan and C. E. Holmes.
1996	An Overview of the Radiocarbon Chronology in Cook Inlet Prehistory. IN Adventures Through Time: Readings in the Anthropology of Cook Inlet, Alaska, edited by Nancy Y. Davis and William E. Davis, Cook Inlet Historical Society, Anchorage, with Alan Boraas.

OTHER KEY PERSONNEL

Debra Corbett
Archaeologist
Alaska Regional Office
U.S. Fish and Wildlife Service
1011 E. Tudor Road
Anchorage, AK 99503
Phone: (907)786-3399

Debra Corbett will be the lead investigator for this project for the lands managed by the U.S. Fish and Wildlife Service on Kodiak Island. Ms. Corbett will be responsible for all arrangements for field work and analysis of her findings. She will be responsible for writing the section of the final report describing and interpreting the site on that agency land. Ms. Corbett will be responsible for any coordination with Old Harbor Village.

Dale Vinson
Archaeologist
Chugach National Forest
U.S.D.A. Forest Service
3301 C. Street, Suite 300
Anchorage, AK 99503-3998
Phone: (907)271-2511

Dale Vinson will be responsible for all arrangements for field work in the Prince William Sound area under this project. He will be responsible for coordination with Chenega Village, doing the field work, analysis of results and writing of the appropriate section of the final report.

LITERATURE CITED

Dekin, Albert A., Mark S. Cassell, James Ebert, Eileen Camilli, Janet Kerley, Michael R. Yarborough, Peter A. Stahl, Beth L. Turcy
1993 Exxon Valdez Oil Spill Damage Assessment, Final Report. Contract No. 53-0109-1-00325, USDA Forest Service, Juneau.

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FFY 1997	Proposed FFY 1998	PROPOSED FFY 1998 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
					$89.3	$28.0	$28.0	
Personnel	$70.3	$87.0						
Travel	$18.8	$19.1						
Contractual	$24.9	$21.2						
Commodities	$6.4	$3.4						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$120.4	$130.7	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004
General Administration	$1.3	$14.6						
Project Total	$121.7	$145.3	$151.5	$135.0	$151.5	$135.0	$151.5	$135.0
Full-time Equivalents (FTE)	1	1.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

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

1998

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Lead Agency: AK Department of Natural Resources

FORM 2A
MULTI-TRUSTEE
AGENCY SUMMARY

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FFY 1997	Proposed FFY 1998						
Personnel	$51.3	$55.5						
Travel	$12.1	$9.2						
Contractual	$19.4	$13.3						
Commodities	$4.5	$2.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$87.3	$80.0	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	
General Administration		$9.3						
Project Total	$87.3	$89.3	$91.8	$91.8	$91.8	$91.8	$91.8	
Full-time Equivalents (FTE)	0.7	0.8						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Agency: AK Department of Natural Resources

FORM 3A TRUSTEE AGENCY SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1997
Douglas R. Reger	Archaeologist II	18M	6.0	6.5		39.0
J. David McMahan	Archaeologist I	16K	3.0	5.5		16.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		9.0	12.0	0.0	
					Personnel Total	$55.5

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
Travel to Kodiak to monitor sites	0.5	4	36	0.115	6.1
Travel to Homer to monitor sites	0.2	4	20	0.115	3.1
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$9.2

1998

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Agency: AK Department of Natural Resources

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FFY 1997
Air charter (Kodiak 20 hours, Homer 15 hours @ $275)	9.6
Radiocarbon dating, 4 samples @ $300/sample	1.2
Film processing	1.5
Report duplication	1.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$13.3

Commodities Costs:	Proposed
Description	FFY 1997
Field supplies	1.0
Office supplies	1.0
Commodities Total	$2.0

1998

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Agency: AK Department of Natural Resources

FORM 3B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1998

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Agency: AK Department of Natural Resources

FORM 3B
Equipment
DETAIL

1998 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Budget Category:	Authorized FFY 1997	Proposed FFY 1998						
Personnel	$12.0	$18.0						
Travel	$5.0	$4.3						
Contractual	$2.2	$2.8						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$19.2	$25.1	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	
General Administration		$2.9						
Project Total	$19.2	$28.0	$16.5	$16.5	$16.5	$16.5	$16.5	
Full-time Equivalents (FTE)	0.1	0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Agency: DOI- Fish and Wildlife Service

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs: Name	Position Description	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1997
Charles E. Diters	Archaeologist	GS-12	3.0	6.0		18.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.0	6.0	0.0	
					Personnel Total	$18.0

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1997
Travel to Kodiak to monitor sites	0.4	4	12	0.225	4.3
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$4.3

1998

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Agency: DOI- Fish and Wildlife Service

FORM 3B
Personnel
& Travel
DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FFY 1997
Air charter (Kodiak 4.5 hours @ $275)	1.3
Film processing	0.5
Radiocarbon Dating (4 samples @ $250/sample)	1.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$2.8

Commodities Costs:	Proposed
Description	FFY 1997
Commodities Total	$0.0

1998

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Agency: DOI- Fish and Wildlife Service

FORM 3B
Contractual &
Commodities
DETAIL

4/14/97

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1998

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Agency: DOI- Fish and Wildlife Service

FORM 3B
Equipment
DETAIL

1998 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FFY 1997	Proposed FFY 1998						
Personnel	$0.0	$13.5						
Travel	$0.0	$5.6						
Contractual	$0.0	$5.1						
Commodities	$0.0	$1.4						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$25.6	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	
General Administration		$2.4						
Project Total	$0.0	$28.0	$28.0	$28.0	$28.0	$28.0	$28.0	
Full-time Equivalents (FTE)	0	0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Agency: USDA - Forest Service

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1997
	Archaeologist	GS-11	2.6	5.2		13.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.6	5.2	0.0	
					Personnel Total	$13.5

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
Travel toPrince William Sound to monitor site	0.224	3	22	0.225	5.6
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$5.6

1997

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Agency: USDA - Forest Service

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FFY 1997
Air charter,(10 hours @ $275/hour)	2.8
Film processing	0.5
Report processing	0.8
Publication	1.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$5.1

Commodities Costs:	Proposed
Description	FFY 1997
Office supplies	0.4
Field supplies	1.0
Commodities Total	$1.4

1998

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Agency: USDA - Forest Service

FORM 3B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1998	Project Number: 98007a Project Title: Archaeological Index Site Monitoring Agency: USDA - Forest Service	FORM 3B Equipment DETAIL

Prepared:

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FFY 1997	Proposed FFY 1998						
Personnel	$7.0	$0.0						
Travel	$1.7	$0.0						
Contractual	$3.3	$0.0						
Commodities	$1.9	$0.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$13.9	$0.0	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	
General Administration	$1.3	$0.0						
Project Total	$15.2	$0.0	$15.2	$0.0	$15.2	$0.0	$15.2	
Full-time Equivalents (FTE)	0.2	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

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

1998

Prepared:

Project Number: 98007a
Project Title: Archaeological Index Site Monitoring
Agency: DOI - National Park Service

FORM 3A
TRUSTEE
AGENCY
SUMMARY

98007B

SITE SPECIFIC ARCHAEOLOGICAL RESTORATION

Project Number:	98007B
Restoration Category:	Restoration management actions; archaeology
Proposer:	Chugach National Forest
Lead Trustee Agency:	USFS
Duration:	1 year
Cost FY98:	$10,300
Geographic area:	Prince William Sound
Injured Resource/Service:	Archaeological resources

RECEIVED
APR 15 1997
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

Funding is requested for an additional phase of the Forest Service's archaeological restoration at sites SEW-440 and SEW-488. Project 98008B is a continuation of projects 97007B, 96007B, 95007B and 94007B. The final report on the restoration project having been completed in FY97, this phase of the project will present the results of additional analysis to the professional and general public. The Principal Investigator will prepare a professional paper for publication, and a shortened version for presentation at the Alaska Anthropological Association annual meeting.

INTRODUCTION

The proposed phase is part of the restoration project previously funded as 94007B, 95007B, 96007B, and 97007B. Restoration field work was completed in FY94 and FY95. The report on the analysis of data resulting from those field seasons is nearing completion. A paper was presented April 6, 1997 at the Society for American Archaeology (SAA) regarding the EVOS archaeological restoration project, its rationale, and results. Another paper is being prepared for submission to a peer-reviewed journal. Preparations are underway to present the results to the public in oil spill affected communities. The Trustee Council and their staff have called for Principal Investigators to write papers concerning their projects for professional journals, and to educate the public regarding the outcome of these projects. The work proposed for FY98 is the preparation of an additional paper for publication in a professional journal and public presentation.

NEED FOR THE PROJECT

A. Statement of the Problem

Restoration work at archaeological sites SEW-440 and SEW-488 has resulted in the collection of a wide variety of data. The project report now being finalized addresses the restoration goals of full field site damage assessment; recovery, analysis and curation of artifacts; the nature of each site; and the extent to which the identified damage has compromised or destroyed information contained in the sites. The report is generally descriptive in nature, allowing room for additional analyses of the data as they relate to archaeological research problems in the Oil Spill area. Also, the final report will be part of what is commonly called "grey literature", meaning that it will not be widely available or easily found by other professionals. Preparation and publication of two papers addressing more detailed analysis of specific aspects of the sites was requested for this year, but only one was funded. Additional analyses reported in peer-reviewed journals will lead other professionals to seek out the final restoration report, and build on its data and analyses to pursue other research questions. The Trustee Council now actively encourages publication of project results in peer-reviewed journals as soon as scientifically appropriate and logistically possible. The scientifically appropriate time for presentation of material regarding detailed analysis of the archaeological sites will be in 1998, following publication of the project report.

B. Rationale/Link to Restoration

The restoration project emphasized artifact analysis and the nature of each site. The final report contains descriptions of the sites and limited analysis of the artifacts, and adds significantly to the human and biological understanding of the prehistory of Prince William Sound. Additional analyses pertaining to particular research questions in the sound are appropriate now that the basic research has been done, to understand the significance of these sites in the context of other north Pacific culture areas. It is important, as the Trustee Council has noted, to disseminate such knowledge to other professionals through papers in peer reviewed professional journals.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Not applicable to this project.

PROJECT DESIGN

A. Objectives

The objective is to relate specific data from restoration project archaeological sites to regional and theoretical research questions in a paper for peer-reviewed publication in a professional journal.

B. Methods

The research paper will address regional and theoretical archaeological questions using the data from the EVOS restoration project sites. This paper will consider taphonomic processes affecting the differential preservation of archaeological faunal data at the sites. It will focus on soil chemical processes, variability in patterns of biological species acquisition and use, transport and processing techniques.

Soil pH was ascertained on samples from SEW-440 and SEW-488, however additional soil tests are necessary to understand the unusually poor preservation of calcium-rich materials at SEW-488 (bone and shell). Additional soil tests for base concentrations of metallic ions and calcium content will be conducted.

Results of the research paper will be presented in poster format at the 1998 Annual EVOS Restoration Workshop. The paper for presentation at the Alaska Anthropological Association will be a shortened version of the paper for publication, and will present the highlights of the detailed research.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

No contracts are anticipated as necessary to accomplish this phase of the project. Forest Service will be the only agency involved.

SCHEDULE

A. Measurable Project Tasks for FY

Oct. 1-Jan.15:	Prepare research paper for peer-review professional journals, poster for Annual EVOS Restoration Workshop
Jan 15-24 (3 of these days):	Attend Annual EVOS Restoration Workshop
April (dates undetermined):	Presentation of paper at annual AAA

B. Project Milestones and Endpoints

February 1:	Submission of paper to peer-reviewed journal

C. Completion Date

The project will be completed in FY98.

PUBLICATIONS AND REPORTS

The paper described above will be prepared for submission in FY98. It is presently anticipated that it will be submitted to either the journal *American Antiquity* or *Archaeology* for publication after going through the review process as described in the Restoration Office guidelines of March 29, 1996.

PROFESSIONAL CONFERENCES

A shortened version of the paper, emphasizing its highlights and results, will be presented at the Alaska Anthropological Association annual meeting in April.

NORMAL AGENCY MANAGEMENT

The entire scope of the archaeological restoration project is outside the Forest Service's normal management activities. No assessment and testing work would have been conducted at these sites had it not been for the *Exxon Valdez* Oil Spill and resultant damage. This project has been necessary for the Trustee Council to fully document recovery of injured archaeological resources.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Project 98007B is a continuation of 97-, 96-, 95-, and 94007B. The existing Forest Service heritage program does not dovetail with this project. The Forest archaeologists perform fieldwork and related analysis and report writing on a project funded basis.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The original proposal for FY97 included preparation of two papers for submission to peer-review journals, however only one was funded, and the principal investigator was encouraged to submit the proposal for the second paper for FY98. The Trustee Council has highly encouraged dissemination of research results to the professional community.

PROPOSED PRINCIPAL INVESTIGATOR

Linda Finn Yarborough
Assistant Forest Archaeologist
Chugach National Forest
3301 C St., Suite 300
Anchorage, Alaska 99503

The proposed principal investigator for the project meets the professional qualifications standards specified under the Secretary of the Interior's Guidelines for Archaeology and Historic Preservation, and has worked on the project for the past four years. She will be responsible for writing the peer-reviewed paper and professional conference paper.

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel	$13.0	$7.8						
Travel	$3.4	$0.0						
Contractual	$0.0	$0.3						
Commodities	$1.5	$1.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$17.9	$9.1		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
General Administration	$2.0	$1.2						
Project Total	**$19.9**	**$10.3**						
Full-time Equivalents (FTE)		0.1						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: Publish results of 95007B.

1998	Project Number: 98007B Project Title: Archaeological Site Restoration Agency: US Forest Service	FORM 3A TRUSTEE AGENCY SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1998
L.Yarborough	Archaeologist	GS-11	1.5	5.2		7.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.5	5.2	0.0	
					Personnel Total	$7.8

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

1998

Prepared:

Project Number: 98007B
Project Title: Archaeological Site Restoration
Agency: US Forest Service

FORM 3B
Personnel
& Travel
DETAIL

4/15/97

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

Contractual Costs:	Proposed
Description	FY 1998
Soil sample testing	0.3
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.3

Commodities Costs:	Proposed
Description	FY 1998
Printing (page costs)	1.0
Commodities Total	$1.0

1998

Project Number: 98007B
Project Title: Archaeological Site Restoration
Agency: US Forest Service

FORM 3B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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

1998

Project Number: 98007B
Project Title: Archaeological Site Restoration
Agency: US Forest Service

FORM 3B
Equipment
DETAIL

Prepared:

4/15/97

98007C

Archaeological Documentation, New Habitat Areas

RECEIVED
APR 1 4 1997
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

Project Number:	98007c
Restoration Category:	Monitoring
Proposer:	ADNR, Office of History and Archaeology
Lead Trustee Agency:	ADNR
Cooperating Agencies:	DOI-FWS, USFS
Alaska Sealife Center:	
Duration:	1st year, 2 year project
Cost FY 98:	$80,000
Cost FY 99:	$20,000 (Closeout)
Geographic Area:	Prince William Sound, Kodiak Island
Injured Resource:	Archaeological Resources

ABSTRACT

Habitat acquisition by the EVOS Trustees brought into public ownership, sites vandalized during EVOS related activities. These sites, not accessible to the site restoration process because of ownership, now will be documented to determine restoration needs and be included in the continuing site monitoring program as necessary Five sites on Kodiak Island, five sites on Shuyak Island and five sites in Prince William Sound will be examined.

INTRODUCTION

Damage to archaeological sites as a result of cleanup activities after the EVOS have been well documented at sites on public lands is the spill area. Monitoring and assessment of current status at sites not on public land was not pursued by the land managing agencies, largely due to restrictions on spending settlement money on non-public lands. Recent habitat acquisitions by the EVOS Trustees of private lands have brought damaged sites under public lands management. Documentation of damages to the new sites is contained in Exxon reports and damage assessment reports by agencies. There is a need to document the current status of those sites and determine what is needed to accomplish recovery from the damages.

Most of the sites have suffered damages from vandalism encouraged by increased knowledge of sites by collectors during spill cleanup. Reducing site vandalism to pre-spill levels and preserving scientific data in damaged sites are two goals identified as measures of site recovery in the spill management plan. Documentation status at the newly acquired sites and devising preservation strategies contributes to reaching those goals. Sites identified during review of Exxon documents or through reports by the public have identified sites in the Kodiak area, on the Kenai Peninsula and in Prince William Sound.

The U.S. Fish and Wildlife Service proposes to examine four sites on the southeast coast of Kodiak Island. Two sites in the Sitkalidak Strait, KOD-377 and KOD-382, will be surveyed and evaluated. The sites are adjacent to each other on the mainland shore of Sitkalidak Strait, opposite the mouth of Port Hobron. Two other sites, KOD-099 and KOD-100, are located in Kiavak Bay. Both sites were listed on the AHRS prior to the Spill.

Sites located on lands purchased by the Trustees from the Kodiak Borough are both midden and house pit sites, AFG-084, AFG-150, AFG-157, AFG-160, and AFG-188. The sites are to incorporated into Shuyak State Park. All three sites have suffered some degree of vandalism based on Exxon documents and public reports.

In Prince William Sound, the U.S. Forest Service proposes to document five sites on the mainland in Jackpot Bay, Ewan Bay, Paddy Bay and in Hogan Bay on Knight Island. The sites have all been noted as eroding and subject to vandalism. Information derives from Exxon field notes and information from the public.

NEED FOR THE PROJECT

A. Statement of Problem

Directions provided early in the spill response and cleanup process to public land managers from the EVOS Trustees and staff were to assess only sites on public lands. The reason for the guidelines was because the funding was with public funds and to respect the wishes of private upland owners. Those guidelines have continued in effect resulting in a lack of systematic information about spill damaged sites on habitat lands purchased by the Trustees. Spill related damages did occur on privately held sites specifically on lands newly acquired. This project proposes to document the damages and current status of sites on those lands. The archaeological peer reviewer while reviewing an FY97 proposal, recommended visiting the sites on acquired habitat to assess the reported damages.

Sites selected for documentation were identified from field notes filed by Exxon shoreline assessment teams, Exxon reports, and from public reports. Sites which are damaged and require future monitoring will be added into the current agency monitoring program (EVOS Project 9x007a).

Damage was inflicted mainly during or just after the cleanup phase of the Spill response. Vandalism was associated with people placed near exposed sites while on chartered boats and during unsupervised cleanup. Cleanup crews particularly in the Kodiak area frequently were active without the structured supervision evident in the Prince William Sound and Kenai Peninsula coast areas. Resource managers fear that vandalism witnessed during cleanup expanded in the spill area and continued on privately owned sites.

B. Rationale/Link to Restoration

Vandalism of sites results in the loss of information about aboriginal use of the Spill area and heritage of the Native people. Destruction of the sites removes the possibility that archaeologists can interpret remains and document the prehistory of the people. Evidence found in Spill area sites during the 1996 field season attests to the fact that vandalism still occurs. The loss suffered is irreversible.

C. Location

The project is located in Prince William Sound, on Shuyak Island and the main island of Kodiak. The sites are located in remote areas with nearest villages being Chenega for the Prince William Sound area and Old Harbor for the Kodiak Island sites. The Shuyak Island sites are remote from any villages.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The archaeological investigations proposed will not effect any subsistence resources either directly or indirectly. Because the level of investigation will not involve theoretical interpretation of the data, little or no traditional knowledge will be involved with the project. Villages in the vicinity of the sites will be notified of the proposed work and their concerns accommodated to the extent possible.
Transportation needs specifically boat charter will be secured in the area of use through normal agency contracting procedures.

PROJECT DESIGN

A. Objectives

The objective of this project is to document evidence of vandalism and other damage to the selected sites. The documentation will be used to support monitoring damaged sites until vandalism ceases or agency management can halt continuing injury. The stated goal for restoration of vandalized archaeological sites is reduction of vandalism to pre-Spill or lower levels.

B. Methods

Selected sites which exhibit damage from Spill related vandalism will be mapped and described to facilitate future monitoring. Site maps will be prepared and reference points established for future photo and sample collection. Any documentation or sample collecting will follow standard archaeological methods. Documentation, artifacts and samples will be cataloged and archived until a repository is identified.

<u>Shuyak Island</u>

AFG-084

This location is a house pit site with accompanying midden in Shangin Bay on Shuyak Island. The site was examined by Exxon archaeologists in 1989 and vandalism has been reported (Exxon Segment files). The extent of the vandalism is unknown.

AFG-150

The AFG-150 Site is a small midden site on an isolated rock in an un-named cove on southwest Shuyak Island (McMahan, 1993: 72). The midden is exposed and subject to collecting. The site was not identified by Exxon SCAT when they surveyed the area. Vandalism is not confirmed but a known collector is active in the area.

AFG-157

The AFG-157 Site is located near AFG-150 and contains house depressions and exposed midden (McMahan, 1993: 75). The amount of disturbance at the site is unknown. A known collector is active in the area. Exxon archaeologists did not locate the site and cleanup proceeded in the segment without archaeological protection.

AFG-188

This house pit site was identified during 1990 and was also not recorded by Exxon archaeologists (McMahan, 1993: 83). Cleanup in the segment proceeded without archaeological constraints. A collector has been active in the area as noted above .

AFG-160

The Tetrakof House Pit Site, AFG-160 was noted by Exxon archaeologists (Abbott, 1989) as having midden exposed and evidence of vandalism present (McMahan, 1993: 76). Ownership of the land was not clear but will be included in the new State Park boundaries with newly acquired habitat. The site has not been examined since 1989.

Kodiak Island

KOD-099
KOD-100

Two sites, KOD-099 and KOD-100, are located in Kiavak Bay. This area was systematically surveyed by Exxon archaeologists in 1989 (Mobley, et al., 1990: 173), but they failed to relocate KOD-100. The archaeologists stipulated that any cleanup in the area would require monitors but there is no record any cleanup occurred. We have information from local bear guides that the site has been subject to repeated vandalism and is actively eroding. The guides have also provided evidence KOD-100 and collect some information on site condition for both sites.

KOD-377
KOD-382

Two other sites, KOD-377 and KOD-382, are located adjacent to Sitkalidak Strait in the southeastern part of the Kodiak area. They were located during a helicopter survey by Exxon archaeologists in 1989 (Mobley, et al., 1990), but never visited on the ground. The shoreline was lightly oiled and cleanup took place i the vicinity, but sites were not monitored during the cleanup Exxon field notes, Segment SX-001). A later damage assessment study surveyed a shoreline segment on Sitkalidak Island opposite in the vicinity of the two sites (Dekin, et al., 1993:15). Investigation would include documenting the size and condition of both sites.

Prince William Sound

Sites in Prince William Sound included in this proposal were not oiled but are considered damaged from vandalism or in danger of such damage.

SEW-515

This site in Hogan Bay was located in 1990 by EVOS archaeologists. In addition to a recent fish camp a series of possible pit features was mapped. In addition, the possibility of an older component beneath a peat bed was mentioned. The site has not been examined since 1990.

SEW-492

In 1989 EVOS SCAT personnel entered un-oiled Jackpot Bay without autorization and located a stone wall fish weir at the mouth of an anadromous fish stream. Noathing is known of this site beyond the presence of the fish weir as there is no record of an upland survey. The discovery of this site exemplifies the opportunities for oil clean-up crews to make unauthorized visits to areas outside of areas being cleaned to vandalize archaeological sites.

SEW-065

Natives of Chenega reported to Fredrica de Laguna (1956: 28, Site #53) a settlement called Naxqualaq was located on a salmon berry bush covered island at the mouth of Ewan Bay. EVOS archaeologists briefly visited the site in Auguse, 1992 and reported intertidal peats, stumps, and animal bones on the beach. Wide ranging cleanup crews were active in the area without close supervision and the sites need to be checked for damage.

SEW-431
This property consists of a rock shelter near the west shore of an island in Paddy Bay. Reports of disturbance could not be confirmed because the EVOS archaeologists could not relocate the site in 1989.

SEW-064
This site was identified by de Laguna (1956: 28, Site #52). The site was described as a 2 feet deep midden containing shells and animal bones. This site was behind a boom across the outer portion of Eschamy Bay and was not visited by EVOS archaeologists, therefore there is no documentation of site condition or vandalism. Boom crews and visiting workers were not closely supervised.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The Alaska Department of Natural Resources, Office of History and Archaeology, will act as the lead agency for this project. The Office of History and Archaeology will work with the EVOS Executive Director and staff for tracking the field work and reporting. Additionally, ADNR will do field examinations on the sites on Shuyak Island and write the report of findings for those sites. The U.S. Fish and Wildlife Service will perform the field examinations on sites on Kodiak Island and write sections of the annual report for those sites. The U.S. Forest Service will look at the sites in the Prince William Sound area and will write the report of findings for those sites. The ADNR Office of History and Archaeology will compile all segments of the annual report and present them according to reporting guidelines.

The U.S. Forest Service plans to contract for a boat to act as a support base vessel during their field investigations. They will follow required agency contracting procedures. Radiocarbon samples will be processed in commercial laboratories most of which are located in other states.

SCHEDULE

A. Measurable Project Tasks for FY 98 (October 1, 1997 - September 30, 1998)

The following milestones are for the project as a whole but activities leading to and including fieldwork will be accomplished by individual agencies without oversight by the lead agency, ADNR Office of History and Archaeology. The project milestones for this project are:

Oct. 1, 1997-Feb. 1, 1998:	Finalize fieldwork plans, coordinate with local villages, finalize boat contract provisions
January 15-24:	Attend Annual Restoration Workshop
Feb. 1 - May 15:	Contract for boat, finalize field plans
June 1 - Sept. 15:	Complete field investigations, submit film and samples for processing
Sept. 15 - Oct. 1, 1998:	Analyze data and begin preparation of final report and future

recommendations

B. Project Milestones and Endpoints

This project is intended to be a one year project. Vandalized sites will be identified for incorporation into the agency site monitoring project, EVOS Project 9x007a or the site stewardship project, EVOS Project 9x149.

Oct, 1 - Dec. 31:	Finalize fieldwork plans, coordinate with local villages (Chenega and Old Harbor)
Feb. 1:	finalize boat contract requirements
May 15:	Complete boat contract procedures
August 31:	Complete fieldwork
Sept. 15:	Complete submittal of film and radiocarbon samples for processing.
Dec. 31:	Complete draft of final report
April 15, 1999:	Complete and submit final report, incorporation of findings into site monitoring or stewardship projects

C. Completion Date

Fieldwork for the project will be complete by August 31, sample processing by December 31, and the final report closeout filed by April 15, 1999.

PUBLICATIONS AND REPORTS

No publications are anticipated from this project. The information generated in the final report is most likely to be incorporated into publications generated from the agency site monitoring project, EVOS Project 9x007, final report.

PROFESSIONAL CONFERENCES

Results of fieldwork could be presented at the annual meeting of the Alaska Anthropological Association. The 1999 annual meeting of that group will be held in Anchorage during March 1999. Any report at that meeting will depend on the importance of the findings.

NORMAL AGENCY MANAGEMENT

This project is proposed to document EVOS related damage to archaeological sites on land acquired by EVOS money under the habitat protection program. The damages attributed to EVOS related activities need to be made part of the restoration process outlined in the EVOS Restoration Plan. These sites have not been part of the restoration process to this point because they were located on private lands thus not subject to monitoring.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Field work support and personnel will be closely coordinated with that of the Site Monitoring program (EVOS Project 98007a) and the Archaeological Site Stewardship program (EVOS Project 98149). Arrangements by the U.S. Fish and Wildlife Service for examination of the Kodiak Island sites will be combined with that agency's effort in the above two projects. ADNR site monitoring on Shuyak Island will allow combining personnel, air charters, use of Alaska State Parks support and report writing arrangements. The U.S. Forest Service will be able to coordinate this project field work with that under the site monitoring project. Anticipated savings from coordination with those continuing projects have been included in the budget estimate for this project. No coordination with any other projects is anticipated.

PRINCIPAL INVESTIGATOR

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1981 PhD.- Anthropology, Washington State University

PROFESSIONAL EXPERIENCE:

1964	Field and museum assistant, Univ. of Alaska, Fairbanks
1965	Field assistant, Univ. of Alaska, Fairbanks
1966	Field assistant, Alaska Methodist Univ.
1966-67	Laboratory/research assistant, Alaska Methodist Univ.
1969	Short field surveys, Cordova and Katmai, AK
1970	Field School instructor, Alaska Methodist Univ., Tangle Lakes
1970-71	Excavated site 49KEN-029, near Kenai, AK
1971	Salvage archaeologist, Alyeska Pipeline Project
1971-74	Teaching assistant, Washington State Univ.
1972	Assistant Highways archaeologist, Washington State Univ.
1973	Project Archaeologist, Homer Society for Natural History
1974-75	Regional archaeologist, USDA Forest Service, Alaska Region
1975-82	Alaska State archaeologist, Alaska Division of Parks
1978-82	Deputy State Historic Preservation Officer, Alaska
1982-86	Archaeologist, Alaska Division of Geological and Geophysical Surveys

1986- Archaeologist, Alaska Division of Parks and Outdoor Recreation

PUBLICATIONS/REPORTS:

1972 *An archaeological survey in the Utopia area, Alaska,* **Anthropological Papers of the University of Alaska**, 15(2), with R.D. Reger

1974 *Prehistory of the northern Kenai Peninsula,* In **Prehistory of the North American Subarctic: the Athapaskan Question**, edited by J.W. Helmer, S. VanDyke, and F.J. Kense, Univ. of Calgary, p. 16-21

1977 *An Eskimo Site near Kenai, Alaska,* **Anthropological Papers of the University of Alaska**, 18(2): 37-52

1983 *Norton: a changing southeastern boundary,* **Arctic Anthropology** 19(2): 93-99, with Joan B. Townsend

1987 *Archaeology of a late prehistoric subsistence locality, the Clam Gulch Site (49KEN-045),* **Anthropological Papers of the University of Alaska** 21:89-103

1992 Effect of crude oil contamination on some archaeological sites in the Gulf of Alaska, 1991 investigations. Office of History and Archaeology Report No. 30. Alaska Division of Parks and Outdoor Recreation, with J. David McMahan and C. E. Holmes.

1996 An Overview of the Radiocarbon Chronology in Cook Inlet Prehistory. IN Adventures Through Time: Readings in the Anthropology of Cook Inlet, Alaska, edited by Nancy Y. Davis and William E. Davis, Cook Inlet Historical Society, Anchorage, with Alan Boraas.

OTHER KEY PERSONNEL

Debra Corbett
Archaeologist
Alaska Regional Office
U.S. Fish and Wildlife Service
1011 E. Tudor Road
Anchorage, AK 99503
Phone: (907)786-3399

Debra Corbett will be the lead investigator for this project for the lands managed by the U.S. Fish and Wildlife Service on Kodiak Island. Ms. Corbett will be responsible for all arrangements for field work and analysis of her findings. She will be responsible for writing the section of the final report describing and interpreting the site on that agency land. Ms. Corbett will be responsible for any coordination with Old Harbor Village.

Dale Vinson
Archaeologist
Chugach National Forest
U.S.D.A. Forest Service
3301 C. Street, Suite 300

Anchorage, AK 99503-3998
Phone: (907)271-2511

Dale Vinson will be responsible for all arrangements for field work in the Prince William Sound area under this project. He will be responsible for coordination with Chenega Village, doing the field work, analysis of results and writing of the appropriate section of the final report.

LITERATURE CITED

Dekin, Albert A., Mark S. Cassell, James Ebert, Eileen Camilli, Janet Kerley, Michael R. Yarborough, Peter A. Stahl, Beth L. Turcy

1993 Exxon Valdez Oil Spill Damage Assessment, Final Report. Contract No. 53-0109-1-00325, USDA Forest Service, Juneau.

de Laguna, Fredrica

1956 Chugach prehistory: the archaeology of Prince William Sound, Alaska. *University of Washington Publication in Anthropology*, No.13, Seattle.

McMahan, J. David

1993 Archaeological Investigations in the Gulf of Alaska: a State Response to the Exxon Valdez Oil Spill. Office of History and Archaeology Report Number 29, Alaska Division of Parks and Outdoor Recreation, Department of Natural Resources, Anchorage.

Mobley, Charles M., James C. Haggerty, Charles J. Utermohl, Morley Eldridge, Richard E. Reanier, Aron Crowell, Bruce A. Ream, David R. Yesner, Jon M. Erlandso, and Paul E. Buck

1990 The 1989 Exxon Valdez Cultural Resource Program. Exxon Shipping Company, Anchorage.

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FFY 1997	Proposed FFY 1998	PROPOSED FFY 1998 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
					$26.9	$35.8	$17.3	
Personnel	$0.0	$34.0						
Travel	$0.0	$11.4						
Contractual	$0.0	$25.9						
Commodities	$0.0	$1.7						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$73.0	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	
General Administration	$0.0	$7.0						
Project Total	$0.0	$80.0	$20.0					
Full-time Equivalents (FTE)	0	0.8						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Comments: New project. Document cultural resources on acquired habitat lands. Sites were not included in earlier site assessments and monitoring programs because of private ownership. Compilation of inal report during FY99 after sample processing.

1998

Prepared:

Project Number: 98007c
Project Title: Archaeological Documentation, New Habitat Areas
Lead Agency: AK Department of Natural Resources

FORM 2A
MULTI-TRUSTEE
AGENCY SUMMARY

Budget Category:	Authorized FFY 1997	Proposed FFY 1998
Personnel	$0.0	$14.8
Travel	$0.0	$5.3
Contractual	$0.0	$3.3
Commodities	$0.0	$1.0
Equipment		$0.0
Subtotal	$0.0	$24.4
General Administration		$2.5
Project Total	$0.0	$26.9
Full-time Equivalents (FTE)	0	0.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	
$7.5	$0.0	$0.0	$0.0	$0.0	

Dollar amounts are shown in thousands of dollars.

Comments:

1998

Prepared:

Project Number: 98007c
Project Title: Archaeological Documentation, New Habitat Areas
Agency: AK Department of Natural Resources

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1997
Douglas R. Reger	Archaeologist II	18M	1.0	6.5		6.5
J. David McMahan	Archaeologist I	16K	1.5	5.5		8.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.5	12.0	0.0	
					Personnel Total	$14.8

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
Travel to Kodiak to monitor sites	0.5	4	29	0.115	5.3
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$5.3

1998

Prepared:

Project Number: 98007c
Project Title: Archaeological Documentation, New Habitat Areas
Agency: AK Department of Natural Resources

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs: Description	Proposed FFY 1997
Air charter (6.5 hours @ $275)	1.8
Radiocarbon dating, 4 samples @ $300/sample	1.2
Film processing	0.3
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$3.3

Commodities Costs: Description	Proposed FFY 1997
Field supplies	0.5
Office supplies	0.5
Commodities Total	$1.0

1998

Prepared:

Project Number: 98007c
Project Title: Archaeological Documentation, New Habitat Areas
Agency: AK Department of Natural Resources

FORM 3B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description		Number of Units	Unit Price	Proposed FFY 1997
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.			New Equipment Total	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1998

Prepared:

Project Number: 98007c
Project Title: Archaeological Documentation, New Habitat Areas
Agency: AK Department of Natural Resources

FORM 3B
Equipment
DETAIL

1998 EXXON VALDEZ TRUSTE UNCIL PROJECT BUDGET
October 1, 1997 - ember 30, 1998

Budget Category:	Authorized FFY 1997	Proposed FFY 1998						
Personnel		$6.1						
Travel		$6.1						
Contractual		$3.9						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal		$16.1	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	
General Administration		$1.2						
Project Total	$0.0	$17.3	$5.0					
Full-time Equivalents (FTE)		0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998	Project Number: 98007c Project Title: Archaeological Documentation, New Habitat Areas Agency: DOI- Fish and Wildlife Service	FORM 3A TRUSTEE AGENCY SUMMARY

Prepared:

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1997
Debra Corbett	Archaeologist	GS-9	1.0	3.6		3.6
	Archaeologist	GS-7	1.0	2.5		2.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.0	6.1	0.0	
					Personnel Total	$6.1

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
Travel to Kodiak to monitor sites	0.4	4	20	0.225	6.1
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$6.1

1998

Prepared:

Project Number: 98007c
Project Title: Archaeological Documentation, New Habitat Areas
Agency: DOI- Fish and Wildlife Service

FORM 3B
Personnel
& Travel
DETAIL

4/14/97

Contractual Costs:	Proposed
Description	FFY 1997
Air charter (Kodiak 4 hours @ $300/hour)	1.2
Film processing	0.3
Radiocarbon Dating (4 samples @ $250/sample)	2.4
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$3.9

Commodities Costs:	Proposed
Description	FFY 1997
Commodities Total	$0.0

1998

Prepared:

Project Number: 98007c
Project Title: Archaeological Documentation, New Habitat Areas
Agency: DOI- Fish and Wildlife Service

FORM 3B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1998

Prepared:

Project Number: 98007c
Project Title: Archaeological Documentation, New Habitat Areas
Agency: DOI- Fish and Wildlife Service

FORM 3B
Equipment
DETAIL

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

Budget Category:	Authorized FFY 1997	Proposed FFY 1998						
Personnel	$0.0	$13.1						
Travel	$0.0	$0.0						
Contractual	$0.0	$18.7						
Commodities	$0.0	$0.7						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$32.5	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	
General Administration		$3.3						
Project Total	$0.0	$35.8	$7.5	$0.0	$0.0	$0.0	$0.0	
Full-time Equivalents (FTE)	0	0.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998

Prepared:

Project Number: 98007c
Project Title: Archaeological Documentation, New Habitat Areas
Agency: USDA - Forest Service

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1997
Vinson	Archaeologist	GS-9	2.0	3.0		6.0
Vacant	Archaeological Tech.	GS-5	1.5	2.2		3.3
Vacant	Archaeological Tech.	GS-7	1.5	2.5		3.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		5.0	7.7	0.0	
					Personnel Total	$13.1

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
					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

1997

Prepared:

Project Number: 98007c
Project Title: Archaeological Documentation, New Habitat Areas
Agency: USDA - Forest Service

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FFY 1997
Boat Charter ($1200/day for 10 days)	12.0
Train Ticket (3 @ $28.00)	0.1
Radiocarbon Dating (12 samples @ $550/sample {accelerator processing})	6.6
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$18.7

Commodities Costs:	Proposed
Description	FFY 1997
Film	0.1
Field supplies	0.6
Commodities Total	$0.7

1998

Prepared:

Project Number: 98007c
Project Title: Archaeological Documentation, New Habitat Areas
Agency: USDA - Forest Service

FORM 3B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FFY 1997
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

1998

Prepared:

Project Number: 98007c
Project Title: Archaeological Documentation, New Habitat Areas
Agency: USDA - Forest Service

FORM 3B
Equipment
DETAIL

4/14/97

98012-BAA

COMPREHENSIVE KILLER WHALE INVESTIGATION IN PRINCE WILLIAM SOUND, ALASKA (Submitted under BAA #52ABNA700049)

Project Number: 98012a

Restoration Category: Monitoring, Research

Proposer: North Gulf Oceanic Society

Lead Trustee Agency: NOAA

Duration: 1 year

Cost FY 98: $155,885

Geographic Area: Prince William Sound, Alaska

Injured Resource/Service: Killer Whales, Harbor Seals

RECEIVED
APR 7 1997
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

This project continues the monitoring of the damaged AB pod and other Prince William Sound killer whales that has occurred on a yearly basis since 1984. It also provides a continuation of analysis of a GIS database on killer whales. We propose in FY98 to identify critical habitats for transient whales in Prince William Sound using these data. When coupled with genetic, behavioral, and acoustic data, this project will evaluate recovery of killer whales, recognize changes in behavioral ecology, estimate killer whale predation on harbor seals, estimate impacts of the harbor seal decline on the potential recovery of killer whales and determine critical habitats. Year round residency of killer whales will be assessed using a remote hydrophone system. Environmental contaminant levels in the blubber of specific whales will be determined and potential effects on recovery evaluated. An updated catalogue of individual killer that use Prince William Sound will be constructed and incorporated in a popular book detailing research results (FY99)

INTRODUCTION

This project is a continuation of the comprehensive killer whale investigation initiated in 1995 in Prince William Sound and continued in FY96 and FY97. Killer whales were monitored under EVOS Trustee Council funding in 1989, 1990, and 1991 (damage assessment) and in 1993 and 1995 (restoration monitoring) with a reduced annual monitoring program initiated in 1996.

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. The pod had a net increase of one indivdual in 1996 and currently contains 23 individals. The rate of mortality observed in this pod after the oil spill far exceeds that recorded for other resident pods observed in Prince William Sound over the past 11 years or for 19 pods in British Columbia over the past 20 years.

Nine whales from the transient AT1 group have not been observed since 1989. Two additional AT1 whales have not been sighted for five years or more. One of these eleven whales is known to be dead. However transient killer whale social structure is not fully understood and we cannot be certain that the other whales are dead. Statistical analysis strongly suggests that they have either died or emigrated from the area on a permanent basis.

This project will continue the monitoring program necessary to map the changes (recovery or non-recovery) of Prince William Sound killer whales on a reduced annual basis. When possible, data and samples necessary to complete other aspects of this project will be collected simultaneously with the monitoring effort.

In 1995-96 thirteen years of systematic data collected under public and private funding were placed in a specially designed GIS system at the Prince William Sound Science Center. The database contains 663 records of encoutners with killer whales in and near Prince William Sound. Among these are 192 encounters with transient-tyupe whales. Analyses conducted at the end of FY96 found that large-scale spatial distribuition patterns differed between resient and transient whales and were different over time. Work in FY97 (in progress will focus on whether changes in transient whale distributions can be related to available data on harbor seal populations. In FY98 we propose to identify critical habitat for these whales and identify the ways that whales use these habitats.

FY98 will be the final year for collection of killer whale biopsy samples and observation and collection of killer whale prey remains. This final samplng effort will be considerably reduced from FY97. We will attempt to sample specific whales that will fill data gaps and aid in the final evaluation of contaminant levels and the genetic examination of social structre in Prince William Sound killer whales. By the end of FY97, the results of mitochondrial DNA analysis of Prince William Sound killer whales will be published and nuclear DNA analysis well under way. Current results show fixed differences in mitochondrial DNA between of the resident and transient groups and between three transient and two resident populations. Because mitochondrial DNA is maternally inherited it accurately reflects patterns of female dispersal. Thus, it is commonly used as a first step in population analyses. It does not, however, shed light on male dispersal. Male dispersal, genetic divergence and variation can be assessed directly by analysis of nuclear DNA, and we are combining both mitochondrial and nuclear analyses. Microsattelite markers in nuclear DNA is being used to investigate a wide variety of population properties, including mating systems, inbreeding levels, effective population size, and the extent of population subdivision (Queller et al. 1993). The uniqueness of pods or groups (particularly AB pod and the AT1 population) are being tested and the potential vulnerability of populations to extinction from random causes or from increases in mortality associated with human activity examined.

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. We are in the process of determining contaminant levels both resident and transient killer whales, and are finding much higher levels in the transient population. Contaminants seem to passed from mother to offspring via lactation and levels follow consistent patterns within genealogies. Samples are obtained from individually identified living whales that can be resampled to assess future changes. The ability to sample and potentially resample specific known individuals and their known kin is a unique aspect of this project. Baseline contaminant levels and contaminant loading patterns are being determined in cooperation with the NMFS/NOAA Environmental Contaminant Laboratory in Seattle.

There is very limited sighting information for killer whales during the November through March period in Prince William Sound. In 1995, NGOS, as part of a pilot project, installed a remote hydrophone (underwater microphone) in southwestern Prince William Sound in order to record vocalizations of killer whales and to examine their year-round use of the area. The hydrophone is anchored to the sea floor off the north end of Latouche Island and transmitted a radio signal to two receiving stations, one at the AFK salmon hatchery, and one in the Chenega Bay Community School. Winter use of the southwestern Sound by resident killer whales was documented (at least 2 pods are identifiable by calls in the recordings). The recordings also detailed residency of humpback whales in the area and included the recordings of humpback whale song development in Prince William Sound. In a FY97 a more permanant hyrophone system will be installed using more reliable and sophisticated equipment

In FY98 we propose the continuation of the remote hydrophone project and the installation of a second system in the Point Helen area. Because the hydrophone is being monitored at the Chenega Bay Community School, we propose to initiate an educational program at the school, in order to involve the students more closely in this project, from monitoring the system and collecting data, to interpreting the whale sounds that they collect. Residents of Chenega Village will be hired to assist in the project. Further analysis of pod specific dialects will be completed to clearly establish pod identities of whales in the recordings (NGOS is using a 13 year database of killer whale recordings to establish these dialects). Recordings will be analyzed to document which specific killer whale pods and groups were present through out the year, and specifically, when AB pod was present in the Sound. The long-term goal of this aspect of project is to determine the year-round habitat use of southwestern Prince William Sound by AB pod and other killer whale pods.

Unique information being developed by this project and there is considerable public interest and demand for identification materials and other information on killer whales. We have proposed a combination catalogue of individually identifiable killer whales and a popular book detailing our research results to be completed in FY 99.

NEED FOR THE PROJECT

A. Statement of Problem

The AB pod of killer whales was injured by the EVOS. Although it had shown signs of recovery from 1991 to 1993, recent mortalities have reduced the number of surviving AB pod whales to 23. At least 11 of the AT1 group of transient killer whales have either died or left the Sound since 1989. This project will continue to monitor the status of AB pod and the AT1 group.

The behavior of killer whales in Prince William Sound has changed since the spill. High mortality following the spill and an increase in unusual social patterns indicate that the structure of AB pod has deteriorated. Despite considerable effort, re-sightings of AT group have declined and fewer individuals are seen when the group is located.

These patterns reflect changes in killer whale social behavior and distribution - the basic patterns that mark normal use of their habitats in Prince William Sound. Our analyses found that both resident pods and the AT transient group have become harder to find in the Sound (1997 Annual report). As yet no increase has been detected in sightings of other transient groups, suggesting that no transients are increasing their use of the Sound as use by the AT group declines. Further, the occurrence of harbor seals in transient whale's diet may be declining (1997 Annual report). We do not know as yet whether such changes can be related to changes in the Sound ecosystem (e.g. the decline in harbor seals, changes in hatchery production).

Ecological studies on killer whales emphasize the need to identify and protect critical feeding, transit or social areas and rubbing beaches used by these animals (Matkin & Saulitis 1994, Heimlich-Boran 1988). However, habitat associations for transient killer whales have received minimal attention in part due to small sample sizes (e.g. Heimlich-Boran 1988). Data from Prince William Sound, including 160 encounters with the AT transient group and 32 encounters with GOA transient groups, provides an opportunity to identify these critical habitats using 13 years of data and a larger sample of killer whale behaviors than has been analyzed in other similar studies (e.g. Heimlich-Boran 1988 considers transient whale habitat associations from 12 encounters over nine years).

In addition predation by killer whales may be a significant factor in the non-recovery of harbor seals, another damaged resource. Harbor seals have continued to decline since 1989 in Prince William Sound (16-20% reduction from 1989-1994). We will continue to refine our estimates of killer whale predation rates on harbor seals.

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

Another gap in our understanding of killer whale behavior and ecology is the extent of their use of the Sound in the winter months. The remote hydrophone system is a cost-effective means of examining use by resident pods during the winter months.

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

The analysis of historical data, continued observations and sampling of killer whale prey items, genetic and contaminant analysis, and acoustic studies will examine factors important in the recovery of killer whales and harbor seals.

B. Rationale/Link to Restoration

Annual killer whale population monitoring will determine recovery status of AB pod and the AT1 transient group. The actual status of AB pod appears to be non-recovering at this time. Long term patterns will only be clarified by continued monitoring. A low level annual monitoring program (expanded with matching funds) is proposed and a part of the FY98 project. A detailed summary of pod status (last provided in FY95) will be completed in FY98. Since all pods and whales are not observed in every year, annual monitoring will prevent extensive data gaps and allow certain determination of recruitment and mortalities in a much shorter time frame. An annual killer whale identification database of 14 years duration now exists. Continuation of this approach will provide consistency in analysis and interpretation. Because killer whales are a long-lived species with low reproductive and mortality rates, this monitoring must be consistent and long-term to be meaningful.

It may be that little that can be done to prevent or reverse the demographic trends that have appeared among PWS transient whales in the 1990s. However, protection of the resources in the Sound that are used by these whales may prevent or minimize further problems, thereby allowing recovery. Data are available from a thirteen year period that document the locations and behaviors of the killer whales that use Prince William Sound. Analysis of these data will help to better monitor the recovery of killer whales from the spill, to evaluate suggested restoration actions for killer whales and to protect resources that attract killer whales to the Sound.

Populations have been separated using mtDNA analysis supporting the behavioral observations that resident killer whales differ from transients and do not prey on seals, and thus help to estimate the predation pressure on harbor seals from killer whales. Accurate estimates of the predation pressure on harbor seals will in turn facilitate effective strategies for harbor seal restoration.

The southwestern part of Prince William Sound is an important habitat for resident and transient killer whales during the summer months. Both feeding and social behaviors have been consistently documented in Knight Island Passage and Montague Strait from April through October. While photographic monitoring of the killer whale population of Prince William Sound has been carried out since 1984, little is known of the year-round behavior and distribution of this species. Vessel-based research during the winter months in Prince William Sound is prohibitive due to stormy weather conditions and lack of daylight.

In FY98 we will continue investigating the year-round use of southwestern Prince William Sound by specific killer whale groups using a remote hydrophone system. A second remote hydrophone will be installed at Point Helen to track movements of killer whales through the region. Additional years of monitoring are critical to this assessment, as between-year differences in killer whale winter distribution are likely to occur.

Annual population monitoring, genetic and contaminant analysis, interpretation of historical data on seasonal killer whale distribution and feeding behaviors, and remote hydrophone monitoring of killer whale movements will present a comprehensive overview of the recovery status of killer whales in Prince William Sound through 1998. In addition, a detailed picture of killer whale predation on harbor seals will be developed and the potential effect the harbor seal decline on killer whales assessed. Restoration objectives for killer whales in Prince William Sound , should be considered based on the apparent non-recovering status of AB pod and the AT1 group.

C. Location

This project is part of an ongoing killer whale research in Prince William Sound, Alaska. The project is centered in southwestern Prince William Sound and directly involves the village of Chenega.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

There is great public concern and interest for killer whales in Prince William Sound. We will involve tourboat and recreational operators and residents by exchanging sighting information on a daily basis and providing a catalogue of individual whales to enhance enjoyment of whale observation. Our presentation of research results in Cordova, Homer, and Chenega will continue.

With our supervision, the residents of Chenega and students at the Chenega school will be directly involved in the killer whale project by assisting in monitoring and maintaining a remote hydrophone system and participating in the data analysis. Chenega and Port San Juan residents will be contracted to maintain the system.

In addition, the role of the killer whale in local native story and tradition will be recorded through interviews with native elders and others in the villages of Chenega and Tatitlek. With the assistance of Apila Colorado, the native viewpoint, story, and experience will be incorporated in the proposed killer whale book/ catalogue detailng results of our work in a popular format.

PROJECT DESIGN

A. Objectives

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

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

3. Assess the year round residency of killer whales (by pod) in the southwestern Sound using a remote hydrophone system monitored at Chenega Community School and the Port San Juan hatchery

4. Final year of collection biopsy samples from specific indivduals as needed to complete genetic analysis and complete our interpretation of contaminant levels in killer whale blubber

5. Determine extent of nuclear gene flow between the EVOS impacted AB killer whale pod and AT1 transient group and other resident and transient killer whales frequenting Prince William Sound

6. Determine the mating system of Prince William Sound killer whales

7. Continue analysis of behavioral /predation data in a geographical framework using the Arc Info GIS system and the historcal data base to:
a) Identify critical habtats used by transient killer whales in Prince Willam Sound and create an interpretive map portraying these habitats b) Draft publication on FY97 work for journal submission

8. Continue to collect stories and information from elders and others in Chenega, Eyak and Tatitlek villages on the role of killer whales in the traditions and spiritual history of local native groups

9. Initiate construction of photographic catalogue of Prince William Sound killer whales, complete with genealogies and life history information to be incorporated into a book summarizing the findings of the comprehensive killer whale studies.

B. Methôds

Killer Whale Monitoring

The goal of this aspect of the study is the photoidentification of each individual in each pod/group, that regularly uses the Sound, particularly AB pod and the AT1 group. Knowledge of the demographics of all regularly sighted pods and groups may be necessary to meet new recovery definitions.

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

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

Specifics of each encounter with killer whales will be recorded. The killer whale encounter data sheet developed in 1995 and specifically tailored to GIS data entry requirements will be used. Data recorded will include date, time, duration, and location of the encounter. Rolls of film exposed and the estimated number of whales photographed will also be recorded. A chart of the whales' trackline during the encounter will be completed and the distance traveled by the vessel with the whales will be calculated. General behavior of the whales (i.e. feeding, resting, traveling, socializing, milling) will be recorded by time and location.

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

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

The primary vessel used to secure identification photographs will be a 27' diesel inboard/outboard powered vessel that can sleep two individuals (R.V. *Whale 2).* With sleeping accommodations and large fuel capacity, the R.V. *Whale 2* will return to camp or to Chenega Village (fuel storage) infrequently which greatly increases available time searching for or photographing whales. Although this vessel will primarily collect photoidentification data, it will collect feeding habit observations and samples and biopsy samples for the predation studies. The operator of this vessel, Eva Saulitis, has ten years experience in the Sound conducting photoidentification of killer whales and humpback whales and collecting food habit data. This vessel will operate a total of 60 days, from early July through early September. From historical data these dates are judged to be to be the most likely time to encounter AB pod as well as many of the other resident pods that use the Sound. Photographic data will also be collected from the 43' R.V. *Lucky Star* and its associated skiff (17 days in the field) when it does not interfere with the primary goal of this vessel of taking biopsy samples for contaminant and genetic studies and providing feeding habit observations and prey sampling. The R.V.*Lucky Star* will also deliver fuel to designated locations and provide other logistical support for the operation of the R.V. *Whale 2*. The *Lucky Star* will operate a total of days. This will be the final year for biopsy sampling from this vessel

The report for the monitoring segment will include a summary of field effort, and summary of the pods and individuals encountered and a status report on AB pod and the AT1 group. Changes within AB pod will be examined with consideration for the age and sex structure of the pod and maternal groups within the pod. Frame by frame input of identification data from exposed film into VAX and IBM PC computer systems will occur and identifications tabulated by pod and by individual. Copies of killer whale encounter data and vessel logs will be made available to the EVOS Trustee Council and/or lead agency. Frame by frame identification data will also be made available on disc. Copies of the GIS program and data base will also be made available by request to NGOS and the PWSSC.

<u>Behavioral Ecology</u>

1.Critical habitats - We will begin by examining the type of behaviors that occur within Prince William Sound, which indicate why the whales spend time in the Sound. Critical area for these behaviors will be identified as areas with relatively high prevalence of the behavior in relation to the total area over which whales were observed. For example, near-shore foraging (e.g. for harbor seals), while declining in frequency, appears to occur most often along certain sections of shoreline, while off-shore foraging (e.g. for Dall's porpoises) is concentrated in more open waters. We will continue to base our analyses on the 2km-x-2km grid developed earlier, and identify larger areas based on the data. Parametric and non-parametric statistics will be used to evaluate differences between areas.

2.Interpretive map - Based on habitats identified in the first objective, a color interpretive map will be developed showing the areas most used by transient whales, the types of behaviors that occur there, and providing details on the resources the whales are using in each area. The map will be developed with Arc/Info. We will produce an 8.5 x 11 color hard-copy and electronic versions of the map.

3.Publication - At least one manuscript will be prepared for submission to a professional journal (see below, Publications and Reports), dealing with habitat use by transient whales in Prince William Sound

Contaminant Analysis

Samples will be analyzed for selected chlorinated hydrocarbons (CHs) by a screening method using high performance liquid chromatography coupled with photodiode array detection (Krahn et al. 1994). The CH analytes include dioxin-like and other selected CB congeners, DDTs and their metabolites (e.g. DDEs, DDDs) and hexachlorobenzene (HCB). These analytes are potentially toxic, persist in the environment, and are bioaccumulated by marine mammals. The dioxin-like CB congeners are stereo chemically similar to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) and have been shown to exhibit TCDD-like toxicity.

The NGOS has entered into a cooperative agreement with the NMFS/NOAA Environmental Contaminant Laboratory (John Stein, director) to examine contaminant levels in killer whale biopsy samples taken in Prince William Sound. Blubber samples from biopsy samples taken under Trustee Council funding in 1995 were provided to the NMML/NMFS pilot project examining lipid/fatty acid composition and unavailable for contaminant analysis. In FY98 we wish to collect the final samples that will increase our sample size of whales with known lineages and from specific groups. This will allow examination of contaminant downloading on offspring and other detailed effects. Transient (marine mammal eating) killer whales have shown the most significant contaminant loads and sufficient samples from these whales are vital to the project. Since known individual whales are being sampled, future resampling can examine individual specific changes in contaminant levels over time.

Biopsy sampling and processing in FY97 will be conducted from the 43' R.V. *Lucky Star* and associated console skiff. Additionally, the R.V. *Whale 2*, the primary platform for the completion of the monitoring fieldwork will obtain biopsy samples when possible. Skin samples obtained from biopsies will also expand sample size for statistical analysis continuing genetic work. Hopefully it will provide the final specific samples needed in our examination of resident and transient killer whale social structure.

The R.V. *Lucky Star* can house 4 scientists and has work space and equipment sufficient for complete workup of samples taken by biopsy as well prey samples. Freezing facilities for storage of samples are available on both the R.V. *Whale 2* and F.V.*Lucky Star*. Most biopsy sampling will actually occur from a 17' fiberglass console skiff that will be launched from the R.V. *Lucky Star*.

The biopsy sampling for the chemical and genetic analysis will be collected without handling or tranquilizing the whales. A small dart will be fired from a specially outfitted pneumatic rifle. The setup is similar to that used to deliver tranquilizing drugs to terrestrial mammals in wildlife research. A lightweight plastic dart (approx. 10 cm long by 1.2cm dia.) is fitted with a beveled tubular sterile stainless steel tip that will take a small core of skin and blubber (approximately 1.8cm long and 0.5cm diameter). The sterilized dart will be fired from a range of 16-20m. The dart hits the animal in the upper back (in the area of the saddle patch), excises a small tissue sample and bounces off. The dart floats with the sample contained until retrieved. Identification photographs using data-back equipped cameras will be taken of all whales biopsied to insure accurate identification of the individual. The whales will be approached by researchers in the manner currently authorized under permit No. 840 (held by the North Gulf Oceanic Society) for photoidentification and biopsy sampling of killer whales.

Genetics

To date we have been successful in acquiring biopsy samples of the two of the focal groups, AT1 group and AB pod. We have also obtained some samples for comparison from transient killer whales from the Gulf of Alaska, and from seven additional resident pods (AE, AD, AI, AK, AS, AJ and AG). We lack samples from the one of the largest pods in the Sound, AN (now AN10 and AN20) and our sample size from several pods is very small. The sample size sample size for transient whales must be increased for meaningful statistical analysis and animals of particular age and sex are desired. Samples from specific individuals and lineages are needed to detail killer whale breeding systems. For this reason, and because of the need for additional samples for contaminant analysis, the final biopsy sampling is planned in FY98; however, the effort will be reduced from FY97. The methods will be identical to those used in FY97 (described in Barrett-Lennard et al. 1996).

The procedures in the final phase of our genetic analysis involve examination of miocrosattelite loci initiated in FY97. From each biopsy sample, 6-8 microsatellite loci that have proven to be informative in the British Columbian study will be amplified using the polymerase chain reaction (PCR). The PCR products will be radioactively labeled and separated by polyacrylamide gel electrophoresis, and sized by reference to sequences of plasmid DNA. Both the mitochondrial and microsatellite genotypes thus obtained will be compared statistically using maximum likelihood analysis routines in the software package PHYLIP (Felsenstein1995), to determine the genetic distance between putative populations, and between the two focal pods and other pods in their populations. Average levels of genetic relatedness based on microsatellite loci within and between pods will be also be analyzed using the RELATEDNESS software package (Goodnight and Queller, 1994).

Two specific hypotheses will be tested in FY98. (1) Resident killer whales do not move between pods. (2) Matings occur between and not within pods.

Hypotheses will be tested using microsatellite DNA-based pedigrees. Samples from AB pod will be given the highest priority in these tests. The first hypothesis predicts that pods consist of maternally-related individuals only, and will be tested by searching the pedigrees of pod members for unrelated individuals. the second hypothess predcts that offsprng and their fathers will be found in different pods. We will test this hypothesis directly: if offshpring and fathers are found in the same pod during the pedigree analysis, the hypothesis will be disproved. Conversely, matches between offspring and fathers in different pods will support the hypothesis. Analysis of samples will be conducted concurrently with samples from killer whales biopsied off British Columbia.

In addition we will use standard ZFX/ZFY sexing protocal to sex juveniles and calves of unknown sex. This is an important tool in refining our understanding of population dynamics and modeling. It is also important in our assessment of killer whale mating systems.

Remote Hydrophone

Pod specific dialects for resident killer whales have been determined from tape recordings made by several researchers in the Prince William Sound area and in Southeast Alaska during the spring and summer months of the years 1984 to 1996. Final construction of a catalogue of pod specific calls will occur in FY97. Specific calls from Prince William Sound transient (AT1 group) killer whales also have been catalogued (Saulitis 1993). A total of 141 hours of recordings have been screened using a Kay Elemetrics Real Time Sound Spectrum Analyzer, Model 5500. Samples from this screening process were digitized using the Canary acoustic spectrum analysis software (The Cornell Bioacoustics Workstation). Calls from different killer whale pods and transient groups are categorized using the same method used by John Ford in British Columbia, Canada. It involved arbitrary acoustical identification paired with a visual and statistical comparison of sound spectra.

To assess year round residency and movements of killer whales in the Montague Strait region, a second remote hydrophone will be attached to the sea floor near Point Helen, Knight Island. An anchored and encased cable will run from the transmitter on shore to the hydrophone at a depth of about 20 meters. The transmitter will be enclosed in a waterproof case and placed atop the bluff. It will be powered by deep cycle batteries stored in waterproof containers. A solar panel will charge batteries in summer months, in winter, residents of Chenega Village will be contracted to recharge and replace batteries.

During summer months the hydrophone will be monitored from the R.V. *Whale 2* via broad band receiver as an aid in locating whales. During winter months it will be monitored at the Chenega Community School under supervision of teacher Billie Jo Mills and at Port San Juan Hatchery by Chuck Pratt and Sarah Mariner. The receivers will be connected to cassette recorders so that calls can be recorded. The receiver will be monitored on a regular scheduled basis and a log of operation maintained.

Some analysis will take place in the school, and will be directed by Eva Saulitis. Identities of the pods will be determined by calls. Analysis will be completed using Macintosh "Canary" sound analysis software by Harold Jurk at the University of British Columbia. The frequency of occurrence of each pod by month will be determined. Because pod sizes will be determined by photographic monitoring in summer months, estimates of numbers of whales using the area by month can be developed.

With guidance from Apila Colorado and Martha Vlassof, additional information from native elders and other residents on the role of killer whales in their mythology, stories and history will be gathered by interview and conversation. Interviews will be conducted in Chenega Village and Cordova during our regular visits. The summaries of the interviews will be submitted as an addendum to our annual report in FY98.

This material will also be included in a killer whale identification catalogue/ popular book that will present the findings of the research over the past 15 years with emphasis on research funded by the Council. The book will center around a catalogue of individual killer whales similar to that produced in 1991 (Heise et al 1991). That catalogue is in need of an update due to changes in pod compositions and does not contain photographs of many of the individuals we have photographed in recent years. New techniques, including computer scanning of photographs will make a construction of a more efficient, easier to use catalogue possible. Genealogies of groups will determine layout; individual life histories will be integrated. The text will include examination of population dynamics, social structure, behavioral ecology, genetics, environmental contaminants, acoustics in a popular format, with stories of the research and background from native and other local residents. The catalogue portion will be completed in FY98 with the text completed in FY99. The book will be completed for the tenth anniversary of the EVOS.

Most equipment needed to complete the contracted field research will be provided by the North Gulf Oceanic Society, including binoculars, nets, directional hydrophones, photographic equipment and biopsy equipment. The remote hydrophone, transmitter, receivers, and recorders will be purchased as special equipment for this project Additional supplies and minor equipment will be purchased as necessary. Apple Macintosh and IBM compatible computers owned by NGOS as well as the full array of computers and the GIS system available at the PWSSC will be used in data analysis.

C. Contracts and Other Agency Assistance

The entire project will be completed under the auspices of the North Gulf Oceanic Society. The Prince William Sound Science Center will be responsible for maintaining the geographic information system database, and for completing analyses and report on geographic aspects of killer whale behavior. NGOS will provide a technician to enter data collected in 1998 into the GIS database using the menu interface provided by the Science Center. Genetic analysis will be completed by Pacific Ecological Services at the University of British Columbia. Acoustic analysis will be completed by Harold Jerk at the University of British Columbia. The NGOS will contract residents of Chenega Village and Port San Juan to monitor the remote hydrophone system during the October to May period. Contracts for vessel leases will be issued by the North Gulf Oceanic Society or the Society will use its own boats for the project.

SCHEDULE

A. Measurable Project Tasks for FY98

Oct 97: Ship/transport FY97 samples to genetic and contaminant labs

Oct-March : Extract DNA from new samples. Continue microsatellite analysis of nuclear DNA and mtDNA of new samples. Contaminant analysis of new (FY98)samples.

Oct 1-30: Summarize monitoring data for FY97.

Oct. 1 - Dec. 31: Analysis and writeup of draft FY97 annual report
Finalize FY97 GIS analysis, draft manuscript

Oct. 1 - July 1:Critical habitat analyses.

Jan. 5, 1998: Draft FY97 report due

Jan 1998: Attend Bienniel Society of Marine Mammalogy Conference in Monaco (Matkin), present paper (at same time as restoration workshop).

Jan 1998 Attend restoration workshop (Co PI David Scheel) poster presentation

March1 - March 31: Address review comments on draft FY97 report and submit final annual report.

April -July Conduct pedigree analysis of microsatellite DNA data. Begin interpretive map for critical habitat, begin draft manuscript and report

April 1 - Sep 30 Complete critical habitatreport & critical habitat interpretive map

April 10-20 Killer whale biopsy emphasis fieldwork

May 1 - June 30: Analyze winter recordings from remote hydrophone.

June 98 Attend Conservation Biology Society annual meeting (Scheel)

July 7-Aug 30: Killer whale monitoring emphasis field work. Monitor hydrophone from research vessel.

Aug-Sept Conduct allele frequency analysis of microsatellite DNA from transient assemblages. Complete Critical habitat interpretive map and report.

Aug- Sept : Begin write-up of microsatellite DNA data for submission to primary literature

Sept 7-15 Killer whale biopsy emphasis field work Setup remote hydrophone operation for winter (98/99)

The R.V. *Whale 2* will operate for 40 days in July and August July 7- September 1). A portion of the operational time will be funded by matching monies. The primary function of this vessel will be killer whale photoidentification monitoring. This time period is generally a period of high encounter rate with AB pod and other resident pods and will complement the schedule of the R.V. *Lucky Star*. In addition the R.V. *Whale 2* will collect biopsy samples and feeding data when it does not interfere with the monitoring segment of this project and monitor the remote hydrophone project. The early and late season fieldwork for the R.V. *Lucky Star* will be aimed at sampling transient killer whales. Resident whales generally are sighted more frequently in the July-early September period.

B. Project Milestones and Endpoints

The FY98 project will conclude the biopsy field program with a limited field season. Future fieldwork will involve limited population monitoring and acoustic monitoring. Final analysis of genetic, contaminant and GIS data will begin in FY98. A paper detailing the mtDNA analysis will be submitted in FY98 . Publication of a paper describing Prince William Sound resident pod dialects should be drafted in FY98; however, data from the remote hydrophone probably will not be sufficient for publication until FY 99. Initial work on the popular account of the research and the updated killer whale catalogue will be initiated in FY98 and completed in FY99, for the tenth anniversary of the Exxon Valdez Oil Spill. Final writeup of all phases of the project (except ongoing photo monitoring and acoustic monitoring) will occur in FY99.

C. Completion Date

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

PUBLICATIONS AND REPORTS

Annual Report FY98: (Draft January 1999, Final April 1, 1999)

Final report : April 2000

Scheel, D., C. Matkin, & E. Saulitis. Critical habitats of transient killer whale groups in Prince William Sound, 1984-1996 (Marine Mammal Science)

Barrett-Lennard, L, Matkin, CO, Saulitis, EL, Ellis, GM Genetic isolation between sympatric populations of killer whales in Prince William Sound, Alaska. (Intended for submission to Molecular Biology and Evolution, September 1997)

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

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

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

PROFESSIONAL CONFERENCES

14th Bienniel Conference on the Biology of Marine Mammals, Monte Carlo, January 25-29, 1988. Joint Conference of the American and European Societies for Marine Mammalogy. P.I. Craig Matkin will present a paper on "Patterns in contaminant levels Alaskan killer whales"

Annual Conference of the Conservation Biology Society, June 1998. Co-PI David Scheel will attend and present a paper on the GIS aspects of the killer whale work.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The monitoring of killer whales and analysis of historic and current data on killer whale behavior is part of an program to investigate killer whale recovery and the interactions of killer whales and harbor seals. It will be integrated with the harbor seal trophic studies (project 96064, Kathy Frost, project leader). In FY98 this project will rely on approximately $12,500 in matching funds from foundations or other private sources. In addition, an estimated $10,000+ in analytical fees will be absorbed by the NOAA/NMFS environmental contaminant lab as part of a cooperative agreement. A cooperative program with the University of British Columbia has allowed substantial reduction in laboratory costs for genetic analysis. As a non-profit research institution familiar with private funding sources and cooperative programs, NGOS can work with the Trustee Council cooperation to maximize potential for matching funds in the future.

PROPOSED PRINCIPAL INVESTIGATORS:

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dls@grizzly.pwssc.gen.ak.us

PRINCIPAL INVESTIGATORS

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

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

David Scheel (Phd. University of Minnesota) is an Associate Scientist, at the Prince William Sound Science Center. Scheel is responsible for the analyses of behavioral and distribution data for examination of killer whale predation. Scheel will provide detailed interpretation of his analyses for the final report.

Scheel's research projects have included predator-prey dynamics of Serengeti lions and their prey, habitat selection models of Texas mammals, frequency and density dependence in models of community evolution, social behavior and resource habitat use of primates in Gombe. He has extensive experience with GIS systems.

KEY PERSONNEL

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

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

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

Barrett-Lennard has researched killer whales for 9 years, specializing in their acoustics and genetics. He has operated research vessels in Prince William Sound and British Columbia. He is currently completing an extensive investigation and modeling of killer whale predation on Steller sea lions in Alaska and is conducting genetic analysis on over 100 killer whale biopsy samples taken in British Columbia over the past 3 years.

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

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

LITERATURECITED

Barrett-Lennard, L.G., Smith, T.G. and Ellis, G.M. 1996. A cetacean biopsy system using lightweight pneumatic darts, and its effect on the behavior of killer whales. Marine Mammal Science, 12:14-27.

Goodnight, K.F., and D.C. Queller 1994. RELATEDNESS version 4.2. Distributed by the authors. Department of Ecology and Evolutionary Biology, Rice University, Houston, Texas.

Felsenstein, J. 1995. PHYLIP (Phylogeny Inference Package) version 3.57c. Distributed by the author. Dept. of Genetics, University of Washington, Seattle, Washington.

Heimlich-Boran, J.R. 1988. Behavioral ecology of killer whales (*Orcinus orca*) in the Pacific Northwest. Canadian Journal of Zoology 66: 565-578

Heise, K., G. Ellis, and C. Matkin. 1992. A catalogue of Prince William Sound killer whales, 1991. ISBN# 0-9633467-3-3, North Gulf Oceanic Society, Homer, Alaska. 51pp.

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

Matkin, C.O., and E.L. Saulitis. 1994. Killer whale (*Orcinus orca*) biology and management in Alaska. Contract #T75135023 Marine Mammal Commission. Washington, D.C.

Palumbi, S.R., Baker, C.S. 1994. Contrasting population structure from nuclear entron sequences and mtDNA of humpback whales. Molecular Biology and Evolution. 11: 426-435.

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

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

Proposed Project Manager
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1998 EXXON VALDEZ TRU: COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$47,640.0						
Travel		$5,940.0						
Contractual		$79,038.0						
Commodities		$9,550.0						
Equipment		$1,840.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$144,008.0		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
Indirect		$11,877.0						
Project Total	$0.0	$155,885.0		$96,000.0	$45,000.0	$42,000.0		
Full-time Equivalents (FTE)		13.8						
	Dollar amounts are shown in thousands of dollars.							
Other Resources		$12,500.0						

Comments:

1998

Prepared:

Project Number: 98012a
Project Title: Comprehensive Killer Whale Investigation
Name: North Gulf Oceanic Society

FORM 4A
Non-Trustee
SUMMARY

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

Personnel Costs:						
Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 1998
Craig O. Matkin	P.I. Field Biologist		5.0	4400.0		22,000.0
Graeme Ellis	Photo Analyst Field Biologist		1.5	3500.0		5,250.0
Eva Saulitis	Field Biologist Community Liason		3.0	2800.0		8,400.0
	Field Assistant		1.5	1500.0		2,250.0
	Data entry technician		0.3	2800.0		840.0
	Acoustic Analyst		2.0	3400.0		6,800.0
	Biometrician		0.5	4200.0		2,100.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		13.8	22600.0	0.0	
					Personnel Total	$47,640.0

Travel Costs:					
Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1998
Homer/Vancouver (RT)	650.0	2	6	75.0	1,750.0
Fairbankds/:HomerRT	380.0	2			760.0
Homer/AnchorageRT	150	2	4	100.0	700.0
Faribanis/CordovaRT	410.0	1			410.0
Faorbanks/Anchorage RT	230.0	2			460.0
Homer/Monaco RT	1260.0	1	4	150.0	1,860.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$5,940.0

1998

Prepared:

Project Number: 98012a
Project Title: Comprehensive Killer Whale Investigation
Name: North Gulf Oceanic Society

FORM 4B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FY 1998
Prince William Sound Science Center (GIS/behavioral analysis and interpretation)	25,238.0
Pacific Ecological Services (genetic analysis and interpretation)	16,600.0
Chenega Village (hydrophone maintenance)	3,200.0
27' research vessel (Whale 2) 40 days @ $360.00/day	14,400.0
43' research vessel (Lucky Star) w/console skiff for 12 days (775/day)	9,300.0
Killer Whale Catalogue Construction/Phanse1*	10,300.0
*includes printing and scanning photographs, layout, related text, printing cost	
Contractual Total	$79,038.0

Commodities Costs:	Proposed
Description	FY 1998
Phone	940.0
Field Food ($14/person/day)	1,520.0
E-mail	120.0
Fuel	2,400.0
Film/Processing/Printing	2,400.0
Field Supplies	320.0
Land use liscense, Chenega Corp	100.0
Hydrophone and Cable	1,100.0
Deep Cycle batteries	180.0
Shipping	470.0
Commodities Total	$9,550.0

1998

Prepared:

Project Number: 98012a
Project Title: Comprehensive Killer Whale Investigations
Name: North Gulf Oceanic Society

FORM 4B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
Professional cassette recorder	1		410.0
FM band transmitter and receivers	1		1,430.0
			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**	$1,840.0

Existing Equipment Usage: Description	Number of Units	
Professional cassetter recorder	1	
FM band transmitters and receivers	1	

1998

Prepared:

Project Number: 95012a
Project Title: Comprehensive Killer Whale Investigations
Name: North Gulf Oceanic Society

FORM 4B
Equipment
DETAIL

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

Project Number:	98025
Restoration Category:	Research
Proposer:	Leslie E. Holland-Bartels and NVP Scientists[1]
Lead Trustee Agency:	U.S. Geological Survey, DOI
Cooperating Agencies:	ADFG, NOAA, USFS
Alaska SeaLife Center:	
Project Duration:	4th year, 5-year project
Cost FY 98:	~~$1,669,400~~ $1,689,200
Cost FY 99:	$450,000
Geographic Area:	Western Prince William Sound
Injured Resource/Service:	Sea otter, River otter, Harlequin duck, Pigeon guillemot, intertidal organisms, subtidal organisms

ABSTRACT

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

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

INTRODUCTION

The nearshore ecosystem served as a repository for much of the oil spilled by the T/V *Exxon Valdez* in March 1989. Mortalities occurred across a suite of apex predators, as well as in benthic invertebrate populations, including mussels, clams, and crabs. The initial changes in composition and abundance of species which resulted from these acute mortalities and habitat disturbances likely continue to modify important structuring processes in the nearshore populations (i.e., competition, predation, and recruitment), thus constraining recovery (Table 1).

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

Work completed in FY 95 and early FY 96 included completion of an extensive data management plan and a data archiving and file serving system to facilitate exchange and integration of project data among the fifteen project scientists. Certain project components were initiated (sea otter, harlequin duck, avian copredators); however, primary focus was on pilot efforts to refine prey sampling strategies for further study. There will be three full field seasons (FY 96, 97, 98) in the NVP study with project closeout in FY 99.

NEED FOR THE PROJECT

A. Statement of Problem

The nearshore marine ecosystem of PWS plays a critical role in the commercial, subsistence, and recreation economy of southcentral Alaska. Because of shorelines and coastal physiography, the nearshore ecosystem served as a repository for much of the oil spilled during the *Exxon Valdez* oil spill (EVOS). As a result, many of the injured resources under study by the EVOS Trustees Council are components of the nearshore system. Thus, the NVP study describes a research approach for assessing the biological and ecological significance of trophic issues and contaminants present in the nearshore environment. We focus on the status of system recovery and a suite of injured apex predators as indicators of environmental stress--the invertebrate feeding sea otter and harlequin duck, and fish feeding pigeon guillemot and river otter. The first three of these species are not considered to have recovered from the spill, and the recovery of the fourth is unknown (Table 1). NVP takes a multispecies, integrated approach to assess several potential key mechanisms constraining recovery of the nearshore system.

Table 1. Injury and evidence for lack of recovery from the Exxon Valdez Oil Spill, 1989 in four top nearshore vertebrate species as evidenced through demographic, bioindicator, and trophic evidence.

Injured Resource	Injury to Nearshore Ecosystem and Lack of Recovery as Evidenced in Four Key Species	Status/Recovery Strategy
Pigeon guillemots	**DEMOGRAPHIC** •1,500-3,000 killed by EVOS in 1989 •Populations in PWS have declined from c.15,000 in the 1970s to c.3,000-5,000 in 1993 based on boat surveys. Declines have been greater in oiled vs non-oiled areas of PWS (Klosiewski and Lang, unpubl. data; Sanger and Cody 1993). •Number of breeding pairs on Naked Island (largest guillemot breeding aggregation in PWS) have declined c.50% since the late 1970s and give no evidence of recovery (D.L. Hayes, USFWS, pers. comm.) **BIOINDICATOR** •Average growth rates of chicks have declined since the spill (Oakley and Kuletz 1993) and remained lower at Naked Islanded (oiled) versus Jackpot Island (non-oiled) during the 1994 breeding season (D.L. Hayes, USFWS, unpubl. data). **TROPHIC** •No direct evidence collected. However, nearshore demersal fish, primary prey of this species, demonstrate a high incedence of hemosiderosis in oiled eelgrass beds of Herring Bay (Jewett et al. 1994). This suggests continued exposure to hydrocarbons. Nearshore demersal fish comprised ~half the diet of chicks on Naked Island. •Sandlance, a schooling fish that burrows in nearshore sandy sediments, formerly comprised c. a third of the diet of chicks on Naked Island. Since the spill, the proportion in the diet has declined.	•Stable or continuing decline •Conduct research to find out why recovering; likely causes climatic /oceanographic, prey limitations and predation. •Recovery judged by stable or increasing populations.
River otters	**DEMOGRAPHIC** •Although some were killed, there was no catastrophic mortality--river otters continued to live in areas that were through 1990 (Testa et al. 1994) •Initially modified use of habitat by avoiding heavily oiled shorelines (Bowyer et al. 1995). Selected habitat differently on oiled vs non-oiled areas by concentrating their activities on steeper tidal slopes and using areas with greater exposure to wave action (Bowyer et al. 1994), where oil was less likely to persist (Wolfe et al. 1994) •In 1990, home ranges in oiled areas were 2x those in non-oiled areas, suggesting a loss of habitat on oiled sites (Bowyer et al. 1995) •Continued exposure has adverse health effects; lower body mass. Lower body mass often related to lower reproductive output in large mammals (Docktor et al. 1987) •Throughout broad areas of PWS, latrine sites (an index of population density) were abandoned at a rate of three times greater on oiled versus non-oiled areas (Duffy et al. 1994a). **BIOINDICATOR** •Continued exposure has adverse health effects; higher haptoglobin (an acute-phase protein indicator of damage) than otters in non-oiled (Duffy et al. 1993). **TROPHIC** •Diets in oiled vs non-oiled areas were similar through 1990, but differed markedly by summer 1991 (Bowyer et al. 1994). A number of taxa were absent from the diet in oiled areas. •Nearshore demersal fish, primary prey of this species, demonstrate a high incidence of hemosiderosis in oiled eelgrass beds of Herring Bay (Jewett et al. 1994). This suggests continued exposure to hydrocarbons.	•Unknown status •Rely on natural recovery, indications of recovery are when habitat use, food habitats and physiological indices return to prespill conditions.

Injured Resource	Injury to Nearshore Ecosystem and Lack of Recovery as Evidenced in Four Key Species	Status/Recovery Strategy
Sea otters	**DEMOGRAPHIC** •Up to 4,000 acute mortalities •Various surveys suggest abundance of sea otters has not recovered to pre-spill numbers. Densities in 1995 were found to be lower in oiled than in unoiled areas (.5/km² vs. 3.4/km², respectively; J. Bodkin, pers. comm.). •Significant differences in juvenile survival between oiled and un-oiled areas in 90/91 and 92/93. •Proportions of prime aged animals among dead returning to pre-spill levels(Ballachey et al. 1994). **BIOINDICATOR** •Hemotological and serum chemistries suggest otters in oiled areas had higher incidence of inflammatory and/or infectious conditions. **TROPHIC** •Primary foods include mussels, clams, and urchins, as well as other subtidal organisms. Sea otters feed in the lower intertidal and subtidal areas, areas that were especially contaminated by the oil spill (Wolfe et al. 1994) and may still be exposed to hydrocarbons through their feeding (EVOSTC 1994a). •In areas where recovery has not occurred, increases in sea urchin densities (a preferred prey) have been observed (Jewett pers. comm.).	•Stable, not recovered in heavily oiled areas. •Conduct research to find out why not recovering; hypotheses include continued hydrocarbon ingestion; spill-caused changes in benthic prey. •Recovery judged when population abundance and distribution are comparable to prespill, and when all ages appear healthy.
Harlequin ducks	**DEMOGRAPHIC** •1,000 acute mortalities in Harlequins •875 acute mortalities in other species •Summer populations of harlequin ducks, which may be year-round residents, were lower than expected in the oiled area of Prince William Sound between 1989 and 1991 (Klosiewski and Laing 1994). **BIOINDICATOR** •Patten (1994) found hydrocarbon metabolites in sea ducks collected in oiled areas and also suggested that reproductive effort and productivity of harlequin ducks were lower in oiled areas. **PREDATOR/PREY** •Although harlequin ducks rely on benthic invertebrates that may continue to transport hydrocarbons through their food chain, no specific assessment evidence of the potential for trophic-related constraints to recovery exists.	•Unknown status •Conduct research to find out why not recovering; hypothesis related to oil-contaminated prey. •Recovery judged for harlequins when no difference between spill and non-spill areas.

B. Rationale/Link to Restoration

Effective implementation of the EVOS Trustee Council's policy that "Restoration should contribute to a healthy, productive and biologically diverse ecosystem...", is complicated by the diversity and trophic interdependence of the numerous injured resources within the nearshore system. Beyond these ecological constraints, we are practically constrained by a lack of accurate and precise pre-spill population demographic data for many injured resources upon which to judge the progress of restoration. However, sufficient evidence exists to suggest that a wide variety of nearshore vertebrate predators and crucial subtidal and intertidal invertebrate prey are not recovered (Table 1). The three factors most likely to be limiting recovery are intrinsic demographic constraints, continued hydrocarbon exposure, and food limitation. The NVP project will examine these factors as mechanisms constraining recovery. Concurrently, data collected on these factors will provide information regarding the status of recovery.

Demography--Demography will be examined by comparing population densities and parameters affecting population growth rates between oiled and unoiled areas. The rate of recovery of nearshore vertebrate predators may be constrained by oil-related factors (continued toxicity of oil and food availability) as well as non-oil related processes. The latter include death and birth processes as affected by factors such as intrinsic reproductive capacity and mortality due to adverse weather conditions. It may be, for example, that death and birth rates do not differ among injured and non-injured subpopulations of nearshore vertebrate predators, but that the rate of population increase is too slow to have allowed for complete recovery of the injured nearshore vertebrate predator populations, in the absence of continued effects of oil. In other words, the nearshore vertebrate predator populations may not be fully recovered, but may be recovering as quickly as possible under naturally-occurring conditions.

Continued Hydrocarbon Exposure--The question of continued exposure to oil will be assessed by comparing indicators of exposure to oil and individual health between oiled and unoiled areas. Today, hydrocarbon impacts may still exist. Between 8-16% of the 10.8 million gallons of crude oil spilled by the *T/V Exxon Valdez* remains buried in marine sediments. Such oil is not subject to degradation by marine organisms and remains in a form that is toxic to many vertebrates. Moreover, microbial analyses suggest that oil in sediments along oiled shorelines is still several orders of magnitude more common than in unoiled areas, suggesting oil may still be available for biological transport from benthic invertebrates through the food chain. In fact, various bioindicator and health measures suggest that continued injury may be occurring among vertebrate predators.

Food Availability--Food limitation will be considered by examining population densities and size class structures of dominant prey species. Considerable dietary overlap and potential competition for food exists among the top predators of the nearshore system. There is also evidence to suggest that population densities of many nearshore vertebrate predators are limited by food. Evaluation of abundance and size distribution data for prey items also may be useful for providing additional indirect evidence for estimating recovery of some predator species. For example, it is well documented that sea otters prefer sea urchins as prey and that in the presence of strong predation by sea otters, both the abundance and average size of sea urchins is reduced. Other suggestions of food limitation exist for sea ducks. There is circumstantial evidence that pigeon guillemots nesting at Naked Island in central PWS are food-limited. There is evidence that population densities of at least some important vertebrate prey species declined as a result of the EVOS. For example, mussels, an important component of the diets of sea otters and sea ducks, were less abundant at oiled areas relative to unoiled areas following the EVOS. Many of the prey species of the nearshore vertebrate predators, including crabs, limpets, chitons, and mussels have failed to recover fully in some habitats.

C. Location

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

COMMUNITY INVOLVEMENT

NVP, both in its component projects and as an integrated program, can benefit from community involvement, especially the inclusion of observations and insight from traditional ecological knowledge (TEK). While there remains some uncertainty over the mechanism for incorporating such information, NVP P.I.s will work with Project -052B: Traditional Ecological Knowledge to facilitate the exchange of information relevant to the restoration process.

Specifically for FY98, NVP is interested in holding synthesis workshops in spill-affected communities. Such workshops, the idea for which has been developed in discussions with -052B personnel, would bring together P.I.s and local experts to discuss findings and observations about resources and ecological components and interactions of mutual interest and concern. These workshops would be held in or near affected communities, in a setting designed to facilitate open exchange of information and substantive discussion of findings. Discussions might use a facilitator (perhaps -052B personnel) to prepare participants and to moderate the sessions. The workshops would produce a report of the discussions, which would be presented at a community meeting at the close of the workshop. In addition to making TEK insight available to P.I.s, the workshops would allow P.I.s to share their information with community members through both the workshops and through the community meetings.

Topics for such workshops include: resource distribution, abundance, and trends; ecology and biology of the resource; interactions of the resources and other ecological components; interpretation of trends; comparability and compatibility of TEK and scientific data; and future work needs for scientific research and for incorporating TEK.

Two to four workshops are proposed for FY98, involving the subtidal clam and sea otter components. P.I.s for these components would travel to one or two communities for the workshops, which would last two to three days. Final plans depend on community review and willingness to take part. In addition to working with -052B, the workshops would seek to involve the Youth Area Watch program.

PROJECT DESIGN

A. Objectives

For our test species, the document "Proceedings of the Workshop: Science for the Restoration Process" suggested that three factors had high potential as factors constraining recovery: 1) recovery of nearshore resources injured by EVOS is limited by recruitment processes; 2) initial and/or residual oil in benthic habitats and in or on benthic prey organisms has had a limiting effect on the recovery of benthic foraging predators; and 3) EVOS induced changes in populations of benthic prey species have influenced the recovery of benthic foraging predators.

Based on that consensus, we will ask "are vertebrate populations recovering, and if so, are they recovering as quickly as possible given potential rates of population increase?" We will do this by measuring population density and demographic factors (e.g., size and age distributions, birth rates, survival rates) at both oiled and unoiled areas to examine possible reasons for lack of recovery, and assess progress toward recovery given demographic restraints. In conjunction with this "recovery monitoring" approach, we will also ask the questions "is it oil?" and "is it food?" that limit recovery (Figure 2). This will be addressed through evaluation of demographic measures, health assessments, biomarkers of oil exposure, and availability of prey for the four nearshore vertebrate predators in oiled and unoiled areas of PWS.

Objective 1. Determine status of recovery of injured populations of nearshore vertebrate predators, by determining if there are differences between oiled and unoiled areas in:
a. Abundance or indices to abundance.
b. Demographic characteristics.
c. Measures of health.
d. Abundance or size distribution of prey.

Objective 2. Determine if recovery of nearshore vertebrate predators is constrained by demographic factors unrelated to oil toxicity or food supply.

Objective 3. Determine if recovery of nearshore vertebrate predators is constrained by continued oil toxicity, by determining if there are differences between oiled and unoiled areas in:
a. Bioindicators of exposure to oil in predator species.
b. Bioindicators of exposure to oil in prey species.
c. Hydrocarbon levels in prey species.

Objective 4. Determine if recovery of nearshore vertebrate predators is constrained by food availability.

We will address all major objectives for each of the four predator species selected for study. Methods are detailed below.

B. Methods

Methods for 98025 are outlined in detail in Holland-Bartels et al. (1995, 1996) and are summarized below and in Table 2. The generalized study design calls for comparing predator abundance, demographic measures, health, indicators of oil exposure, and prey abundance within a selected oiled area and a selected unoiled area. We are constrained to using selected areas, rather than a random sample of all potential oiled and unoiled areas, for several reasons. First, the mobility of nearshore vertebrate predators makes it difficult to clearly define subpopulations of these species within PWS. For example, sea otters can range up to 40 km, making it difficult to select clearly defined replicate "oiled" subpopulations. Second, habitats within PWS are extremely diverse, making it difficult to segregate effects of oiling from other environmental factors, especially in cases where habitats in oiled and unoiled areas are clearly different. Third, the areas representing the total of all oiled and unoiled areas are extremely large, and it would be impossible to effectively sample from the entirety of these areas given reasonable monetary constraints.

Table 2. Summary of methods for the NVP project, listed by species and approach.

APPROACH	SEA OTTERS	HARLEQUIN DUCKS	PIGEON GUILLEMOTS	RIVER OTTERS
DEMOGRAPHY	•AERIAL SURVEYS •SURVEYS OF ANNUAL REPRODUCTION RATES •CARCASS RECOVERY TO EVALUATE MORTALITY PATTERNS	• HABITAT USE AND ABUNDANCE IN OILED AND UNOILED AREAS •OVERWINTER SURVIVAL OF FEMALES	•CHICK GROWTH RATES •REPRODUCTIVE SUCCESS •ADULT ATTENTIVENESS TO CHICKS •MEAL DELIVERY RATES AND MEAL SIZE	•LATRINE SITE ABANDONMENT AS ABUNDANCE INDEX
HEALTH AND OIL EXPOSURE	•BLOOD AND IMMUNE FUNCTION ASSAYS •P450 ASSAYS •MORPHOMETRICS AND CONDITION	•BLOOD ASSAYS •P450 ASSAYS •BODY COMPOSITION	•BLOOD ASSAYS •P450 ASSAYS	•BLOOD, IMMUNE FUNCTION ASSAYS •P450 ASSAYS •MORPHOMETRICS
TROPHIC INTERACTIONS	•ABUNDANCE, DISTRIBUTION, SIZE CLASS STRUCTURE--CLAMS, MUSSELS, SEA URCHINS, CRABS •PREY SELECTION AND FORAGING SUCCESS •FACTORS AFFECTING PREY ABUNDANCE: VARIATION IN RECRUITMENT AND GROWTH OF INVERTEBRATE PREY; COMPETING PREDATORS	•ABUNDANCE AND SIZE CLASS DISTRIBUTION OF PRIMARY INVERTEBRATE PREY	•ABUNDANCE OF PREY FISHES	•ABUNDANCE OF PREY (DEMERSAL FISHES)

In using selected areas, we are restricted to making statistical inferences to these areas only, and not to the oiled and unoiled regions as a whole. Extrapolation of results to the broader oiled and unoiled parts of PWS will therefore rely on "best professional judgement". However, given the alternative of what would assuredly be an unworkable experimental design, we feel this is the only reasonable approach.

Study locations will be within generalized "oiled" and "unoiled" areas. The oiled area is identified as the Naked Island-Northern Knight Island group (Figure 1). Oiling was heaviest here, and population levels of sea otters are much lower here than at unoiled areas in PWS. Harlequin duck densities also are lower in this area. The unoiled area will be along the northwestern shore of Montague Island for sea otters and harlequin ducks, and around Jackpot Island for river otters and pigeon guillemots.

We have selected areas to maximize sampling efficiency from a logistical perspective as much as possible. For example, sea otter and harlequin duck study areas overlap completely and the oiled study area for river otters overlaps with part of the oiled study area for sea otters and harlequin ducks. However, complete overlap of oiled and unoiled areas was not possible because no two areas had appropriate habitat for all four predator species.

The following sections describe methods that are general to several of the study species (e.g. various health and oil exposure methods, Table 3; and habitat characterizations) as well as species specific methodologies. Detailed standard operating procedures are on file and available upon request.

General Methods for Determining Health and Exposure to Oil.--We will examine a common suite of biomarkers (Table 3) for each of the nearshore vertebrate predator species to determine the health and oil exposure of oiled and unoiled populations. Health will be evaluated through hematology and immune function assays as well as morphometrics (weights, lengths, etc.) and, for harlequin ducks, body composition measurements. Oil exposure will be evaluated by measurements of cytochrome P450-1A's, enzymes that are specific indicators of exposure to aromatic hydrocarbons. P450 assays will be done for the four predator species and on vertebrate prey (selected fish species). Additional tests of oil exposure will include ELISA assay of pelage or plumage swabs and, if warranted based on outcome of P450 assays, analysis of hydrocarbon levels in archived prey samples.

General methods for assessing health and oil exposure are presented here. Methods specific to each species will be addressed in sections on each species, below.

Table 3. List of assays, measurements for evaluation of health and oil exposure.

Assay or Biomarker	Laboratory or Location	Sea Otters	Harlequin Ducks	Pigeon Guillemots	River Otters	Demersal Fishes
		n=60	n=100	n=75 nestlings n=25 adults	n=30	n=40
Blood - CBC, WBC	Commercial lab/ Purdue	X	X	X	X	
Serum Chemistry	Commercial lab	X	X	X	X	
Interleukin-6	UAF	X	X	X	X	
Haptoglobin	UAF	X	X	X	X	
Immunoglobulin Quantitations	Purdue	X	X			
Serum electrophoresis	Purdue/ UAF	X	X		X	
Lymphocyte Transformation Assay	Purdue	X	X		X	
Cytochrome P450 Immunohistochemistr y	Woods Hole	X	X	X	X	X
Cytochrome P450 Quantitative PCR	Purdue	X			X	
External oil (ELISA)	In field/ UAF/NBS	X	X	X - Adults	X	
Morphometrics (weights, lengths)	In field	X	X	X	X	
Body Composition	In field/NBS		X			

Collection of Blood Samples.--Samples will be collected at capture from sea and river otters (30 ml) by standard jugular venipuncture techniques, and from pigeon guillemots (1 ml) and harlequin ducks (3 ml) by brachial or jugular venipuncture. Blood volumes collected on sea and river otters will be sufficient to conduct conventional hematology, immune function and cytochrome P450 assays. For harlequin ducks and pigeon guillemots, because blood volumes will be limiting, the primary focus will be on conventional hematology.

Hematology and Serum Chemistry.--For the CBC's (complete blood cell counts), WBC's (white blood cell counts) and serum chemistries, one EDTA tube, one serum tube and two blood smears from each animal will be prepared in the field. Samples will be submitted to commercial clinical laboratories (Corning Clinical Laboratories, Anchorage and Portland, for the sea otter and river otter samples, and Avian Exotic Animal Laboratory, California, for the harlequin and pigeon guillemot samples) for analyses.

Haptoglobins in serum will be measured at UAF. Haptoglobins (Hp) are alpha glycoproteins that stoichiometrically bind free hemoglobin (Hb) in a haptoglobin-hemoglobin complex (Gordan and Koj 1985). Excess hemoglobin will be added to the serum sample in a 1 part of a 10% hemoglobin suspension to 20 parts of undiluted serum, and allowed to mix for 5 min. Two microliters of the sample mixture are then electrophoresed on agarose gels at 100 volts for 1 hr. After fixing the protein complex with 7.5% trichloroacetic acid, gels will be stained for hemoglobin using o-dianisidine, as described by the manufacturer (Helena Laboratories Technical Bulletin Number 5445). The Hp-Hb complex, which migrates in a different region from hemoglobin, is quantified by densitometry and results are expressed as mg of hemoglobin binding capacity per 100 ml of serum as described by the manufacturer (Helena Laboratories Technical Bulletin Number 5445; Valeri et al. 1965).

Serum samples will be analyzed for Interleukin-6 (IL-6) at UAF using an immunochemical assay (Quantakine ELISA). Samples will be run in duplicate on a microtiter plate coated with a monoclonal antibody for IL-6. After washing away any unbound protein, an enzyme-linked polyclonal antibody for IL-6 will be used to detect IL-6 levels.

The serum samples from sea otter, river otters, and harlequin ducks will be batch tested at Purdue University for serum electrophoresis (SEP) and immunoglobulin quantitation using standard methodologies. Serum protein electrophoresis offers information on relative protein distribution and allows for the calculation of absolute values (Melvin 1987). Many disease states may alter the electrophoretic pattern (Turnwald and Barta 1989). Acute phase, complement, immunoglobulin and coagulation proteins can all be assayed using SEP.

Immune Function Assays.--From sea and river otters, a total of 20 ml of blood collected with 40μ of preservative-free heparin/ml as the anticoagulant will be used to isolate buffy coat leukocytes. Blood samples will be processed using a technique modified from Truax et. al. (1993) on cryopreservation of buffy coat cells, stored in liquid nitrogen, and shipped to Purdue University. For analysis, frozen cells will be thawed rapidly in a 37°C water bath and immediately placed on ice. The sample will then be transferred to a 15 ml centrifuge tube and diluted to 10 ml with Hank's balanced salt solution (HBSS) containing 40 μ of heparin/ml. The sample will then be layered over 4 ml of a ficoll gradient and centrifuged at 1600 x g for 30 minutes. The cells at the interface will be collected and washed 3 times in HBSS. Following the final wash the cells will be resuspended in RPMI 1640 medium supplemented with 10% (v/v) fetal clone, 2 mM L-glutamine, 25 mM 2-mercaptoethanol and antibiotics. Enumeration and viability will be assessed using trypan blue dye-exclusion. Lymphocyte proliferation assays will be performed using the mitogens PHA, Con A and PWM in 5 day cultures. All assays will be done in triplicate. Proliferation will be assayed by adding tritiated thymidine to the cultures at 16 hours prior to harvesting. Results will be recorded as counts per minute (cpm). Control wells will contain medium only.

Cytochrome P450 Assays.—The cytochrome P450 isoenzymes are biological markers of exposure to hydrocarbons. Two approaches will be taken to evaluate cytochrome P450 levels:
1) Immunohistochemistry: The induction of cytochrome P4501A (CYP1A) in tissues of the predator species will be evaluated by immunohistochemistry. Candidate tissues to be used include skin punches from flipper of sea otters and from ear of river otters; liver from collected Barrow's goldeneyes; foot web biopsies from captured harlequin ducks and pigeon guillemots; and liver from demersal fishes (sample at collection). Tissue samples will be preserved in 10% neutral buffered formalin immediately after collection and shipped to Woods Hole Oceanographic Institute for analysis.
2) Quantitative RT-PCR to measure cytochrome P450: The purpose of this approach is to use an alternate method (quantitative polymerase chain reaction) to measure cytochrome P450 expression in peripheral blood lymphocytes. The lymphocytes will be isolated from blood samples drawn from animals captured from oiled and non-oiled areas. The method to be used will be adapted from Vanden Heuvel et al. (1993). Total RNA will be extracted from isolated peripheral blood lymphocytes and a reverse transcriptase-polymerase chain reaction (RT-PCR) assay will be used to quantify cytochrome P450 levels. Advantages of this technique are: (1) the use of peripheral blood samples for analysis; (2) the small sample size required for detection and (3) potentially increased sensitivity as compared to other methods.

Assays of External Oil.--Personnel at the CA Dept. of Fish and Game have recently adapted an ELISA assay to detect oil contamination of pelage under field conditions (J. Mazet, CDF&G, pers. comm). Controlled tests of the procedure show sensitivities in the range of less than or equal to .7 parts per million. To sample the pelage or plumage, a 4x4 gauze swab is saturated with isopropanol and applied for 15 seconds. These swabs can then be assayed immediately (ELISA field kit) or frozen for later analysis. We will sample pelage or plumage of all captured sea otters, river otters, harlequin ducks and adult pigeon guillemots; however, ELISA analyses will be limited to a subset of the collected samples. If initial ELISA results are positive for contamination, or if the P450 assays indicate continuing hydrocarbon contamination, the remaining samples can be tested to evaluate external contamination as a route of oil exposure.

Body Condition/Composition.--Body condition will be used to assess population health in oiled and unoiled areas in PWS. For river otters, sea otters, and pigeon guillemots, condition will be estimated based on morphometrics (weights, lengths). For harlequin ducks, body composition will be estimated using nondestructive condition indices that incorporate body mass, morphometrics, and measures of total body electrical conductivity (TOBEC; Walsberg 1988, Roby 1991). A major advantage of the TOBEC technique is that measurements can be obtained rapidly and repeatedly without harm to the subject. Also, validation studies to date indicate that the accuracy of the technique can be high (r^2 = 0.996) (Bracco et al. 1983, Walsberg 1988, Roby 1991) if subjects are positioned consistently within the measurement chamber and plumage is dry. Condition index models will be derived based on collection (outside the spill area) of 25 harlequin ducks in 1996.

Specific Methods for Sea Otters.--

Aerial Survey: Aerial surveys will be conducted in the summer of 1998, including (1) a full survey of western PWS, and (2) five replicate surveys of study areas at Knight and Montague Islands. No winter or spring aerial surveys will be conducted in 1998.

The aerial sea otter survey methodology consists of two components: (1) strip transect counts and (2) intensive search units. Sea otter habitat is sampled in two strata, high density and low density, distinguished by distance from shore and depth contour. Survey effort is allocated proportional to expected sea otter abundance by adjusting the systematic spacing of transects within each stratum. Transects with a 400 meter strip width on one side of a fixed-wing aircraft are surveyed by a single observer at an airspeed of 65 mph (29 m/sec) and altitude of 300 feet (91 m). The observer searches forward as far as conditions allow and out 400 m, indicated by marks on the aircraft struts, and records otter group size and location on a transect map. A group is defined as one or more otters spaced less than three otter lengths apart. Observation conditions are noted for each transect and the pilot does not assist in sighting sea otters. Intensive search units (ISU's) are used to estimate the proportion of sea otters not detected on strip transect counts. ISU's are flown at intervals dependant on sampling intensity, throughout the survey period. An ISU is initiated by the sighting of a group and is followed by five concentric circles flown within the 400 m strip perpendicular to the group which initiated the ISU. The pilot uses a stopwatch to time the minimum one minute spacing between consecutive ISU's and guide the circumference of each circle. ISU circle locations are drawn on the transect map and group size and behavior is recorded on a separate form for each ISU. Number observed on the strip count and number observed during the circle counts are recorded for each group.

Estimation of Annual Production of Sea Otters: Estimates of annual reproduction, as indicated by ratios of independent to dependent sea otters, and patterns of habitat use will be obtained from small boat surveys. Surveys will be conducted in July and August. Sample units correspond to coastline transects established by Irons et al. (1988) and extend offshore out to the 100 m depth contour or one half the distance to the opposing shoreline, whichever is less. A subset of sample units will be randomly selected to be surveyed in each of the study areas. The survey vessel maneuvers about 200 to 300 m offshore, and out to the offshore boundary as necessary to observe and classify all otters within each selected sample unit. Boat speed is maintained at <15 mph. Surveys are conducted only when calm to light winds and sea state less than Beaufort 2 exists. Two observers use high resolution binoculars to classify otters as either dependent or independent. Crews will record the number of dependent and independent sea otters found in each sample unit. Each sample unit is classified by coastline physiography (protected bay, open coast, or island) and bathymetry (<31 m for more than 50% of the sample unit's length at 200 - 300 m offshore, or >31 m for more than 50% of the sample unit length). Ratios of independent to dependent sea otters is obtained for each stratum and for each habitat type by summing over all sample units within each stratum or habitat type. Proportions of dependent sea otters is calculated for each transect. Kruskal-Wallis tests will be used to evaluate differences in proportions among areas.

Beach Surveys of Sea Otter Mortality: Mortality patterns, based on age distributions of the dying portion of the population, will be evaluated through recovery of beach-cast sea otter carcasses in western PWS. Beaches in the Green Island area of western PWS, surveyed for carcasses in 1976-84 by Johnson (1987), and again in 1990-97 (Monson and Ballachey 1996, J. Bodkin, pers. comm.), will be surveyed in 1998. In addition, a limited number of beaches on Knight, Naked, and Montague Islands will be surveyed in 1998. Beaches will be surveyed once during late April or early May after snow melt but prior to summer revegetation, which may hide carcasses washed high on the beach by winter storms. Data recorded for each carcass include: 1) relative location of carcass on the beach, 2) relative condition and completeness of carcass, 3) position of remains relative to previous year's vegetation, 4) relative age (adult, subadult, pup), 5) sex, and 6) specimens collected (e.g., entire carcass, skull, baculum, none). Skulls (when present) will be taken from all carcasses and a tooth extracted for aging (Garshelis 1984). Any fresh carcasses collected will be necropsied as soon as possible and tissue samples collected for potential toxicology and histopathology studies.

Subsequent to final age analyses, otters are classed as: 1) juvenile: ages 0 and 1; 2) prime: ages 2-8; and 3) older: ages 9 and above. The distribution of age classes will be compared with other post-spill collections (1990-96) and pre-spill collections (1976-84).

Sea Otter Foraging: Because of potential differences in both observed foraging success and habitat characteristics, primarily benthic slope, we are proposing to implement studies of energetic budgets and diving behavior in our respective study areas in 1998. Implantable time-depth recorders will provide an accurate and unbiased record of an individual's activity over the annual cycle. The most useful data will be the proportion of time that individual sea otters allocate to foraging in our two areas. If prey are equally available, and of equal size, we would predict that time allocated to feeding would not differ between areas. It is also possible that differences in habitat (slope and depth) are reflected in differences we have observed between areas. An accurate record of activity relative to habitat use and availability should allow evaluation of the potential effects of habitat differences between areas.

Time-depth recorders: In 1998, we will capture and surgically implant 15 adult sea otters in each study area with time-depth recorders (TDR's). These instruments will allow us to evaluate potential differences in foraging behavior relative to water depth, and to test for differences in foraging effort allocation between areas. Otters Will need to be recaptured in 1999 to recover the data stored in the TDR's between deployment and retrieval. Recapture in 1999 will be supported by funds from the Alaska Science Center.

Sea otter foraging success will be measured in 1998 with methods similar to those emplyed in 1996 and 1997, using focal animal foraging observations (Altmann 1974) adapted for sea otter work in past studies (Calkins 1978, Estes et al. 1986). We will conduct shore-based, nearshore observations at randomly selected sites (coordinated with the invertebrate sampling sites) within each of the two study areas.

Foraging success: Foraging observations in 1998 are similar to those done in 1996-97; however, whenever possible, the implanted otters will be targeted as focal animals. Data collection will be observational, following standard operating procedures. Observations will be made from shore with the aid of high resolution telescopes (Questar Corporation) and 10X binoculars. Data will be collected at both locations within a six week period during the months of June, July and August, beginning in 1996. Data recorded will include sex, age class of \\focal animal (adult or juvenile), number of prey and relative prey size (A: < 2 cm, B: ≥ 2 to < 4 cm , C: ≥ 4 cm to < 8 cm, D: ≥ 8 to < 12 cm, and E: ≥ 12 cm), dive time, surface time, success rate and prey item to lowest taxon. Prey size will be visually estimated based on an estimated mean forepaw width in sea otters of 4.5 cm. Repeated dives will be recorded for a focal animal until a maximum of 50 identifiable prey items are observed per individual or until the animal is lost or discontinues foraging. Focal animal selection, when more than one otter is feeding at an observation site, will be random. A minimum of 500 identifiable prey items will be recorded at each of the two selected geographic areas. Foraging observations will be randomly distributed among vantage points within each study area. Compiled foraging data will be compared to the invertebrate data collected, particularly as it pertains to species composition and size class composition. Adult animals will be categorized as male, independent female or female with a pup. Juveniles will be identified as small dark-headed otters estimated to be less than 24 months of age. Dependent otters will be classified as such. Data will be collected only during daylight hours, during all tidal cycles. Tidal state will be recorded for all observation periods.

Capture: In 1998, 30 adult sea otters (15 per study area) will be captured for implantation of time depth recorder units (see "Foraging" section, above). Sea otters will be captured with either tangle nets, hand-held dip nets or underwater diver-held traps, all methods which have been used routinely in previous capture efforts. Otters will be sedated with a combination of fentanyl and diazepam and will be reversed with naltrexone following collection of data and samples. They will be tagged with unique color/number coded polyethylene tags in their hind flippers, and a coded transponder chip will be implanted subcutaneously in the right groin area. Flipper tags are often lost, so the transponder chips provides a permanent identification in the event that the animal is recaptured or recovered. Both methods of tagging have been used routinely in previous studies of sea otters, without deleterious effects. Otters will have a time depth recorder (25 gm) and a VHF radio (100 gm) surgically implanted into the peritoneal cavity for foraging studies (described above). In summer 1999, otters will be recaptured for retrieval of the time depth recorder units (expenses of recapture will be shared by USGS-BRD funds).

Indicators of Health: Morphometric data collected on captured otters will include age class, sex, length, weight, girth, canine width and baculum length (in males). Weight and length will be used to estimate animal condition. Morphological characters will include head color and tooth wear. The mouth will be checked for oral lesions, and if observed they will be surgically biopsied and preserved in formalin for histological examination. A premolar tooth will be removed for age estimation. A blood sample of up to 30 cc will be collected by jugular venipuncture from each sea otter and processed as described in the general methods section; conventional hematology, immune function assays and cytochrome P450 assays will be conducted.

Subtidal Clam Populations: Subtidal clams have proven a major food source for sea otters. Therefore, determining their density and size class distribution remains a key element of our efforts to assess if food may be constraining recovery of sea otters in the Knight Island area. However, sampling of subtidal clam populations proved problematic in 1996 because of their rare and highly clumped distribution. In June 1997, we will initiate the protocol described below. We believe this protocol will increase the probability of effectively sampling this critical food source. It is possible, however, that dense patches are sufficiently rare or localized that our maximum possible level of random-based sampling, ultimately constrained by available funding, may not be adequate to resolve the NVP questions. Thus, our first effort under the 1998 DPD will be to examine our 1997 field data with regard to number, apparent size, species composition, within-patch clam density and size distribution, and frequency of dense clam patches by study area. Power analyses will assess the need for additional clam population work during the 1998 field season. We will apply the NVP adaptive management procedures during our annual fall project leaders' meeting to evaluate these data. We will either proceed as described below or modify and place greater emphasis on the predator-based sampling and foraging data. The following is our general protocol for the FY 1998 field season at this point.

Adult clam densities and size distributions will be sampled with a diver-deployed Venturi suction dredge as used in 1996 and 1997 field work. We will use two criteria for selection of sampling sites. First, a random subset of the systematically identified shoreline segments will be chosen at each of the, following the general pattern of site selection adopted for 1996 NVP field work. We will sample a minimum of ten sites at each area. Second, an additional subset of shoreline segments will be selected on the basis of observed patterns in sea otter foraging effort in the study areas. Clearly, sea otters are successful in obtaining subtidal clams. We hope that a predator-driven sampling strategy will help us target clam habitat and reduce the high variance we have in our estimates to date. Information on sea otter foraging effort will be provided by the sea otter foraging component of the NVP Project. We will chose segments in which significant foraging effort has been observed prior to our field work. We plan to sample a minimum of twenty such sites, distributed in the same pattern as the first subset described above.

Juvenile clams will be sampled with diver-deployed benthic corers (surface area of 0.009 sq. m to a sediment depth of 10 cm) at each site sampled by dredging. Groups of four randomly-placed cores will be collected at 0, 1.3, 2.6, 4.0, 5.3, and 6.7 m (MLLW). Cores will be sieved through a 0.5 mm screen and samples fixed (10% formalin), and preserved (70% ethanol). These data will allow us to assess recruitment patterns in clams by species, site, and bottom depth. We will also examine sediment grain size and organic carbon to view how these variables contribute to recruitment patterns in clams.

In addition, we will survey for clamshells apparently discarded by foraging sea otters. Three to five randomly-positioned transect lines will extend from the lower intertidal to a depth of 10 m

MLLW at each of the randomly-selected sites. Freshly-discarded adult-sized shells will be collected within 1 m of either side of the line by divers. Such shells are defined as those lacking significant erosion or fouling, with one valve intact, the other valve fractured, and the hinge region intact and still articulated. Similar collections will be made at sites of recently-observed otter foraging activity, as described above. Collected shells will be identified, measured, and the size composition compared between sites. Comparison of data between randomly-selected and otter-foraged sites will allow assessment of patterns of prey patch selection by foraging otters.

During our 1996 sampling we commonly encountered an assemblage of dead clam shells that may represent important information about the dynamics of clam populations in the Sound, and the relationship of sea otter foraging and other sources of mortality to clam population density and age/size structure. The dead clam assemblage was dominated by large individuals (to > 100 mm shell length) of *Saxidomus gigantea*, densities of 20 - 50/sq. m, usually 30-50 cm below the sediment surface. Individuals had shells that were still paired and articulated, in life position, only moderately weathered, and showing no indication of traumatic disturbance. The cause and timing of death in the death assemblage are unknown (perhaps previous earthquake related). Knowledge of timing of death of the clams will permit inferences about likely cause. Collection, identification, and measurement of clams in the death assemblage require only a trivial additional field effort, given that the same plots are excavated for purposes of sampling living clams as indicated above. Thus we will continue to gather data on the death assemblage during our 1997 and 1998 field seasons. We believe that, given the density and size of clams in the death assemblage and its dominance by *Saxidomus*, it is quite likely that the assemblage represents clam populations as they existed prior to the initial return of sea otters in the 1960s and 1970s. Sea otters feed preferentially on large *Saxidomus*, and our 1996 samples from Montague Island indicate such dense patches of large individuals are unlikely in areas where sea otters are common. Thus, these data provide the opportunity to determine if, in the absence of sea otter predation, one is likely to expect significant differences in clam density and size distribution among study areas, or among sediment types within study areas. Resolution of these questions is of substantial importance in interpreting patterns in clam data from our study with regard to the central questions of the NVP project. Recent improvements in isotopic dating techniques for recent-aged samples will allow us to attempt direct measurement of both the date of death and the coincidence of death in the assemblage. Representative samples will be tested with 14-carbon isotopic analyses, using the Dating Laboratory at the Woods Hole Oceanographic Institution. Such analyses are now sufficiently precise to assess both the degree of coincidence in death timing, and to estimate the time of death. As noted above, the added costs for work are limited to laboratory analyses.

Intertidal Clam Populations: Analysis of FY96 and FY97 data will continue, and samples collected in 1997 will be analyzed to determine the relationship between biomass and size in order to allow estimation of standing stock biomass for clam populations.

Sea Urchin Populations: In 1996, there were more large urchins at Knight than at Montague. This pattern was predicted based on the relatively few otters, and the relative lack of predation pressure on sea urchins at Knight Island, and provides additional evidence that sea otters within the Knight Island area have not fully recovered. However, there was a group of male otters observed on Knight Island in 1996, and we suspect that this is a recolonizing group that will eventually lead to the recovery of otters on Knight Island. We predict that as the number of otters increases at Knight Island, the number of larger sea urchins will diminish and the number of large urchins per otter will eventually be about the same at Knight and Montague Islands.

The idea that the recovery of predator populations can be monitored by examining the size and density distribution of the prey is a novel and untested concept in ecology. Continuing to monitor the relationship between sea urchins and sea otters in Prince William Sound should provide valuable insights to the utility of concept.

Sampling of intertidal transects will continue at 30 systematically selected sites within each area (Montague and Knight Island) in FY98. In addition, several other sites with known aggregations of sea urchins will be sampled in order to obtain reasonable estimates of size-distributions of urchins. The sampling design and sampling methods will be the same as described in our 1996 Annual Report. No subtidal sampling will be conducted.

Samples collected in 1997 will be analyzed to determine the relationship between biomass and size, in order to allow estimation of standing stock biomass for the urchin population.

Crab Populations: Analysis of FY96 and FY97 data will continue, and samples collected in 1997 will be analyzed to determine the relationship between biomass and size, in order to allow estimation of standing stock biomass for the crab population.

Mussel Populations: The methodology used in 1996 and 1997 to estimate mussel abundance, biomass and length-frequency distribution will be reduced in scope to focus on developing a protocol for monitoring shifts in mussel size-frequency distribution as sea otters recover at Knight Island (see mussel monitoring below). Research on mussels in 1998 will focus on a particular mechanism that could produce a size distribution in mussels similar to that observed when sea otters structure the mussel population. Relatively few *Mytilus trossulus* may live long enough to exceed 40 mm in shell length in Prince William Sound. Work with *M. trossulus* (= *M. edulis*, auctt.) in British Columbia has-revealed heavy summer and fall mortality in mussels over 4 cm in shell length, independent of predation and diseases such as haemocytic neoplasia (Bower 1989). In some locations over 90% of the mussels in this size range suffered mortality. This high summer mortality may be related to reproductive stress (Emmett et al. 1987, Bower 1989). To determine whether this mechanism is operating in Prince William Sound, we will age mussels using a proven technique (see below). To verify that the growth lines on our mussel shells are true annuli, we will follow individuals marked in 1997 for at least one year to compare growth with that measured with the aging technique, and to estimate size specific mortality rates.

A total of 30 mussels ranging in size from 10 to ≥ 40 mm in shell length will be collected from three areas adjacent to randomly selected quadrats within each study location (Montague Island, Bay of Isles and Herring Bay). The mussels will be frozen in plastic bags for transport to the laboratory. In the laboratory, the mussels will be opened and all tissue removed from the valves.

One valve from each mussel will be imbedded in epoxy resin (Epofix). When the resin has set the imbedded valve will be sectioned longitudinally along the longest axis that bisects the umbo using an Accutom-2 precision cut-off machine with a diamond blade. The plane of section of the block with imbedded valve will then be polished in sequence with 3,600 grit, 6,000 grit, and 12,000 grit polishing paper. The polished surface will then be buffed with 0.05 micron Alumina buffing powder spread on a felt buffing cloth attached to a grinding wheel. The polished valve surface will then be etched with 1.0 % HCl. for 105 sec. Acetone will be dripped on the polished valve surface and a square of diacetate sheet 0.5 mm thick will immediately be placed on the polished surface for 6 min. to receive the impression of the growth lines on the etched valve surface. The resulting acetate peel will be read (growth lines counted) at a magnification of 10 x with a compound microscope in phase contrast. Annual growth will be estimated by measuring the distance between annuli on the un-sectioned valve or acetate peel, depending on the condition of the un-sectioned valve.

To evaluate the accuracy of the aging technique acetate peals will be made of mussels of known age. In addition, mussel growth will be measured at the study locations and compared with growth determined using the mussel aging technique. These growth measurements in the field will help validate the aging technique. The growth of 1,000 mussels ranging in size from 10 to ≥40 mm will be measured at each study location. In 1997, the mussels were carefully removed from the rocks near randomly selected quadrats in three areas at each study location. The mussels were then marked with individually numbered, flexible, polyethylene shellfish tags, and the shell length of each mussel was measured to the nearest 0.1 mm. The mussels were returned to the rocks and caged for two weeks to allow them to reestablish their byssal threads. At the end of that period the cages were removed from half of the group of mussels at each study location. The caged mussels will remain caged until summer 1998 to assess the effect of caging on mussel growth, and, more importantly to measure size-specific mortality of mussels in the absence of major predators. In summer 1998 the annual size increment of all surviving marked mussels will be measured. Growth and size-specific mortality will be compared between caged and uncaged mussels and between study areas.

Growth curves of mussels will be fitted to the von Bertalanffy equation. Growth curves will be compared using analysis of covariance following curvilinear regression. Analysis of variance will be used to compare mortality rates between study areas and caged versus uncaged treatments. A nonparametric anova will be substituted if the data do not meet the assumptions of the parametric anova and standard transformations do not normalize the data and stabilize variance.

Monitoring Mussels During Sea Otter Recovery: Within the Montague and Knight Island study areas a protocol for monitoring shifts in mussel size-frequency distribution as sea otters recover at Knight Island will be developed in 1998. Mussels will be sampled using a modification of the stratified random/systematic design used to sample mussels in 1996 and 1997. In that design each length of coast was divided into two strata based on shoreline type: 1) rocky (including bedrock and boulder) and 2) unconsolidated or mixed substrates (including various mixtures of sand, granules, pebbles and cobbles). About sixty shoreline segments, 200- m long, were systematically sampled in each study area. Within each shoreline segment

10 transects, each separated by 20 m, were laid perpendicular to shore. Each transect spanned the mussel zone. Mussel densities were estimated using 500 cm^2 quadrats, each quadrat placed randomly along a transect. The mussels in each quadrat were collected, placed in plastic bags and frozen for subsequent processing in the laboratory. In the laboratory the maximum shell length of each mussel was measured to the nearest 0.1 mm with a digital caliper linked to a data logger. Mussels <5 mm in shell length were grouped into two size classes (0-1.9 and 2-4.9 mm).

The chief modification to the above sampling design that will be made for the monitoring study will be to reduce the scope of the sampling effort. This will be accomplished by reducing the total number of shore segments sampled to 60 and by focusing exclusively on large (≥ 40 mm) mussels. This approach should reduce the number of field days allocated to monitoring to 10 d and will reduce the amount of labor required for sample processing to 1/4th that presently required. Enough information should be collected on the spatial distribution of large mussels in the study areas by the end of FY97, that the study areas can be stratified by large mussel density, thus minimizing the loss of power with reduced sample size. As in the larger study conducted in 1996-97, analysis of variance will be used to compare the abundances of large mussels between study areas. A nonparametric anova will be substituted if the data do not meet the assumptions of the parametric anova and standard transformations do not normalize the data and stabilize variance.

Specific Methods for Harlequin Ducks.--

Female Winter Survival: Winter survival rates of female harlequin ducks will be assessed using radio telemetry. Variation in female survival is particularly influential on population growth rates and, thus, it is critical to assess to understand population recovery.

A total of 100 birds will be radioed during molt at the end of FY97, with approximately 50 each in oiled and unoiled study sites. We will use implantable radio transmitters with external antennas. Radios will be programed to transmit for at least 210 days and will weigh approximately 15g, which is ≤ 3% of the body weight of the smallest molting female harlequin duck. Transmitters will be equipped with motion sensitive mortality switches; pulse rate will change from 45 to 90 beats per minute when the transmitter is stationary. Range from ground to air will exceed 20 km.

Transmitters will be implanted in the body cavity with an external antenna. Implanted transmitters have been successfully used in waterfowl studies and are less disruptive than backpack transmitters, especially for diving ducks. Surgeries will be conducted by certified veterinarians experienced in avian implant surgeries, following procedures outlined in the Alaska Science Center, NBS standard operating protocol.

Radio telemetry flights will be conducted weekly from the time of marking through the end of March 1998. Flights will detect each marked individual and note status and general location. For birds indicated as dead, more exact locations will be determined to facilitate carcass recovery by boat or float plane as soon as possible.

Data analysis will be an important part of FY98 activities. Data will be entered and analyzed using a Kaplan-Meier staggered entry design (Pollock et al. 1989). Along with traditional analysis methods, we will explore recent model-fitting approaches, using program MARK, to simultaneously assess the effects of area, year, and body condition on survival probabilities.

Distribution and Abundance: Results from winters 95/96 and 96/97 surveys demonstrate differences in density among and within study sites. Presumably, harlequin duck distribution should be related to oiling history and/or food abundance if these are having an effect. The effects of the oil spill may be expressed as either direct toxic effects ("is it oil?") or a reduction in benthic invertebrate abundance ("is it food?") or an interaction of both. Confounding this approach, physical habitat parameters also may influence harlequin duck distribution. This objective is designed to determine factors that explain harlequin distribution and abundance during winter.

Boat survey data for this objective were collected during FY 96 and FY 97. Habitat and food data will be collected in FY 97 and will continue in FY 98 (see below). Once these data are collected and compiled in a GIS format, we will analyze the relationships between harlequin duck densities, habitat variables, and food abundance.

Body Condition Variation: Body condition assessment relies on the derivation of a statistical model that predicts body composition (lipid and protein levels) using morphological measures, body weight, and measures of total body electrical conductivity (TOBEC). Derivation of condition indices will occur during FY 97. Also, final captures of molting females will occur at the end of FY 97. Thus, data analysis is the primary activity for this objective during FY98.

The best fitting predictive model will be applied to estimate body composition of all captured female harlequin ducks, allowing an accurate and nonlethal assessment of body condition. Because there may be an intrinsic change in body composition through the molting period, i.e., body condition may be tied to stage of molt as well as exposure to contaminants, we will compare regression models across oiling treatments. Stage of molt will be indexed by primary length. Linear models describing body condition variation through molt will be derived; slopes and intercepts will be compared between oiled and unoiled areas for each age and sex cohort.

Biosample Collection: We detected no difference in bioindicators between treatments for molting adult females in falls of 1995 and 1996. However, we found that survival probabilities were similar between treatments through fall but diverged during mid and late winter, with survival being poorer on the oiled area. Because molting adult females likely had only recently returned to Prince William Sound from breeding areas when captured, we speculated that health effects due to oil exposure or lowered food abundance might not be expressed until the birds had been on the study areas for a longer period. Also, although the survival data suggest differences between areas, we do not know the mechanism responsible for this difference. Thus, for FY 98, we propose to capture ducks during mid and late winter to compare body mass and bioindicator levels between areas.

We will capture harlequin ducks using floating mist nets originally designed to catch marbled murrelets. We were successful in catching harlequin ducks using this method in trial efforts during winter 1997. Will we conduct captures during December 1997 and March 1998, with a goal of capturing 50 per period, 25 from each area.

Blood (3 cc) will be drawn from the jugulars of captured ducks. Two samples of whole blood will be taken immediately from the syringe in hematocrit tubes, and refrigerated; these samples will be shipped to the lab as soon as possible. Three whole blood smears will be created. Two blood smears will be sent to the blood lab and another will be stored and forwarded to Purdue following the field season. Three to four drops of blood will be placed in a snaptop tube with buffer for genetic analysis. Remaining blood in the syringe will be placed in a vacutainer containing heparin anticoagulant. The blood will be centrifuged to separate plasma and blood cells. Plasma will be distributed into 4 snaptop tubes: one (at least 200 microliters) for the blood lab, one for protein electrophoresis and immune function work at Purdue University, one for haptoglobin and interleukin-6 analysis at University of Alaska, Fairbanks, and one to be archived for auxiliary analyses. Plasma for the blood lab will be refrigerated and shipped as soon as possible and all other plasma will be frozen. Remaining red blood cells will be frozen. All samples will be labeled with the unique number from the metal leg band placed on each bird.

Oil exposure will be evaluated through examination of cytochrome P450-1A's, enzymes that are specific indicators of exposure to aromatic hydrocarbons. Foot web biopsies will be taken from captured ducks. Tissue samples will be preserved in 10% neutral buffered formalin solution immediately upon collection. All samples will be analyzed at Woods Hole laboratory.

Presence of external oil will be determined with ELISA assays. Plumage will be sampled from the 100 females implanted with radios for survival analysis. A one-ply section of 4x4 gauze will be saturated with 4 ml of isopropanol and applied to the plumage for 15 seconds. Samples will be wrapped in aluminum foil and archived.

Harlequin Duck Prey Abundance: Duck food will be sampled for a second year in FY98. The food will be sampled from a minimum of 15 sites within each of two areas, Knight Island and Montague. These will be a subset of the sites sampled for sea urchins and clams. In addition we will sample at 5 sites in each area where high densities of harlequin ducks have been consistently observed.

At each site, we will sample within 3 depth strata: +1.5 to +0.5 m, +0.5 to -0.5 m, and -0.5 to -1.5 m. These depths were selected based on the following rationale. The mean high tide in Prince William Sound is about +3.0 m and the average low tide is about +0.5 m: Harlequin ducks appear to generally feed within several meters from shore, probably at depths of about 2 m. As a result, the ducks probably spend the majority of the time feeding at depths of from +1.5 to -1.5 m.

Sampling will be conducted within three .25 m^2 quadrats placed at random positions within each depth stratum. All algae and eelgrass will be removed from the quadrat and bagged, and the remaining mollusks will be sampled using a diver operated airlift. All sampling will be conducted during high water.

Specific Methods for Pigeon Guillemots.–

Indices of Abundance, Reproductive Success and Growth Rate: This will be the third breeding season that field studies have been conducted in PWS and Kachemak Bay. Field work will again be coordinated with on-going U.S. Fish Wildlife studies in PWS (David Irons/Kathy Kuletz, PI) and Kachemak Bay (John Piatt) as part of APEX (98163). For studies of nesting success, our goal is to locate forty active and accessible nests during late incubation at the oiled (Naked Island) and unoiled (Jackpot Island/Icy Bay, Kachemak Bay) study areas. Nests will be monitored until the young fledge or the nesting attempt fails.

We will try to locate, identify, and map all active guillemot nest sites on Jackpot Island and on the western and northern shores of Naked Island. In Kachemak Bay, we will monitor pigeon guillemot colonies between Seldovia and Mallard Bay. All historically known nest sites will be visited. Once the chicks have hatched, other active nests can be readily identified by the presence of adults transporting fish in their bills. The placement of some of these nest burrows in recesses of the cliff faces make it impossible to retrieve the chicks. We will use these inaccessible nests for indices other than growth rate. Trends in the numbers of active nest sites, as well as nest site and colony abandonment rates, will serve as indices to population trends at each study area. Differences in trends of numbers of breeding pigeon guillemots at unoiled (Jackpot Island and Kackemak Bay) and oiled (Naked Island) areas will be used as a demographic indicator of potential effects of the spill. Colony attendance will be used to estimate the breeding population. To cover the period of maximum attendance by adults, surveys will be conducted between mid-May and mid-June during morning high tide hours (Prichard 1997).

Differences in reproductive success at the unoiled and oiled areas will be measured as several variables: 1) the proportion of breeding age birds that produce a clutch, 2) size of clutches (one or two eggs), 3) the proportion of laid eggs that successfully hatch, 4) the proportion of chicks that successfully fledge, and 5) the proportion of fledged young that survive the post-fledging period. Variables (1) and (5) are extremely difficult to measure, although fledgling body fat reserves can be used as an index to post-fledgling survival. Variables (2), (3), and (4) can be estimated by the Mayfield method (Mayfield 1965, 1971). Active guillemot nests will be checked every five days beginning late in the incubation period to determine hatching success, nestling survival rates, and to weigh and measure chicks for monitoring growth and development. The following parameters will be measured as indices of parent-offspring condition: 1) growth rates of body mass, wing length, and primary feathers in nestlings, 2) accumulation of fat reserves in fledglings, 3) total mass (corrected for body size) and body composition of adults during the chick-brooding period, and 4) fledgling age and body mass. Clutch size, hatching success, fledging success, and overall reproductive success will be compared between the oiled and unoiled study areas.

Data on age-specific body mass, wing length, and primary feather length of nestlings will be separated by year and study area, and fit to Gompertz sigmoidal growth models. Growth constants (K), inflection points (I), and asymptotes (A) of fitted curves will be statistically analyzed for significant differences among years and study areas.

Indices of Health. To more accurately assess the health of individuals and potential effects of oil exposure, we will collect blood from guillemots at the oiled and unoiled study areas. We will use blood sampled from nestlings and adults to determine levels of acute phase blood proteins, such as haptoglobin, and albumin that are indicative of exposure and tissue damage. We also will measure cytokines and liver enzymes. We will supplement our blood molecular work with cellular studies, including red cell volume, hematocrits, and immune functions. Differences in biomarker levels of blood collected from oiled and unoiled areas will be used to evaluate the effects of the spill on contaminant levels in the food supply.

Blood samples (1 ml) from guillemot nestlings will be collected by brachial vein puncture. Because rapid physiological development of chicks may lead to variation in blood variables, we will collect blood samples from chicks at 20, 25 and 30 days of age. When practical, we will draw blood from birds that are exactly 20, 25 and 30 days of age (guillemot chicks normally fledge at 30-40 days post-hatch). Otherwise we will draw the first blood sample as close to 20 days of age as possible and draw the other two blood samples 5 and 10 days later. Blood samples will be collected in heparinized tuberculin syringes, transferred to Eppendorf centrifuge tubes for transport to the base camp, and centrifuged to separate plasma and cells. Plasma and cells will be frozen separately in propane freezers at the base camps. In the lab, plasma and blood cell samples will be analyzed for molecular and cellular biomarkers (e.g., characteristic morphological lesions of red blood cells associated with hemolytic anemia caused by oil ingestion [Leighton 1985]). Hematology and serum chemistry analysis will be performed by Avian and Exotic Animal Lab., Redondo Beach, CA., which specializes in avian samples. If large enough volumes are collected, we will perform haptoglobin and IL-6. The P450 assay will be done on foot web biopsies taken from 30 day old chicks. Tissue samples will be preserved in 10% neutral buffered formalin solution immediately upon collection. Results from biomarker studies will be used to test biostatistical models that predict population health.

The impact of potential contaminant exposure on breeding adults will be monitored using a combination of direct and indirect methods. Frequency of chick meal delivery and meal size will be determined during the chick rearing period by a combination of monitoring adult nest visitation rates and periodic weighing of chicks.

Individual variation in exposure of adults and nestlings to petroleum hydrocarbons will be monitored by periodically collecting food samples from adults as they return to the nest site to feed nestlings and by collecting prey samples at sea. Adult guillemots will be captured and blood samples (1 ml) collected. Blood samples will be analyzed for molecular and cellular biomarkers of contaminant exposure using the same techniques applied to nestling blood samples. Assays of external oil will be done with ELISA swabs of the adult's plumage. Foot web tissue biopsies for P450 assay will also be collected from each adult handled. Tissues samples will be preserved in 10% neutral buffered formalin solution immediately upon collection. These samples will allow us to monitor the impacts of various levels of contaminant exposure on physiological condition of nestlings and foraging efficiency of adults.

Capture: Pigeon guillemots are highly philopatric and usually return to breed in the same nest crevice each year, or to one in close proximity. Consequently, mark-recapture rates can be used to estimate adult survivorship at the three study areas. Floating mist nets and burrow mist netting will be employed to capture adults.

A mist net will be pinned around the burrow entrance to entangle the adult as it enters the burrow to deliver fish to its brood. Once the mist net is in place, we will watch the burrow entrance from a blind. The captured birds will be processed at burrows; in addition to the above tissue samples and plumage swabbing, we will weigh each bird and make measurements of culmen, tarsus, and wing length (flattened, straightened, to the longest primary). Any fish found with the adult will be weighed and standard length measured before being sent frozen to Dr. Daniel Roby's lab at Oregon State University for nutrition analysis as part of APEX (98163) protocol.

We will band each bird with a U.S. Fish and Wildlife Service aluminum band and a unique combination of three color bands.

Chick diet: Adult pigeon guillemots carry a single fish in their bill back to the nest to feed their chicks. Before entering the burrow, adults commonly land in the water in front of the colony. Every five days we will conduct all day colony watches (600 hrs-2200 hrs) or 8 hour watches starting at 600 hrs or 1400 hrs on two consecutive days. From our observation posts on land or boat, we will identify these fish using binoculars or a telescope. We will identify the fish to the lowest taxonomic level and estimate their length to the nearest half bill length. Each time a bird arrives at the colony with a fish, we will record arrival time, delivery time, nest number, prey item, and prey size. In addition to collection of fish delivered to burrows (described above) we will verify our estimates of prey size and species identification by collecting fish from chicks using throat liguatures. The species composition of the chick diets and delivery rate with be compared with past studies.

Subtidal fishes: Analysis of FY96 and FY97 data will continue.

Specific Methods for River Otters.--

Capture. River otters will be captured in the oiled (Herring Bay) and nonoiled (Jackpot Bay and vicinity) areas of Prince William Sound using No. 11 Sleepy Creek leg-hold traps (Blundell et al., in review) under permit 97-006 from the Alaska Department of Fish and Game. Twenty otters will be captured in each study site. Traps will be placed on trails at latrine sites and monitored by means of trap transmitters (Telonics, Mesa, Arizona, USA) that signal when a trap has been sprung. Processing of otters normally begins within 1 - 2 hours. Otters will be anesthetized with Telazol (9mg/kg; A. H. Robins, Richmond, Virginia, USA) administered using Telinject darts and a blowgun.

Trapping sites for river otters will be associated with active ($\geq$ 10 recent feces) latrine sites in each study area. A total of 131 latrine sites were identified in Herring Bay area in June 1990 (Bowyer et al. 1995). Sixty five new latrine sites were located in 1996. Eighty-three latrine sites were identified in Jackpot Bay, and in the neighboring bays (Ewan and Paddy) another 69 latrine sites were located. During the initial trapping effort in 1997 and 1998 we will evaluate latrine sites for use and abandonment by enumerating the presence of fresh scats without actually clearing the sites.

Handling and biosampling. Once anesthetized, otters will be weighed to the nearest 0.1 kg., measured to the nearest mm, and blood samples will be drawn from the jugular vein. Measurements taken will include weight (kg); body length, tail length, and total length (mm); total skull length and zygomatic arch width; canine length and diameter, and distance between canines; and length from hock to toe of the right hind foot. Sex will be distinguished by the relative position of urogenital openings and palpation of the baculum (Larson and Taber, 1980). Females will be checked for evidence of lactation. We will insert a PIT (Passive Integrated Transponder) tag under the skin between the scapulae of each individual to allow identification of recaptured animals within and between seasons.

A total of 22 mls of blood will be drawn from the jugular vein of each otter with care to keep samples sterile. Ten mls will be preserved with heparin (40u/ml or .4ml/10ml of blood) and stored in a red top vacutainer for transporting to the field lab. An additional 2 ml will be preserved with EDTA (purple top vacutainer), and 10 ml of blood will be collected in a red top vacutainer and allowed to clot. Two blood smears will be made for each river otter at the time of blood draw. Age of otters will be determined by removing an upper premolar 1 for cementum annuli aging. A tissue sample will be collected from each river otter for endothelial P450 analysis using a 3mm disposable skin biopsy punch instrument to remove a small circle of skin from the medial surface of the left front limb in the triceps area. The specimen will be preserved in 10% neutral buffered formalin immediately after collection. Swab samples of pelage will be collected for ELISA assay using a 1 by 1 gauze swab saturated with isopropanol and applied to the fur for 15 seconds. Areas of pelage suspected to be contaminated with petroleum will be swabbed as well as the ventral aspect of the neck, the abdomen, a swath along each side and one over the length of the back. Swabs will be handled with gloved hands only, once the pelage has been sampled the swab will be completely enclosed in aluminum foil and frozen for laboratory analysis. Two whiskers, and fur samples (under coat and guard hair) will be collected for stable isotope analysis.

Surgical procedures and radio telemetry implants. Once morphometric data, blood and tissue samples have been obtained, selected adult otters will be prepared for surgical implantation of radio-telemetry transmitters. Only individuals that appear to be in good health will be implanted, with an approximately equal number of males and females receiving transmitters. In Herring Bay, approximately 20 otters will receive radio-telemetry transmitters in 1997. In Jackpot Bay an additional 10 otters will be equipped with transmitters (17 otters were implanted in 1996). Four of the transmitters implanted in 1996 malfunctioned, doubling their pulse rate which will reduce the battery life to one year. If these otters are recaptured their old transmitters will be removed and new transmitters will be implanted if adhesions have not formed that would prevent safe removal of the old transmitter. In 1998 we will replace expired transmitters if the otters are recaptured.

The surgery site will be shaved and surgically scrubbed with Nolvasan soap, alcohol, and a final iodine prep. Near completion of the surgical site preparation, the otter will be checked to ascertain depth of anesthesia and proper analgesia. If a second dose of anesthetic is required, a combination of Ketamine Hydrochloride (100 mg/ml, Ketaset, Aveco Co., Fort Dodge, Iowa, 50501, USA) at a dose of 10 mg/kg, and Midazolam Hydrochloride (5 mg/ml, Versed, Hoffman-LaRoche, Nutley, New Jersey 07110, USA) at a dose of 0.25 mg/kg mixed in the same syringe (Spelman et al., 1993), will be administered to prevent problems with prolonged recovery associated with subsequent doses of Telazol. The surgeries will be performed by a veterinary technician with specialized training in the procedure, using methods outlined in Testa et al. (1994). All surgeries will use sterile technique. An incision will be made on the side, posterior to the last rib to introduce a hermetically sealed radiotransmitter (IMP/400/L -- Telonics, Mesa, Arizona) into the peritoneal cavity. Each muscle layer will be closed separately with simple interrupted sutures, the skin will be closed with a continuous subcuticular suture line to prevent the otter from accessing any sutures. As a final precaution, the skin incision will be sealed with surgical glue. All methods used in this research have been approved (authorization 95-17+) by an independent Animal Care and Use Committee at the University of Alaska Fairbanks, Fairbanks, Alaska, in compliance with policies recommended by the National Institutes of Health (NIH), the National Science Foundation (NSF), and the Scientists Center for Animal Welfare (SCAW).

River otters captured in the oiled and the nonoiled areas will be handled identically (e.g. morphometrics, tissue samples, blood drawn, PIT tags) with the exception of the surgical implantation of radio-telemetry transmitters in selected individuals. Otters captured within a 5 minute boat ride of camp will be transported to camp for processing when surgical procedures are required. All otters captured further from camp will be processed at capture sites. Otters processed in camp will be returned to the capture site while recovering from anesthesia and contained in a holding box until fully recovered before being released (usually 1 - 3 hours). Otters processed on site will also be contained within a recovery box until ready for release.

To protect our study animals in the Herring Bay and Jackpot Bay areas, a river otter trapping closure is in effect by Emergency Order of the Alaska Department of Fish and Game, along with a Federal Subsistence Trapping Closure by Special Action.

Field Processing and Blood Samples. In the field laboratory, red-top tubes will be centrifuged in the field at low speed (800 x g,) for 20 minutes. Serum will be drawn from the clot of the centrifuged sample and frozen separately. All serum samples, and the clot, will be frozen within 12 hours of obtaining the samples. Serum will be removed from the clot within 6-8 hours. The time of blood draw and the time of sample processing in the field laboratory will be recorded. The plasma will be drawn off of the heparinized sample with care so as not to disturb the buffy coat layer. One ml of the plasma will be mixed with 0.2 ml of DMSO (tissue culture grade) and placed on ice. The buffy coat will be removed from the erythrocyte layer and placed in a snap top tube along with 1 ml of plasma. The plasma/DMSO will then be added slowly (one drop at a time) to the mixture. The mixture will be aliquoted into two cryovials (approx. 1 ml each), placed into a prechilled Nalgene freezing unit and placed into the freezer for 12 hours. The buffy coat samples will be transferred to a liquid nitrogen dewar for storage and eventual transport to the Purdue University laboratory for immunoassays and P450 analyses. Any remaining plasma will be frozen. EDTA samples and one blood smear from each otter will be flown to a laboratory in Anchorage (Quest Lab c/o Laurie Rubin, 562-2551) for a complete blood count within 72 hours of the blood draw. All serum and plasma will stay frozen in propane freezers in the field and sent, periodically, to University of Alaska Fairbanks when trustworthy couriers are available. Serum samples will be sent to Quest Lab in the fall for Serum Chemistry Panels and other tests as needed.

Radio Telemetry Locations: In 1997, we will implant radio-telemetry transmitters in 20 adult otters in Herring Bay and an additional 10, if possible, in Jackpot Bay, bringing our sample size of telemetered otters in the Jackpot area to 27. The battery life for these transmitters is approximately 2 years. We will obtain locations for these otters on a seasonal schedule. During the first part of May, when females should be seeking den sites for parturition, we plan to fly every 4 days until denning activity is noted. Few data are available on river otters and denning habitat in a marine environment but studies in SE Alaska noted den sites up to 1 km from the shoreline. Presently this is the only method we have to give us some indication of reproductive activity in females. The young are kept in these natal den sites for 7 to 8 weeks before they are brought to the coastal areas and begin foraging for themselves. Once the denning period has passed, aerial telemetry flights will occur once each week during the active field season (May through August) to supplement other data collected during the field season (e.g. prey availability from diving transects and data loggers at some latrine sites). During the remainder of the year flights will be scaled back to twice per month until May when the aerial schedule will resume with the denning phase. Aerial locations obtained with this frequency will allow us to determine accurate home range sizes for otters in each study area. In 1996 all radio-telemetry tracking was done from a boat. When otters were not located near the shore, no radio signals could be detected. We obtained as few as 6 of a possible 26 locations for many otters, resulting in many hours for very few data points and a likely misrepresentation of some otter home ranges. We will continue with a scaled down version of boat-based radio-telemetry tracking in 1997 and 1998. These locations will be obtained 2 to 3 times each week on a random start schedule to minimize possible bias in activities of otters during radio locations. The long daylight hours should allow us to collect data during most of the 24-hour period. If bad weather or darkness prevents us from collecting data at a given start time, we will select the next random starting time for our next telemetry survey. These telemetry locations will allow us to compare 1997 and 1998 home-range size for otters in Herring Bay with home ranges for otters in that location in 1991 and 1992. Additionally, we will compare home range size between the two study areas in 1997 and 1998, relative to prey availability. Moreover, aerial locations of otters in the Jackpot Bay area will ascertain whether any otters are making extensive use of freshwater systems near Jackpot Bay. The limited number of locations on a subset of the 17 telemetered otters in that area in 1996 could be indicative of reliance on the freshwater system. The lower prey base in the freshwater system could potentially lead to smaller body size in otters, thus adding a confounding variable to our comparison of morphometrics between areas. Any differences in blood chemistry or morphometrics between otters in oiled and nonoiled areas will be further validated by again ascertaining whether otters move from the nonoiled area into the oiled area.

Prey Availability Over Time: We will conduct repeated dives on the same random and latrine sites over the 4 month field season. Dive transects in the early part of our field season must be kept to a minimum to accommodate the labor-intensive capture and processing of river otters. In May 1997, five random and five latrine sites in Jackpot Bay will be sampled following the same procedures used by the subtidal fishes component of NVP. The sites dived by the river otter component in Jackpot Bay will be a subset of the sites that the subtidal fishes component will sample in July of 1997. In June 1997, the river otter component will begin diving in Herring Bay where we will remain for the rest of the field season. Eighteen random and18 latrine sites in Herring Bay will be sampled every two weeks from mid-June through mid-August. We will place data loggers (DCC's) at a subset of the latrine sites ($\underline{n}$ = 6) in Herring Bay where we will be diving. These DCC's will be programmed to scan through all the frequencies of telemetered otters in the study area every 1 minute to record the presence or absence of each otter. The data loggers will quantify otter activity at latrine sites relative to prey availability at those sites. Feces to be used for population estimates (using Microsatellite DNA-fingerprinting) will be collected at three of the dive sites with data loggers. At the other three dive sites with data loggers, feces will be quantified regularly but the feces will not be collected until the end of the season. This may allow us to determine whether collection of feces at these sites influences otter behavior (e.g. increase or decreased use of, or defecation at site). A similar sampling plan is anticipated for 1998.

Population Estimates: We are working closely with another group of scientists at University of Alaska, Fairbanks (Drs. Pamela Groves, Merav Ben-David, and Eric Rexstad) to obtain population estimates for river otters in the two study areas for 1997 and 1998. They will use microsatellite DNA-fingerprinting techniques to identify individual otters from their feces left a latrine sites. Mark-recapture population estimates ("capturing" feces at latrine sites) will be calculated using closed and open-population models. This research is funded by sources outside of NVP.

Subtidal fishes: Analysis of FY96 and FY97 data will continue.

Habitat Modeling.--

Predator, prey and habitat interactions. The sampling of predators and prey has been conducted in an integrated manner in the hopes of achieving a higher order of understanding as to how the Prince William Sound system operates. To date, most of our analyses have been conducted on single species, and have not fully utilized the power of the integrated design. Future analyses will begin to explore the interactions among species in a more integrated way. One class of analyses that we intend to explore are so called "habitat" or "resource selection" models. Examples of potential habitat models, are as follows. First, as an extension of previous work on habitat characteristics for river otters, terrestrial and subtidal habitat characteristics from river otter latrine sites, and from nearby random sites, will be contrasted to determine which characteristics are important to river otters. The second example is for sea otters. The observed spatial distributions of sea otters will be contrasted to measured habitat characteristics, including prey abundance and several physical habitat characteristics on available feeding sites to develop a resource selection function (relative probability of selection of feeding sites). The resource selection function can be used to rank feeding sites on the basis of relative importance (probability of use) to sea otters.

The work will consist of building integrated data bases which include all predator, prey, and environmental data from integrated sampling sites, and producing resource selection models to examine relationships between distributions of animals and associated environmental variables.

Publication of Previous Research.–
Several manuscripts on *Exxon Valdez* oil spill related subjects have recently been published by P.I.'s of the NVP project.

River Otters:
Title: Capturing river otters: a comparison of Hancock and leg-hold traps. In press. Wildl. Soc. Bull.
Authors: G. Blundell, UAF; others.

Toxicology:
Title: Acute phase proteins and cytokines in alaskan mammals as markers of chronic exposure to environmental pollutants. 1996. Am. Fish. Soc. Symp. 18:809-813.
Authors: L. Duffy, UAF, R. Bowyer, UAF; others.

Invertebrates:
Title: Injury to epibenthic invertebrates resulting from the *Exxon Valdez* oil spill. 1996. Pages 424-439 *In:* Rice, S.D., R.B. Spies, D.A. Wolfe and B.A. Wright, eds. Proceedings of the *Exxon Valdez* Oil Spill Symposium. Amer. Fish. Soc. Symp. 18.
Authors: T.Dean, Coastal Resources Associates, Inc., S. Jewett, UAF,; others.

Sea Otter: Three publications on post-spill status of sea otters in PWS will be completed during FY 98; all 3 focus on health and/or survival of sea otters and thus pertain directly to the interpretation of data that will be collected in 1997-98 as part of the NVP:

Title: Herpes virus in sea otter populations: Incidence and prevalence.
Authors: B. Ballachey, USGS; K. Harris; Armed Forces Institute of Pathology; others.
Background: The release of sea otters treated at rehabilitation centers after the oil spill engendered concerns about the introduction of diseases into wild sea otter populations. At the centers, sea otters were found to have oral lesions, later identified to be caused by a herpes virus. Prior to the release, sea otters in the wild were examined and also found to show evidence of similar lesions; on this basis, release of rehabilitated animals proceeded. Nevertheless, there has been continuing controversy over the question of disease transmission to wild sea otter populations. Subsequently, sea otter populations from WA state to the Aleutians have been examined by USGS researchers; evidence of the herpes virus has been found in all populations, confirming the existence of the disease in wild populations prior to the spill. In addition, viral DNA has been isolated from oral biopsies and the viral agent was confirmed to be herpes.
Required: Data analysis, manuscript preparation.

Title: Hematology and serum chemistry of sea otters in Prince William Sound.

Authors: B. E. Ballachey, A.H. Rebar.
Background: As part of a study on post-spill juvenile sea otter survival conducted in 1992-93, blood samples were collected from adult sea otters and pups in eastern and western PWS. Preliminary examination of these data demonstrate some significant differences in white blood cells (eosinophils, basophils) and serum enzymes (AST, GGT) between eastern (unoiled) and western (oiled) areas. Additionally, blood data collected on sea otters in PWS by USGS researchers in 1990 and 1991 is available, and some consistencies are seen when cross year comparisons are made.
We propose to summarize hematology and clinical chemistry data from sea otters captured in PWS between 1990-1992, and discuss differences in consideration of potential effects of oil exposure. Analysis of these data and preparation of this manuscript is particularly important as it will provide a basis for comparison of blood values to be obtained on sea otters as part of the NVP project.
Required: Additional data analyses, manuscript preparation.

Title: Survival of juvenile sea otters in Prince William Sound
Authors: B.E. Ballachey, N.J. Goodson, A.M. Doroff and J.L. Bodkin
Background: Survival rates of juvenile sea otters in eastern (unoiled) and western (oiled) PWS were estimated in 1992-93, by radiotelemetry of sea otter pups in the two areas. Pups were monitored through 1.5 years of age. Pups in unoiled areas were found to have higher survival rates. An initial draft of this manuscript has been prepared; however, further effort is required to incorporate additional data (including information on post-weaning movements of pups) and to finalize the manuscript for journal submission.
Required: Additional data analysis, manuscript revision.

C. Cooperating Agencies, Contracts and Other Agency Assistance

The NVP project is a collaborative research project of scientists from a variety of Federal, State, university, and private research centers. Trustee agencies include the U.S. Geological Service whose responsibilities include lead agency, data archives and management, Chief Scientist, sea otter, harlequin duck, pigeon guillemot and various invertebrate components. In addition, USGS is responsible for the research work order that funds the river otter studies through the Alaska Cooperative Fish and Wildlife Research Unit at the University of Alaska Fairbanks, and contracts to Purdue University and Woods Hole Oceanographic Institute to assess health and oil exposure parameters. The USDA Forest Service scientist is responsible for a portion of the copredator/trophic factor aspect of NVP. Alaska Department of Fish and Game oversees contract research through the University of Alaska Fairbanks and Coastal Resources Associates, Inc. to provide the fisheries and intertidal invertebrate data. Finally, the NOAA scientist completes the research team, providing data on trophic factors constraining recovery of the top predators.

Various survey aircraft and vessels will be chartered from the private sector. Professional services contracts and Research Work Order mechanisms will be used to transfer funds from Trustee Agencies to university and private cooperators on the NVP project. These will include contracts to Purdue University, University of Alaska, University of Washington, Oregon State University, Woods Hole Oceanographic Institute, Coastal Resources Associates, Inc. and others.

SCHEDULE

A. Measurable Project Tasks for FY 98

This project will continue its 1995 and 1996 work through 1998, with completion of data analyses and final reports in 1999.

<u>FY 1998-1999</u>

October:	1. Harlequin: Continue survival monitoring. 2. Sea otter: Aerial survey of western Prince William Sound.
November:	1. Harlequin: Continue survival monitoring and skiff surveys.
December:	1. Harlequin: Continue survival monitoring. *2. All project components: Submission of brief field season summary reports.* *3. Project meeting to discuss field season outcomes and develop/revise proposed approach.*
January:	1. Harlequin: Continue survival monitoring. *2. Reporting of project findings at Restoration Workshop* *3. Project Review with Trustee Chief Scientists and Reviewers*
February:	1. Harlequin: Continue survival monitoring and skiff surveys.
March:	1. Harlequin: Continue survival monitoring.
April:	1. River otter: Live trapping for morphometrics and tissue sampling. 2. Sea otter: Beach-cast carcass survey. *3. FY 98 -- Submission of 1997 Progress Report.* *4. FY 99 -- Submission of 1998 Progress Reports*
May:	1. River otter: Live trapping for morphometrics and tissue sampling. 2. Pigeon Guillemot: Active nest surveys.
June:	1. Pigeon Guillemot: Active nest surveys, blood sampling, prey sampling, and nest monitoring. 2. Sea Otter: Prey selection, foraging success and time-depth recorder implantation.
July:	1. Pigeon Guillemot: Active nest surveys, blood sampling, prey sampling, and nest monitoring. 2. Sea otter: Aerial survey of Prince William Sound, capture for morphometrics and tissue collection. Prey selection and foraging success. 3. Mussel/clam/urchin/fish/duck food and invertebrate predators: Vessel charter to sample study areas..
August:	1. River otter: Latrine sites located, sampled, and monitored. 2. Pigeon Guillemot: Active nest surveys, blood sampling, prey sampling, and nest monitoring.

	3. Sea otter: Boat based surveys of sea otter reproduction.
	4. Harlequin: Vessel charter for harlequin duck capture.
September:	1. Harlequin: FY 98 final year.

FY 1999

Oct-March:	Final data analysis
April-Aug:	Prepare final report
Sept 30:	Submit draft final report

B. Project Milestones and Endpoints

FY 95:	Preliminary field season
FY 96:	Full field season
FY 97:	Full field season (see detailed schedule above)
FY 98:	Full field season (see detailed schedule above)
FY 99:	Closeout/Final data analyses and report submission

Major project objectives will be met following full analyses of data collected through FY 98. Specific questions (e.g., invertebrate structuring by copredators) may be answered sooner. We will use adaptive management processes to define the scope of work in continuing years. Oversight by the NVP chief scientist (Dr. Leslie Holland-Bartels) and annual meetings of the NVP principal investigators with the EVOS peer reviewers will ensure satisfactory progress is made toward the NVP objectives, and that the objectives remain relevant to the overall restoration effort.

C. Completion Date

This project was proposed for one preliminary field season (1995) and three full field seasons (1996-1998), with closeout and final report preparation in 1999.

PUBLICATIONS AND REPORTS

At this time, we have completed the preliminary study period (1995 field season) and one full field season (FY96). We cannot yet anticipate publication schedules for data to be generated in FY 96 and FY 97. The annual reports will be produced as indicated in the above schedule.

PROFESSIONAL CONFERENCES

Presentations at professional conferences have been proposed for FY98. Requests for funding to attend the meetings has been submitted in the FY98 budget. Included there are titles of professional meetings. We propose to notify the Trustees of presentation titles as they are determined.

NORMAL AGENCY MANAGEMENT

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

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Because of the broad scope and large number of scientists (> 15) involved in the NVP project, a concerted effort has been made over the past 1.5 years to ensure maximum coordination and integration of efforts, including logistical support for field operations, within the project. This has been accomplished by holding regular project meetings (2-3/year) and by establishing efficient electronic communications and file servers for the project. Additionally, coordination with the APEX (96163), SEA (96320), Harlequin duck (96161, 96427) and other projects is ongoing for specific NVP project components (including prey fish, pigeon guillemots, harlequin duck sample collection and shared research platforms and field camps). The NVP chief scientist regularly attends ecosystem project meetings organized by the EVOS restoration office for the purpose of coordination.

Although no formal efforts have been made to obtain matching funds from non-Trustee sources for this project, many project expenses are being covered by the U.S. Geological Survey-Biological Resources Division and other agencies and universities involved in the project. Such expenses include provision of equipment (including 4 whalers, inflatable skiffs, dive gear and sea otter capture gear) and full or partial salary costs for many of the project scientists.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The NVP project continues to follow the original detailed project description of 95025 submitted and approved March 1995, with the addition of 96104 approved in December 1995 for inclusion in the original project as a trial study. Minor editing and clarification of procedures have been included in the above methods section. Two additions in methods are the implantation of time-depth recorders in sea otters to evaluate their foraging habits; and predator, prey, habitat interaction modeling. The addition of these methods does not change the objectives or scope of the overall project, rather they will increase our understanding of the data we continue to collect under the original project description of 95025.

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PERSONNEL

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

Dr. Mary Ann Bishop is project leader for a portion of the avian copredator aspect of NVP. Bishop received her Ph.D. in Wildlife Ecology from the University of Florida in 1988. She has studied cranes, swans, and shorebirds, and is the Principal Investigator for EVOS 95320Q, Avian Predation on Herring Spawn. Since 1989, Dr. Bishop has worked for the Pacific Northwest Research Station of the U.S. Forest Service including since April 1990 as the research avian ecologist with the Copper River Delta Institute in Cordova Alaska. Since 1994 she has worked for the Copper River Delta Institute through a cooperative agreement between the Center for Streamside Studies, University of Washington and the Copper River Delta Institute.

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

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

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

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

Mr. Daniel Esler is a Wildlife Research Biologist for the Alaska Science Center, U.S. Geological Survey- Biological Resources Division with a MS in Wildlife Ecology from Texas

A&M University. He has worked primarily with aquatic birds in the fields of reproductive physiology, habitat selction, nesting ecology, and population dynamics, including 7 years of experience in Alaska and Russia. He has 10 publications in national peer reviewed journals.

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

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

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

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

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

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

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

Dr. Glenn R. VanBlaricom has conducted research on coastal ecosystems since 1970, and has been involved in research on sea otters and their ecosystems for 17 years. Dr. VanBlaricom studied relationships of sea otters and intertidal mussels in Prince William Sound from 1978 through 1986 and published papers on population size structure and individual growth rate of mussels, and effects of foraging by sea otters. Dr. VanBlaricom worked on sea otter rescue and rehabilitation in the immediate aftermath of EVOS, primarily in the Kenai region, and has published one paper on rehabilitation strategies. Currently Dr. VanBlaricom is Assistant Unit Leader (Wildlife), Washington Cooperative Fish and Wildlife Research Unit, and is Associate Professor of Fisheries in the School of Fisheries, University of Washington. He has 24 peer-reviewed scientific publications.

Cooperators:

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

Dr. Dan Roby has conducted research on the physiological ecology and reproductive energetics of high latitude seabirds for the last 15 years. His field research on alcid reproductive biology has been in Alaska, Newfoundland, and Greenland, and he is currently conducting research on pigeon guillemots as bioindicators of nearshore ecosystem health in Kachemak Bay, Alaska. Dr. Roby's research on seabird reproductive energetics in the Arctic and Antarctic has been supported by the National Science Foundation. Roby is currently located at the Oregon Cooperative Wildlife Research Unit, Oregon State University. He has over 25 peer-reviewed scientific publications, 17 of them on topics in seabird ecology.

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

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1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998	PROPOSED FY 1998 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
				$407.3		$28.5	$1,091.0	$162.4
Personnel	$368.2	$360.3						
Travel	$55.9	$52.2						
Contractual	$1,140.0	$1,092.7						
Commodities	$64.7	$80.1						
Equipment	$2.5	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$1,631.7	$1,585.3		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
General Administration	$104.6	$103.9						
Project Total	$1,736.3	$1,689.2		$450.0	$0.0	$0.0	$0.0	
Full-time Equivalents (FTE)	0	7.5						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	$0.0		$0.0	$0.0	$0.0	$0.0	

Comments:

1998

Prepared:

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Lead Agency: U.S. Geological Survey-Biological Resources Division

FORM 2A
MULTI-TRUSTEE
AGENCY SUMMARY

4/16/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$272.8						
Travel		$39.8						
Contractual		$645.0						
Commodities		$67.1						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$1,055.5	$1,024.7		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
General Administration	$65.8	$66.3						
Project Total	$1,121.3	$1,091.0						
Full-time Equivalents (FTE)		5.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
SO= Sea Otters
HD= Harlequin Ducks
CS= Chief Scientist
RO/PG= River Otters/Pigeon Guillemots
TEK= Traditional Ecological Knowledge
SC= Subtidal Clams

Additions above core NVP project total:
per 1997 agreement-B. Ballachey salary includes 10.0K for writing
TEK per planning with Henry Huntington of 97052B- 9.9K increase.

1998

Prepared:

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: U.S. Geological Survey-Biological Resources Division

FORM 3A
TRUSTEE
AGENCY
SUMMARY

^/16/97

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1998
SO: Mr. J. Bodkin/Dr. B. Ballachey*		GS-12	9.0	5.4		48.6
D. Monson	Wildlife Biologist (WB)	GS-9	12.0	3.6		43.2
J. DeGroot	Biotech	GS-6	6.0	2.0		12.0
Dr. D. Mulcahy	Veterinarian	GS-13	0.5	6.1		3.1
HD: D. Esler	WB	GS-12	12.0	5.4		64.8
T. Bowman	WB	GS-11	2.5	3.2		8.0
D. Dirksen	WB	GS-14	0.5	7.4		3.7
Biotechs		GS-5	5.0	3.7		18.5
CS: Dr. L. Holland-Bartels	Chief Scientist	GS-14	2.5	7.9		19.8
M. Whalen	Data Manager	GS-9	12.0	4.0		48.0
M. Ronaldson	Secretary	GS-5	1.0	3.1		3.1
	Subtotal		63.0	51.8	0.0	
					Personnel Total	**$272.8**

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1998
SO: ANC/Cordova/ANC	0.3	8			2.4
Per diem Cordova			50	146.0	7.3
ARR Whittier 25' boat	0.8	2			1.6
workshop/meetings					3.0
HD: ANC/Cordova/ANC	0.3	14			4.2
Per diem					2.0
Worshops/meetings					1.3
CS: ANC/CordovaANC	0.3	1			0.3
Per diem			4	144.0	1.2
Purdue Travel: P. Snyder/A. Rebar	0.8	4			3.2
Per diem/Anchorage			20	217.0	7.6
TEK 4 P.I.'s (charter = $1100 round trip for 4 + 10% tax or $220.00/person RT + 10%)		2			2.5
Per diem			24	135.0	3.2
				Travel Total	**$39.8**

1998

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: U.S. Geological Survey-Biological Resources Division

FORM 3B
Personnel
& Travel
DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FY 1998
RO/PG: Univ. Alaska, Fairbanks Research Work Order	255.5
SC: University of Washington Research Work Order	92.7
SO: summer aerial survey and tracking (180 hrs@$200)	36.0
sample transport (20 hrs@$250/hr) and sample equipment	5.0
shipping equipment/camps/emergency	1.0
warehouse-Cordova	2.0
blood assays(commercial lab- 160@ $30) and serum chemistry	4.8
pelage/plumage assays (ELISA-oil-50@$40)	2.0
HD: boat charter (30 d@1.0)	30.0
air charter (144 hrs@.225)	32.4
radio telemetry observer (144@.025)	3.6
CS: boat charter	138.0
P450 assays- Woods Hole	24.0
Purdue contract (this includes no histopath support), only 40 SO and 40 RO samples.	15.0
TEK 5 participants x 2 workshops x 2 days/workshop x $150	3.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$645.0

Commodities Costs:	Proposed
Description	FY 1998
SO: food, 80 days @$15/day)	1.2
fuel, 75 days @20gal/day@$3.00/gal	6.0
office/field supplies(1.5K), blood and samle collectin supplies (.5K)	2.0
boat maintenance and repair	6.2
radio transmitters(20@$600)	12.0
time depth recorders(20@$1400)	28.0
HD: gear shipment	0.8
fuel (1.0K), trap materials and nets (3.0K)	4.0
miscellaneous (cold weather gear, rain gear,)	2.0
training	1.0
publication costs (Estimating Condition)	1.0
CS: workshop presentation materials/film/developing	1.7
TEK office supplies/postage/phone/fax	0.6
printing (village workshop reports)	0.6
Commodities Total	$67.1

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
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
radio transmitters(6.0K)	10	USGS-BRD
time-depth recorders(14.0K)	10	USGS-BRD

All boats, computers and field equipment donated by USGS-BRD for sea otters, harlequin ducks, river otters and pigeon guillemot components.

1998

Prepared:

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: U.S. Geological Survey-Biological Resources Division

FORM 3B
Equipment
DETAIL

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

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$0.0						
Travel		$0.0						
Contractual		$387.1						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$336.0	$387.1		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
General Administration	$54.5	$20.2						
Project Total	$390.5	$407.3						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998

Prepared:

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

/16/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

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

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

1998

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

Prepared:

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

Contractual Costs:	Proposed
Description	FY 1998
Contract	$387.1
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$387.1

Commodities Costs:	Proposed
Description	FY 1998
Commodities Total	$0.0

1998

Prepared:

Project Number:98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual &
Commodities
DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

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

1998	9 of 30

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL
4/16/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$64.8						
Travel		$10.2						
Contractual		$60.6						
Commodities		$12.8						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$135.1	$148.4		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
General Administration	$12.8	$14.0						
Project Total	$147.9	$162.4						
Full-time Equivalents (FTE)		1.8						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

NOAA contribution: Principal Investigator, C. O'Clair, 7mos.= $47.6K

Increased contractual costs needed for specialized laboratory processing and analysis of mussels collected for growth, aging, and mortality studies.

1998

Prepared:

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: National Oceanic and Atmospheric Administration

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/16/97

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1998
C. O'Clair	Fishery Biologist	GS12/10	2.0	6.8		13.6
C. Broderson	Fishery Biologist	GS11/7	1.5	5.3		8.0
Technician	Fishery Biologist	GS7/1	9.0	2.4		21.6
Technician	Fishery Biologist	GS7/1	9.0	2.4		21.6
	Subtotal		21.5	16.9	0.0	
					Personnel Total	**$64.8**

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1998
Jun/ANC/Jun, Workshop & coordination meetings	0.4	4	10	0.3	4.6
Jun/Sew/Jun field work in Prince William Sound	0.7	4	2	0.2	3.2
Jun/Whit/Jun field work in Prince William Sound	0.5	4	2	0.2	2.4
				Travel Total	$10.2

1998

Prepared:

Project Number:98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Personnel
& Travel
DETAIL

4/16/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FY 1998
Contract for sample procesing and aging (12 months@ $5048/mon)	60.6
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$60.6

Commodities Costs:	Proposed
Description	FY 1998
growth supplies	3.8
aging supplies	2.7
chemicals	1.0
field and lab supplies	1.8
weight/measurement supplies	0.5
publication/presentation costs	1.0
project support (shipping etc.)	2.0
Commodities Total	$12.8

1998

Prepared:

Project Number: 98025
Project Title: Mechanism of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Contractual &
Commodities
DETAIL

4/16/97

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
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, compaq	2	NOAA
balance	1	NOAA
camera	1	NOAA

1998

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Equipment
DETAIL

Prepared:

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$22.7						
Travel		$2.2						
Contractual		$0.0						
Commodities		$0.2						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$50.6	$25.1		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
General Administration	$5.7	$3.4						
Project Total	$56.3	$28.5						
Full-time Equivalents (FTE)		0.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: U.S. Forest Service, Pacific Northwest Research Station

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/16/97

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1998
M. Bishop	Principal Investigator	GS12/2	3.0	5.7		17.1
	Biologist/Statistician	GS9/1	1.0	3.1		3.1
P.Green	Bilogical Technician/Data Manager	GS7/1	1.0	2.5		2.5
	Subtotal		5.0	11.3	0.0	
					Personnel Total	**$22.7**

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1998
Cordova/ANC/Cordova	0.2	2	6	0.1	1.0
1998 American Ornithologists Union Meeting	0.8	1	4	0.1	1.2
				Travel Total	$2.2

1998

Prepared:

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: U.S. Forest Service, Pacific Northwest Research Station

FORM 3B
Personnel
& Travel
DETAIL

4/16/97

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

Contractual Costs:	Proposed
Description	FY 1998
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed
Description	FY 1998
poster materials	0.1
computer-generated slides (20 @$5)	0.1
Commodities Total	$0.2

1998

Prepared:

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: US Forest Service- Pacific Northwest Research Station

FORM 3B
Contractual &
Commodities
DETAIL

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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

1998

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: US Forest Service- Pacific Northwest Research Station

FORM 3B
Equipment
DETAIL

4/16/97

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

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$99.9						
Travel		$19.0						
Contractual		$82.2						
Commodities		$31.2						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$232.3		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
Indirect		$23.2						
Project Total	$0.0	$255.5						
Full-time Equivalents (FTE)		22.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998

Prepared:

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Alaska, Fairbanks
Agency: USGS-BRD Contractor

FORM 4A
Non-Trustee
SUMMARY

4/16/97

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

Personnel Costs:				Months	Monthly		Proposed
	Name	Position Description		Budgeted	Costs	Overtime	FY 1998
	T. Bowyer	Principal Investigator		1.1	8.1		8.9
	L. Duffy	Principal Investigator		1.1	7.1		7.8
	Lab Techinician			3.2	3.3		10.5
	Techinician			1.9	6.4		12.2
	Account Technician			0.5	5.6		2.8
	Fieldcrew leader			4.2	2.1		8.8
	Lab Techinician			5.4	2.0		10.8
	Student Asistant			4.6	2.0		9.2
	P. Seizer/G. Blundell Assistanships						28.9
		Subtotal		22.0	36.6	0.0	
						Personnel Total	**$99.9**

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 1998
	Fbx/Homer/Fbx	0.3	1			0.3
	Fbx/Cordova/Anc/Fbx	0.3	2			0.6
	Fbx/Anc/Whitt (3 boats)	0.5	1			0.5
	Fbx/Anc/Whitt (personnel)	0.2	6			1.2
	per diem					0.9
	Fbx/Anc	0.3	18			5.4
	Anchorage per diem			54	0.1	5.4
	Duffy-Mechanism of Toxicology Professional meeting					1.1
	Bowyer- Wildlife Society					1.7
	student-present at AAAS					0.2
	student-present at AAAS					0.2
	student-present at Wildlife Society					1.5
					Travel Total	**$19.0**

1998

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Alaska, Fairbanks
Agency: USGS-BRD Contractor

FORM 4B
Personnel &
Travel

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

Contractual Costs: Description	Proposed FY 1998
AK Dept. Fish and Game Assistance	10.0
air charter/telemetry flights	25.0
air charter personnel transport $800/ea RT X 5	4.0
air charter PIGU blood $110/RT X 14 pick up	1.5
air charter $110 RT river otter blood X 20	2.2
stable isotope latrine site analysis	10.0
duplication/computer fees	1.2
barge 2 trips @$2200	4.4
excess baggage/freight	1.2
publication (4)	4.0
Alaska Railroad	0.5
lease 3 vehicles Fbx/Whitt/Fbx (1500mi@.50/mi)	2.3
freezer maintenance	0.8
boat motor/boat maintenance	1.5
weatherport maintenance	0.6
computer maintenance	0.7
binocular maintenance	0.1
blood panels (150PWS, 75KB @$43/panel)	9.7
blood panels (140otter @$43/panel)	1.7
boat safety training	0.2
telephone services	0.6
Contractual Total	$82.2

1998

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Alaska, Fairbanks
Agency: USGS-BRD Contractor

FORM 4B
Contractual

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

Description	FY 1998
lab-haptoglobin (150PWS,+ 75KB_ 6 kits@$165/kit	1.0
lab-haptoglobin (40 river otters 2 kits@$165/kit	0.3
ELISA 4 kits @$300	1.2
2 interleukin kits@$550 each	1.1
food	7.4
sleeping bag(.2K)/ tent, 4 man dome(.6K)/therma rests 3@$89)	1.1
pesola scales 8 @ $50 ea	0.4
blind(.2K)/boat safety supplies (.4K)	0.6
whirl pacs	0.2
tripods 2 @ $149 ea	0.3
MSR waterworks filtration system (replace 2)	0.3
first aid kit (2@$132)	0.3
field camp supplies	1.0
rite-in-rain notebooks	0.3
rain gear	1.0
waders/extra tuffs (6@$52)	0.3
boat fule (60 gal/day @$1.50/gal, 110days)	9.9
propane tank 1001b. 4@$120 ea)	0.5
propane regular, lines	0.2
camp cooking supplies	0.3
blood samplling/storage supplies	3.5
Commodities Total	**$31.2**

1998

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Alaska, Fairbanks
Agency: USGS-BRD Contractor

FORM 4B
Commodities

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

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

1998	Project Number: 98025 Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators Name: University of Alaska, Fairbanks Agency: USGS-BRD Contractor

FORM 4B
Equipment

Prepared:

4/16/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$35.9						
Travel		$21.7						
Contractual		$18.0						
Commodities		$5.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$80.6		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
Indirect		$12.1						
Project Total	$0.0	$92.7						
Full-time Equivalents (FTE)		17.5						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
indirect cost is 15% total direct costs

1998	Project Number: 98025 Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators Name: University of Washington Agency: USGS-BRD Contractor	FORM 4A Non-Trustee SUMMARY

Prepared:

4/16/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 1998
	Research Assistant		12.0	1.6		19.2
	Research Assistant tuition					6.5
	Research Assistatant benefits					1.5
	Hourly person		5.5	1.4		7.7
	Hourly person benefits					1.0
						0.0
						0.0
						0.0
	Subtotal		17.5	3.0	0.0	
					Personnel Total	$35.9

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1998
Seattle/ANC/Seattle(field/planning)					14.7
Seattle/ANC/Seattle(conferences)					2.0
Int'l Marine Mammal Symposium					2.5
Other meeting					2.5
				Travel Total	$21.7

1998

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Washington
Agency: USGS-BRD Contractor

FORM 4B
Personnel & Travel

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FY 1998
computer/statistical consulting	3.0
taxonomic consulting	3.0
computer repair	1.0
dive gear repair	0.5
clamshell isotope analysis	5.0
publications (2 or 3)	2.5
phone/fax/postage/photocopy/graphics/photoprocessing	3.0
Contractual Total	$18.0

Commodities Costs:	Proposed
Description	FY 1998
replacement dive gear	3.5
field sampling gear	1.0
office supplies	0.5
Commodities Total	$5.0

1998

Prepared:

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Washington
Agency: USGS-BRD Contractor

FORM 4B
Contractual & Commodities

4/16/97

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

1998

Prepared:

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Name: University of Washington
Agency: USGS-BRD Contractor

FORM 4B
Equipment

4/16/97

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

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$156.4						
Travel		$10.1						
Contractual		$166.5						
Commodities		$7.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$336.0	$340.0		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
General Administration	$54.5	$47.1						
Project Total	$390.5	$387.1						
Full-time Equivalents (FTE)		2.1						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

Indirect costs are 25% Total Direct Cost, the rate negotiated by the EVOS Trustee Council with the University of Alaska

1998

Prepared:

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: Alaska Department of Fish and Game Contractor

FORM 4A
NON-TRUSTEE
AGENCY SUMMARY

4/16/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1998
S. Jewett	Project Leader		10.0	7.7		77.0
H. Feder	Technician		0.5	12.7		6.4
A. Blanchard	Technician		2.0	5.0		10.0
M. Hoberg	Technician		10.0	4.8		48.0
	diver		1.5	5.0		7.5
	diver		1.5	5.0		7.5
	Subtotal		25.5	40.2	0.0	
					Personnel Total	$156.4

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1998
Fbx/Anc/Fbx	0.2	4	15	0.2	3.8
Fbx/Cordova/Fbx	0.5	3	6	0.1	2.1
Fbx/San Diego/Fbx	0.8	3	18	0.1	4.2
				Travel Total	$10.1

1998

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: Alaska Department of Fish and Game Contractor

FORM 4B
Personnel
& Travel
DETAIL

Prepared:

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

Contractual Costs:	Proposed
Description	FY 1998
communications	0.9
freight shipping field gear and samples	3.0
Contract with Coastal Resourcs Associates, Inc.	155.0
postage	0.1
compressor repair	5.0
repars on EVOS zodiacs borrowed from Highsmith Projects	2.5
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$166.5

Commodities Costs:	Proposed
Description	FY 1998
SCUBA supplies (misc. and 3 replacemnt suits at 1.5/suit)	5.0
project supplies	1.0
field supplies	1.0
Commodities Total	$7.0

1998

Project Number:98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: Alaska Department of Fish and Game Contractor

FORM 4B
Contractual &
Commodities
DETAIL

Prepared:

4/16/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
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
13 ft. zodiac from Highsmith EVOS project		EVOS
14 ft. zodiac from Highsmith EVOS project		EVOS

Project Number: 98025
Project Title: Mechanisms of Impact & Potential Recovery of Nearshore Vertebrate Predators
Agency: Alaska Department of Fish and Game Contractor

FORM 4B
Equipment
DETAIL

Monitoring of Cutthroat Trout and Dolly Varden Habitat Improvement Structures

Project Number:	98043B
Restoration Category:	Monitoring
Proposer:	USFS
Lead Trustee Agency:	USFS
Cooperative Agencies:	None
Alaska SeaLife Center:	
Duration:	3rd year, 5-year project
Cost FY 98:	$24,000
Cost FY 99:	$18,400
Cost FY 00:	$ 8,000
Geography Area:	Western Prince William Sound
Injured Resource / Service	Cutthroat Trout and Dolly Varden

RECEIVED
APR 1 5 1997
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

This project provides for monitoring of habitat improvement structures and their effects on cutthroat trout and Dolly Varden populations. These structures were installed in 1995 under EVOS Restoration Project number 95043B. There has been concern raised that habitat structures may inadvertently increase coho salmon populations, and thereby increase competition stress on Dolly Varden, and cutthroat trout populations. Preliminary data were collected in 1995 and 1996 could be interpreted to support this assumption, with regard to cutthroat trout. Additional monitoring seeks to address these questions, and provide solid results to base our conclusions on the effectiveness of these types of improvements to benefit Dolly Varden and cutthroat trout.

INTRODUCTION

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

Cutthroat trouts in PWS are at the northern extent of the species' North American range. Generally speaking, species inhabiting the extreme limits of their habitat exhibit higher sensitivities to environmental stresses than the same species well within the habitat limits. Little is known of the genetic diversity, distribution, or life histories of cutthroat trout in PWS. The cutthroat trout stocks known to exist within PWS are few in number and appear to be discrete populations with limited interbreeding with other cutthroat stocks. It is highly possible that there have been unique genetic adaptations in these populations due to local conditions and their relative isolation from other stocks. The population in a given stream system rarely numbers more than 1,000 individuals. Several stocks of cutthroats within PWS appear to be anadromous and have a limited home range within streams (Heggenes et al., 1991). The number of streams within PWS that have cutthroat trout populations is unknown. Of 143 streams surveyed for spawning salmon in 1989, anadromous cutthroat trout were found in only 10 streams. Both adults and subadults of anadromous populations migrate to the ocean for summer feeding (Trotter, 1989; Hepler et al, 1993). Emigration to saltwater occurs in early May through July (Hepler et al, 1993). They return to freshwater in July through November, peaking in September and October (Trotter 1989; Wedemeyer 1993). In Prince William Sound, field observations indicate cutthroat are spring spawners.

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

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

The exception to this is the work done at Billy's Hole where initial sampling indicated cutthroat trout in numbers too low to be sampled in a statistically valid manner using the proposed mark recapture design. Nearly 100 traps were set at this location throughout the summer that resulted in the capture of only two cutthroat trouts, both juveniles. Instead, trapping was conducted in a nonrandom manner to maximize capture for cutthroat trout throughout the entire project area prior to any construction. A catch per unit effort (CPUE) was calculated for each species at this location.

Bailey's modification of the Lincoln-Petersen Mark and Recapture model (as described in Kohler and Hubert, 1993) was used to estimate the populations of coho, cutthroat trout and Dolly Varden juveniles in the affected stream reaches and a coefficient of variation (CV) was calculated for each population estimate. Sampling again in 1996 produced population estimates for the most part with a CV value of greater than 0.20 which is generally inadequate and indicates low precision of the estimates. This is due to the small sample size and the low numbers of recaptures of cutthroat trout.

The sampling design for 1996 had been modified to address this problem. The modification involved adding a second day of trapping during the recapture phase using the same techniques as discussed above thereby increasing the sample size during the recapture phase which was expected to increase the precision of the estimates. Table 1. in Appendix A. summarizes the mark recapture and CPUE datum collected in 1995 and 1996 for each of the project locations. Estimates of cutthroat trout populations did not appear to improve using this modified technique. However estimates of other species did improve. It appears that cutthroat trouts are "trap shy" making the likelihood of a recapture more difficult than anticipated. The additional trapping time is however providing useful CPUE information on habitat distribution and enhancement structure utilization, therefore I propose to continue using this method.

Sampling by Glacier Fisheries Crews in 1996 again suggested that cutthroat trout densities were greatest in the upper reaches of these inlet tributary streams. This is consistent with studies that have shown that cutthroat trout juveniles are pushed to less desirable habitats by the more dominant coho salmon juveniles (Glova and Mason, 1976). Interspecific competition with juvenile coho salmon is believed to limit cutthroat trout production in quality pool rearing habitat which is one of the key factors for cutthroat trout survival. A summary of the CPUE for Otter Creek, Gunboat Lakes and Red Creek by the three major habitat type and species for 1995 and 1996 data can be found in Appendix A. Chart 8. Preliminary data seems to indicate that cutthroat trout utilize all three habitat types nearly equally while coho and Dolly Varden seem to predominantly utilize slow water habitat types.

Preliminary catch per unit effort (CPUE) information is presented in Appendix A. Charts 2-7, this information is based on pre-project trapping in 1995 of enhancement sites and project area streams, and the data collected last season in these same locations. Since only a base line year and data from one season of post project exist, it is premature to draw conclusions on how the habitat improvements have affected the fish populations. Information collected in 1997 and subsequent years will help to refine these observations.

All sixty-three structures were inspected and minor repairs made, three cross-log structures required repositioning and anchoring. These structures were most probably dislodged during the fall 1995 Typhoon Oscar event. In general all the improvements were in good order and functioning as predicted.

NEED FOR THE PROJECT

A. Statement of Problem

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

B. Rationale/Links to Restoration

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

Monitoring prior to and after the installation of improvement structures will provide necessary information to ascertain the effectiveness of the various projects or of a particular structure.

C. Location

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

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

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

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

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

PROJECT DESIGN

A. Objectives

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

Specific objectives are:

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

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

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

4. Provide annual project monitoring results.

5. Provide a project completion report and a summary of our findings on the effectiveness of the habitat structures installed in 95.

B. Methods

The null hypotheses for this project is that the number of cutthroat trouts at the project locations will not increase due to the habitat improvements made in 1995. To test this and meet the projects objectives five working null hypotheses have been developed:

Hypotheses 1.	The abundance of cutthroat trout at the project sites will not increase over the monitoring project duration.
Hypotheses 2.	The current distribution of cutthroat trout within the project area will not change over the duration of the monitoring project.
Hypotheses 3.	Cutthroat trout and Dolly Varden will not be the predominant species to utilize the newly created habitat structures.
Hypotheses 4.	Aquatic microhabitats adjacent to areas of improvement will not be affected by the structures installed in 1995.
Hypotheses 5.	The structures installed in 1995 will not have benefitted cutthroat trouts over the duration of the monitoring project.

To test hypotheses number one through three, data on the relative abundance, distribution and habitat utilization of cutthroat trout at the project locations was collected during the 1995 field season and are proposed to be collected on an annual basis thereafter for the project duration.

Cutthroat abundance will be estimated using a method described in Hankin's (1986) report, *Sampling Designs for Estimating the Total Number of Fish in Small Streams.* The specific method will be of a two stage stratified random sampling design utilizing auxiliary variables to bias estimators. This method is described in detail as Design B: Ratio Estimation in Hankin's (1986) report. The technique for population estimation in each primary unit will be the mark-recapture method known as the Petersen Index using Bailey's 1951 formula to correct for bias, as described by Ricker (1975). Collection will be conducted using baited minnow traps and fish will be marked by caudal punches. Project area streams have been surveyed and habitats classified using a modified Hankin and Reeves (1988) methodology.

Stream habitat surveys were conducted during the early part of the 1995 field season in conjunction with the installation of the improvement structures. Data collected from the surveys has been analyzed and the associated habitat units characterized. Primary units (those to be sampled) were then selected by stratified random sampling. The strata consist of various pools, riffles, runs and glides that are then categorized as either slow, turbulent or non-turbulent habitat types, see Appendix A. Chart 1.

The trapping effectiveness of minnow traps varies with stream characteristics, this difference results in unequal trapping effort for various habitat types. To compensate for this, trapping effort is conducted proportional to the availability of slow, fast and turbulent habitat types in each sampling area. For example, if slow water habitats comprised 30 percent of the total available habitat within a reach, 30 percent of the trapping effort was randomly placed in slow water habitats.

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

These estimations should be done in mid to late summer to minimize bias due to seasonal migration of fish within the stream. Annual population estimates of the primary units for the project duration should provide enough information to detect a change in the relative abundance and distribution of cutthroat trout at the project sites. The improvement structures and their effects on adjacent habitat types will also be monitored by physical measurements and habitat classification. Additionally an annual photographic record of each structure will be established and maintained over the project duration.

Hankin in his (1986) report discusses errors of estimation of the total number of fish in a stream arising from two sources: (1) extrapolation from the small number of sampled sections to the entire stream, and (2) errors of estimated fish numbers within sampled sections. Hankin demonstrated that errors arising from the first source will usually be far grater than those from the second source, and that total errors of estimation can be reduced by making sampled sections equivalent to natural habitat units. By stratifying these habitat units and selecting sampling units randomly the precision of estimators can be improved and information on the distribution of cutthroat trout within the stream can be gathered.

Mark-recapture population estimates for primary units utilizing minnow trapping techniques will lead to errors in estimated fish numbers for sampled sections due to size selectivity and inefficiency of minnow traps to capture all individuals within a population. There is however a correlation between the sampled catch and the true population for a given size of individuals within a population. This is discussed in a 1976 paper by Arthur M. Bloom, *Evaluation of Minnow Traps for Estimating Populations of Juvenile Coho Salmon and Dolly Varden.* Cutthroat trout of 1+ age class fall within this size range. Though electrofishing is a more efficient means of sampling stream fish populations, currently ADF&G restricts the use of electrofishing in streams containing trout. We concur that it would not be wise to use electrofishing when working with a potentially threatened resource.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

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

SCHEDULE

A. Measurable Project Task for FY 98 (October 1, 1997 - September 30, 1998)

April 15	(1998):	Report on preliminary findings of population and distribution estimations.
August	(1998):	Inspect and measure effects of installed structures. Conduct population estimates of primary units.

B. Project Milestones and Endpoints

August	(1996):	Inspect and measure effects of installed structures. Conduct population estimates of primary units.
April 15	(1997):	Report on preliminary findings of population and distribution estimations. Objectives (1, 2, 3) partially completed. Objective (4) completed.
August	(1997):	Inspect and measure effects of installed structures. Conduct population estimates of primary units.
April 15	(1998):	Report on preliminary findings of population and distribution estimations. Objectives (1, 2, 3) partially completed. Objective (4) completed.
August	(1998):	Inspect and measure effects of installed structures. Conduct population estimates of primary units.

April 15	(1999):	Report on preliminary findings of population and distribution estimations. Objectives (1, 2, 3) partially completed. Objective (4) completed.
August	(1999):	Inspect and measure effects of installed structures. Conduct population estimates of primary units.
April 15	(2000):	Provide a final report for peer review summarizing project results. This will satisfy objectives (1, 2, 3, 5).

C. Completion Date

Baseline data were collected in 1995 prior to any effects from the habitat improvement work. Data to meet the project objective will be collected in 1996, 97, 98, with a final field survey in 1999. The final report summarizing the project results will be provided for peer review in the year 2000.

PUBLICATIONS AND REPORTS

No professional publications are planned for at this time. The Forest Service does however understand that results from this project need to be shared with other resource managers to assist them in making decisions regarding enhancement activities where cutthroat trout are present. Annual Reports will be prepared during each year of the project and provided to the Trustee Council by April 15 of the following year with a final report submitted for peer review by April 15, 2000.

PROFESSIONAL CONFERENCES

At this time there are no plans to present this project at professional conferences. However a poster board display is planned for in 1996 with updates in 1997 for presentation at the District office and at science conferences.

NORMAL AGENCY MANAGEMENT

This project provides for monitoring of habitat improvement structures and their effects on cutthroat trout and Dolly Varden populations. These structures were installed in 1995 under EVOS Restoration Project number 95043B. The Forest Service has focused on this species as a result of the injury incurred from the oil spill. The proposal is not part of the normal Forest outyear planning program, therefore no funds have been directed towards this project within the Forest Service budgeting process. Current budgets and Forest Service priorities would not provide an opportunity to conduct this project under normal agency management.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The proposed project is an integration of project number 95043B, Cutthroat Trout and Dolly Varden Habitat Restoration in PWS. Additionally during the summer of 1994, the Forest Service made significant improvements to an existing fishway at Otter Creek, under EVOS Project 94139-B1 to facilitate pink salmon (*Onchorhynchus gorbuscha*) access to previously inaccessible spawning habitat. This project is designed to monitor the long term effects of implementing project number 95043B. The effects from project 94139-B at Otter Creek are beyond the scope of the proposal and will not be consider in the analysis. The proposal is a response from a primary land and resource manager (Forest Service) in Prince William Sound to the effects of the *Exxon Valdez* oil spill.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The FY98 proposal does not differs from the FY97 proposal. The monitoring plan design remains the same as that proposed in 1997.

PROPOSED PRINCIPAL INVESTIGATOR

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

PRINCIPAL INVESTIGATOR

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

OTHER KEY PERSONNEL

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

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APPENDIX A

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

Loc.	Spec.	Pop.Est		V (N)		CV		CPUE	
		95	96	95	96	95	96	95	96
Otter	CO	45	1220	324	10848	0.4	0.085	0.0019	0.0081
	CT	6	56	9	1344	0.5	0.654	0.0003	0.0002
	DV	128	1023	1536	7597	0.31	0.085	0.0039	0.0080
Red	CO	[illegible]	760	0	60805	0	0.324	0.0002	0.0024
	CT	105	72	1125	1344	0.32	0.509	0.0007	0.0003
	DV	427	374	8169	16456	0.21	0.343	0.0024	0.0012
Gun R 2	CO	504	426	6720	9975	3.25	0.23	0.0127	0.0027
	CT	50	36	300	1296	0.38	1	0.0009	0.0004
	DV	[illegible]	594	768	24293	0.21	0.262	0.0004	0.0034
Gun R 3	CO	N/A	30	N/A	244	N/A	0.51	N/A	N/A
	CT	N/A	54	N/A	1215	N/A	0.64	N/A	N/A
	DV	N/A	[illegible]	N/A	23	N/A	0.068	N/A	N/A
Billy	CO	N/A	N/A	N/A	N/A	N/A	N/A	0.0244	0.0282
	CT	N/A	N/A	N/A	N/A	N/A	N/A	0.0012	0.0001
	DV	N/A	N/A	N/A	N/A	N/A	N/A	0.0589	0.0124

Chart 1. Description of habitat classification technique.

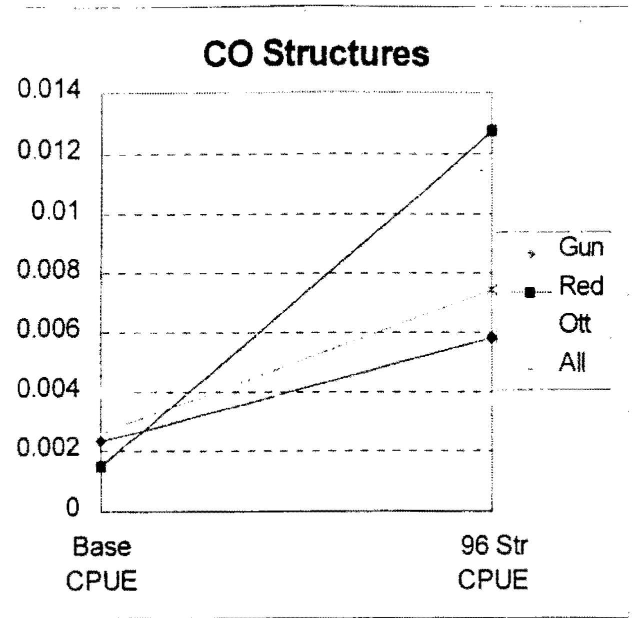
Fast Water Habitat Types

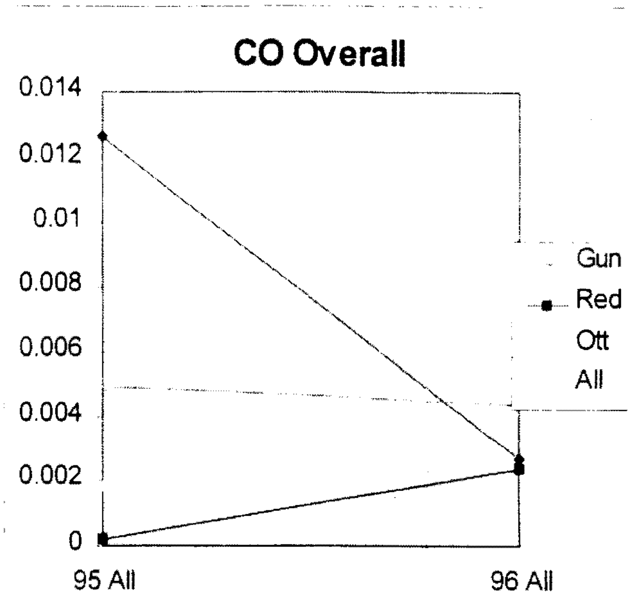
- Turbulent
  - Turbulent (Rapid)
  - High Gradient Riffle
  - Low Gradient Riffle
- Non-Turbulent
  - Runs
  - Glides

Slow Water Habitat Types

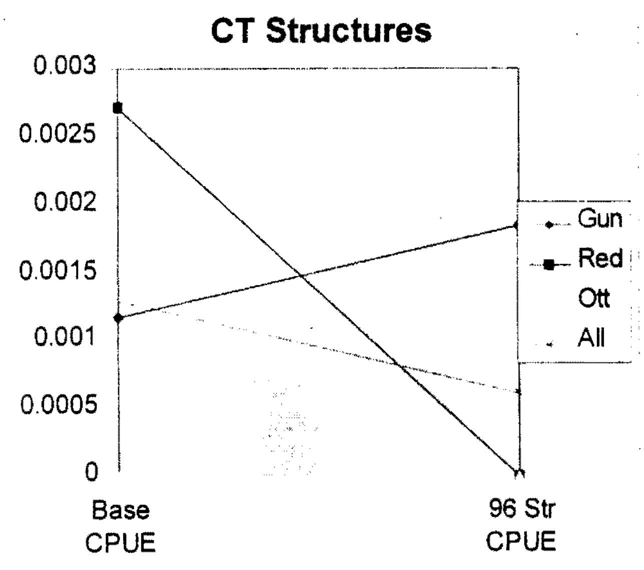
- Dammed
  - Main
  - Backwater
- Scoured
  - Lateral
  - Mid-Scour

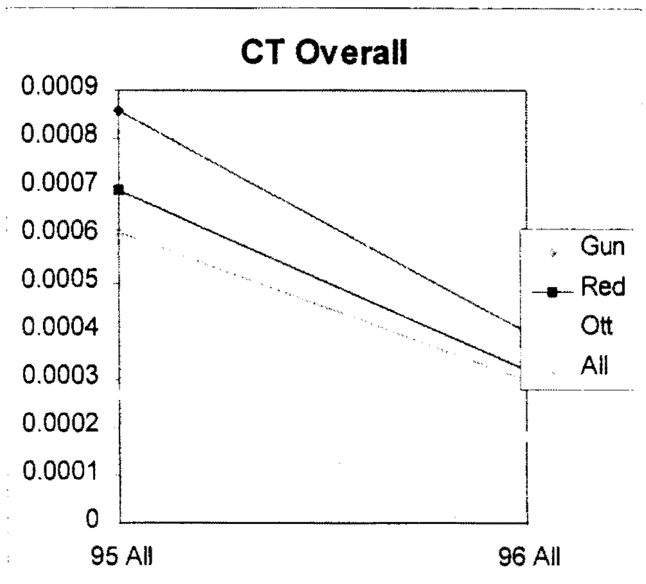
Charts 2,3. Catch Per Unit Effort (CPUE) data for juvenile coho salmon (CO) at the four project locations. Structures are at enhancement sites, Overall is for the entire stream reach within the project areas. Base CPUE is pre-project CPUE at enhancement sites.



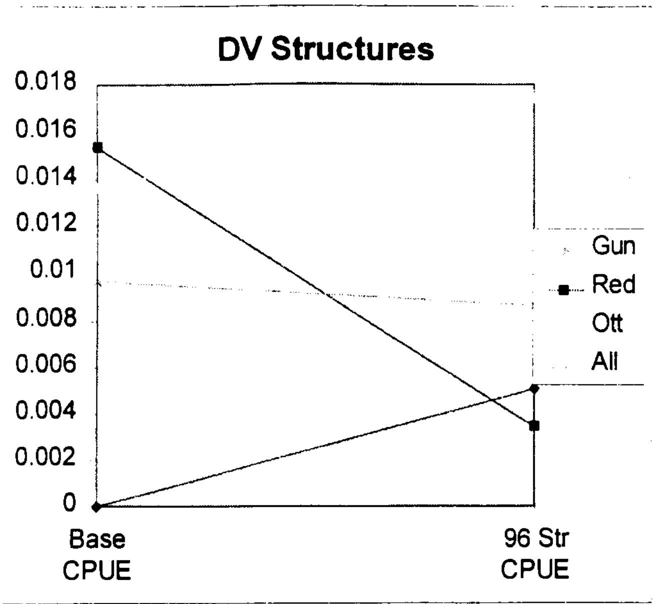


Charts 4,5. Catch Per Unit Effort (CPUE) data for juvenile cutthroat trout (CT) at the four project locations. Structures are at enhancement sites, Overall is for the entire stream reach within the project areas. Base CPUE is pre-project CPUE at enhancement sites.





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



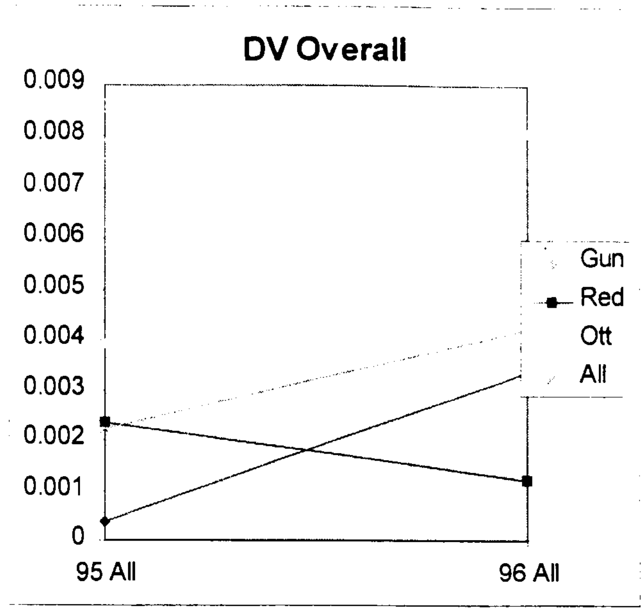
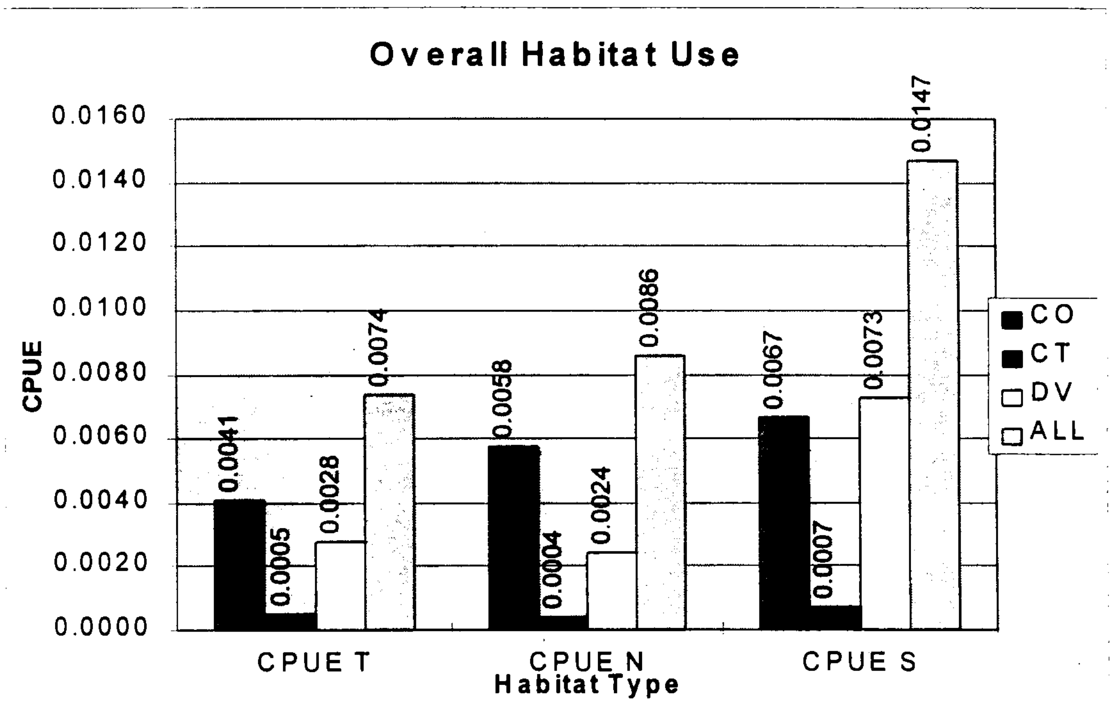


Chart 8. Summary of habitat utilization by species for Otter, Red Creek and Gunboat Lakes. T = Turbulent, N = Non-Turbulent, S = Slow Water habitat types.



1998 EXXON VALDEZ TRL : COUNCIL PROJECT BUDGET

October 1, 199, - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel	$15.0	$15.0						
Travel	$0.4	$0.0						
Contractual	$3.0	$3.0						
Commodities	$3.1	$3.5						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$21.5	$21.5		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
General Administration	$2.5	$2.5						
Project Total	$24.0	$24.0		$18.4	$8.0			
Full-time Equivalents (FTE)	0.3	0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: Continuation of 96043B, 97043B.

1998

Prepared:4/4/97, K.Holbrook

Project Number: 98043B
Project Title: CT/DV Monitoring
Agency: US Forest Service

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/14/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1998
Vacant	Fish Biologist	GS-9	0.8	5.2		4.2
D.Gillikin	Fish Biologist	GS-7	1.0	4.0		4.0
Seasonal	Fish Tech	GS-5	2.0	3.4		6.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.8	12.6	0.0	
					Personnel Total	$15.0

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

1998

Prepared:

Project Number: 98043B
Project Title: CT/DV Monitoring
Agency: US Forest Service

FORM 3B
Personnel
& Travel
DETAIL

4/14/97

Contractual Costs:		Proposed
Description		FY 1998
Air Charter	$250/hr for 12 hrs	3.0
When a non-trustee organization is used, the form 4A is required.	**Contractual Total**	$3.0

Commodities Costs:	Proposed
Description	FY 1998
boat fuel	1.4
truck fuel	0.2
camp supplies	0.4
camp food	0.5
supplies	0.5
Train tickets	0.5
Commodities Total	$3.5

1998

Project Number: 98043B
Project Title: CT/DV Monitoring
Agency: US Forest Service

FORM 3B
Contractual &
Commodities
DETAIL

Prepared:

4/14/97

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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

1998

Project Number: 98043B
Project Title: CT/DV Monitoring
Agency: US Forest Service

FORM 3B
Equipment
DETAIL

98052A

Community Involvement

Project Number:	98052A
Restoration Category:	General Restoration
Proposer:	Chugach Regional Resources Commission
Lead Trustee Agency:	Alaska Department of Fish & Game
Cooperating Agencies:	None
Duration:	4th year, 9-year project
Cost FY98:	$250,000
Cost FY99:	$250,000
Cost FY00:	$250,000
Cost FY01:	$250,000
Cost FY02:	$250,000
Geographic Area:	Oil Spill Area
Injured Resource/Service:	All Injured Resources/Services

ABSTRACT

This is a continuation of Project 95/96/97052A. A Spill Area-Wide Coordinator has been hired through a contract with the Chugach Regional Resources Commission to serve as a liaison between the communities, PIs, agency personnel, restoration office personnel, and the Trustee Council. Through direct communications with a network of local facilitators, the Spill Area-Wide Coordinator would continue to actively involve local residents in the restoration program. Traditional ecological knowledge (TEK) efforts will also continue in FY 98 and will be funded under Project 98052B.

INTRODUCTION

Nine local facilitators were hired in FY 96 through cooperative agreements with the village councils of Tatitlek, Chenega Bay, Port Graham, Nanwalek, Eyak (Cordova), Qutekcak (Seward), Valdez, and the native associations in Bristol Bay and Kodiak. Under 97052A, the number of community facilitators was expanded by one to include the community of Seldovia. No new communities will be added in 98052A. Martha Vlasoff, the full time Spill Area Wide Coordinator, will be hired by the Chugach Regional Resources Commission (CRRC) to continue her work out of the Restoration Office, to accomplish the following tasks:

1. Increase involvement of community members and organizations throughout the spill region in restoration projects. This community process will include a local representative (Community Facilitator), whose duties are described below.

2. Serve as the contact point for a Community Facilitator in each of ten participating communities (Tatitlek, Chenega Bay, Port Graham, Nanwalek, Cordova, Seward, Seldovia, Valdez, Kodiak region, and the Alaska Peninsula region -- the Community Facilitators will be subcontractors to CRRC.) The tasks for the Spill Area Wide Coordinator in relation to the Community Facilitators would be to:

   a. At least every two weeks, fax a brief one-page activities report to the Community Facilitator to keep them informed of Trustee Council actions, Restoration Office activities, upcoming events, new research findings, etc. The report could be in the form of "bullets" with who to contact for more information on each item.

   b. Update the local resources inventories for each community (lodging and meeting space available for rent, boats and people available for hire, etc.). This information will be consolidated and distributed to all PIs. The Spill Area-Wide Coordinator and Community Facilitators will then assist PIs in arranging use of these local resources.

   c. Coordinate the participation of the Community Facilitators in the annual Restoration Workshop and other workshops/meetings as appropriate.

   d. Working with the TEK Specialist (Project 87052B), coordinate an annual review by Community Facilitators and village councils of restoration project proposals involving indigenous knowledge, and develop recommendations for the Executive Director.

3. Annually review the community involvement component of all restoration project proposals. Inform the Community Facilitators of proposals that would involve their communities. Make recommendations to the Executive Director on the adequacy of, and ways to strengthen, the community involvement components. Once funding decisions are made by the Trustee

Council, initiate contact with PIs to offer assistance in implementing their community involvement components.

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

5. Participate in Restoration Work Force meetings.

6. Provide a "community report" to the Public Advisory Group at each of its meetings.

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

8. Work with the EVOS Science Coordinator, the EVOS Communications Specialist, and the TEK Specialist (Project 98052B) to get research results to communities.

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

10. Provide input to the Restoration Update newsletter.

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

The tasks of the local Community Facilitators include:

1. On the last day of each month, provide a brief written report to the Spill Area-Wide Coordinator identifying community issues, concerns or questions regarding restoration. These issues could be identified through community meetings conducted by the Community Facilitators or through other means, and should include relevant issues discussed at village council meetings. Ideas for new projects could also be included.

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

3. Work with the Spill Area-Wide Coordinator in coordinating Trustee Council community meetings as well as community visits from project PIs. Under the TEK protocols adopted by the Trustee Council, the Community Facilitator will also serve as the initial contact in the village for any project involving indigenous knowledge. The Community Facilitators should be knowledgeable about the TEK protocols. All interested Community Facilitators will serve on the TEK Advisory Group (Project 98052B).

4. Disseminate to community members the twice-monthly update from the Spill Area-Wide Coordinator. This could be done by posting the update in a public location, making a presentation to the village council or other community organizations, etc.

5. All Community Facilitators shall attend the annual Restoration Workshop and associated meetings, including scientific review sessions when appropriate.

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

1. Respond to calls to the Resource Abnormality Hotline, oversee transport of abnormal resources, communicate findings back to the communities, and resupply kit components.

2. Work with communities to develop restoration project proposals.

3. Provide technical expertise and general assistance to the Restoration Office, Trustee Council, Spill Area-Wide Coordinator, and PIs on subsistence restoration.

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

5. Contribute to the annual project report.

6. Respond to contacts from the general public in regard to EVOS subsistence projects.

NEED FOR THE PROJECT

A. Statement of Problem

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

B. Rationale

This project furthers the Trustee Council's goal of facilitating the involvement of spill area residents and resource users in the restoration process.

C. Location

The project will be undertaken throughout the oil spill region. Community Facilitators will be hired in the communities as mentioned above. However, all other communities in the oil spill impact area will also be included in outreach efforts, even though a local facilitator will not be hired in each community.

COMMUNITY INVOLVEMENT

The core of this project is community involvement.

FY 98 BUDGET

Budget Line Items	CRRC	ADF&G	In-Kind	Total
Personnel (incl. Fringe)	$ 48,000.00	$15,900.00	28,000.00	$91,900.00
Spill Area Wide Coordinator (Vlasoff)	*48,000.00*	*0.00*	*0.00*	*48,000.00*
Division Project Coordinator (Miraglia)	*0.00*	*15,900.00*	*0.00*	*15,900.00*
CRRC Executive Director	*0.00*	*0.00*	*9,500.00*	*9,500.00*
Natural Resource Specialists	*0.00*	*0.00*	*18,500.00*	*18,500.00*
Travel	30,000.00	3,000.00	2,500.00	35,500.00
Contractual	120,000.00	0.00	17,000.00	137,000.00
Community Facilitators	*120,000.00*	*0.00*	*0.00*	*120,000.00*
Alaska Inter-Tribal Council	*0.00*	*0.00*	*12,000.00*	*12,000.00*
Native American Fish & Wildlife Society	*0.00*	*0.00*	*5,000.00*	*5,000.00*
Commodities	500.00	500.00	2,500.00	3,500.00
Equipment	0.00	0.00	0.00	0.00
Capital Outlay	0.00	0.00	0.00	0.00
Subtotal	$198,500.00	$19,200.00	50,000.00	$267,700.00
General Administration	19,900.00	17,700.00	5,000.00	42,600.00
Project Total	$218,400.00	$36,900.00	$55,000.00	$310,300.00

PROJECT DESIGN

A. Objectives

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

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

B. Methods

The project will be implemented by a Spill Area-Wide Coordinator hired through a contract with the Chugach Regional Resources Commission, and the local Community Facilitators, with the assistance of the Alaska Department of Fish & Game's Division of Subsistence.

The objectives will be achieved using the following methods:

A contract will be renewed by ADF&G Subsistence Division to CRRC for overall coordination of the Community Facilitators and Spill Area-Wide Coordinator. CRRC will be expected to arrange for the hiring (where applicable) and coordination of local facilitators in the communities of Chenega Bay, Tatitlek, Port Graham, Nanwalek, Cordova, Seward, Valdez, Seldovia, and regional coordinators for the Kodiak Island and Alaska Peninsula regions. All other communities in the oil spill impacted area will be included in outreach efforts, even though a local facilitator will not be hired in each community.

Working with the Community Facilitators, the Spill Area-Wide Coordinator will work to increase meaningful public involvement in the restoration process. The goal will be to continue the partnership begun under 95052 between the people of the oil spill region and scientific researchers. Outreach will include communication of research proposals and study results.

The effectiveness of the project will be evaluated on an annual basis, by the Trustee Council staff working in cooperation with the Spill Area-Wide Coordinator, the communities in the oil spill region, and the Subsistence Division of the ADF&G.

C. Contracts and Other Agency Assistance

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

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

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

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

SCHEDULE

A. Measurable Project Tasks for FY98

October 1, 1997	Contract between CRRC and ADF&G renewed
October 1, 1997	Spill Area-Wide Coordinator hired
October 1, 1997	Subcontracts with communities for Community Facilitators renewed
November, 1997	Training workshop/orientation for Community Facilitators
December 1997	Update local resource inventories submitted to Spill Area-Wide Coordinator and compiled for distribution to PIs
January 1998	Participate in Annual Restoration Workshop, including session reviewing TEK program
April 1998	Communities' FY 98 project proposals submitted
May 1998	Submit recommendations to Executive Director on community involvement component of FY 98 restoration project proposals; inform Community Facilitators of proposals that would involve their communities
Each two weeks	Fax update to Community Facilitators
Each month	Report from Community Facilitators

B. Project Milestone and Endpoints

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

C. Completion Date

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

PUBLICATIONS AND REPORTS

Annual reports will be compiled in coordination with ADF&G and submitted to the Chief Scientist on April 15th of each year by CRRC. The annual reports will describe and summarize the progress made toward increasing community involvement during the previous federal fiscal year. In addition, twice-monthly reports will be provided to the participating communities by the Spill Area-Wide Coordinator and monthly reports will be provided by the Community Facilitators to the Spill Area-Wide Coordinator.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

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

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

PROPOSED PRINCIPAL INVESTIGATOR

Patty Brown-Schwalenberg
Chugach Regional Resources Commission
4201 Tudor Centre Drive, Suite 300
Anchorage, Alaska 99508
phone number: 907/562-6647
fax number: 907/562-4939
e-mail: crrcomm@alaska.net

PERSONNEL

Patty Brown-Schwalenberg: Ms Brown is the Executive Director of CRRC. She has worked for the past 13 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 communities 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.

Martha Vlasoff: Ms. Vlasoff has been active in spill area issues for six years and has worked for the Chugach Heritage Foundation in their Language Rejuvenation Project. Ms. Vlasoff was a resident of Tatitlek for 15 years and has been very active in native issues within Alaska. Ms. Vlasoff is on the Board of Directors of the Keepers of the Treasures and the Alaska Conservation Foundation. Ms. Vlasoff will use outside technical assistance in various aspects of the project.

Rita Miraglia: Ms Miraglia has served as the oil spill coordinator for the Division of Subsistence since 1990. As such, she has organized and participated in the subsistence resource collection and testing programs of 1990 and 1991, and participated in the community based subsistence restoration planning process begun in 1994. She has served as the Division's primary liaison with the Oil Spill Health Task Force, and communicated restoration study findings to communities in the oil spill area through community meetings and newsletters. Ms Miraglia has a Masters degree in Anthropology from the State University of New York. Before coming to the Division, she worked for Chugach Alaska Corporation. As a member of CAC's Oil Spill Response Team, Ms. Miraglia sat on the Interagency Shoreline Clean-up Committee in Valdez in 1989, and the Cultural Technical Advisory Group in 1990, working to ensure that the concerns of the predominantly Alaska Native communities and native regional organizations were considered in the oil spill response.

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

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$15.9						
Travel		$2.5						
Contractual		$72.4						
Commodities		$0.5						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$91.3		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
General Administration		$7.5						
Project Total	$0.0	$98.8						
Full-time Equivalents (FTE)		0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998

Prepared: 1 of

Project Number: 98052B
Project Title: Traditional Ecological Knowledge - A Consolidated Approach
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/15/97

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1998
Miraglia	Subsistence Resource Specialist III	18C	3.0	5.3	0.0	15.9
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.0	5.3	0.0	
					Personnel Total	$15.9

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1998
Anchorage-Port Graham/Nanwalek	0.2	1	1	0.1	0.3
Anchorage-Chenega Bay/Tatitlek	1.0	1	1	0.1	1.1
Anchorage-Alaska Peninsula	1.0	1	1	0.1	1.1
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.5

1998

Project Number: 98052B
Project Title: Traditional Ecological Knowledge - A Consolidated Approach
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FORM 3B
Personnel
& Travel
DETAIL

Prepared:

4/15/97

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

Contractual Costs: Description	Proposed FY 1998
4A Linkage: Contract with Chugach Regional Resources Commission	72.4
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$72.4

Commodities Costs: Description	Proposed FY 1998
2 laser printer toner cartridges ($125 @, $250)	0.5
3 boxes IBM PC formatted diskettes ($12 @, $36)	
1 dozen steno pads ($2 @ $24)	
2 dozen ball point pens, 12 black, 12 red ($24)	
Post-it tape flags, assorted colors ($12)	
Post-it notes, assorted sizes ($15)	
1 box manila file folders, third cut ($19)	
1 box hanging file folder ($21)	
Post-it fax memo pads, assorted sizes ($20)	
1 box tyvek envelopes ($50)	
1 box manila envelopes ($29)	
Commodities Total	$0.5

1998

Project Number: 98052B
Project Title: Traditional Ecological Knowledge - A Consolidated Approach
Agency: Alaska Department of Fish and Game

FORM 3B Contractual & Commodities

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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

1998	Project Number: 98052B Project Title: Traditional Ecological Knowledge - A Consolidated Approach Agency: Alaska Department of Fish and Game	FORM 3B Equipment DETAIL

Prepared:

4/15/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$0.0						
Travel		$17.0						
Contractual		$45.5						
Commodities		$3.3						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$65.8		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
Indirect		$6.6						
Project Total	$0.0	$72.4						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998	Project Number: 98052B Project Title: Tradition Ecological Knowledge - A Consolidated Approach Name: Chugach Regional Resources Commission	FORM 4A Non-Trustee SUMMARY

Prepared:

4/15/97

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

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 1998
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1998
Anchorage-Port Graham/Nanwalek	0.4	4	12	0.15	3.4
Anchorage-Seldovia	0.3	2	6	0.15	1.5
Anchorage-Tatitlek	0.5	3	6	0.15	2.4
Anchorage-Chenega Bay	0.6	2	6	0.15	2.1
Anchorage-Cordova	0.3	2	4	0.15	1.2
Anchorage-Seward	0.2	2	2	0.15	0.7
Anchorage-Valdez	0.3	2	2	0.15	0.9
Anchorage-Kodiak	0.5	3	9	0.15	2.9
Anchorage-Bristol Bay	0.5	2	6	0.15	1.9
					0.0
					0.0
Includes travel for TEK Specialist, Advisory Group Members, and Select PIs to accomplish objectives of project.					0.0
				Travel Total	$17.0

1998

Prepared:

Project Number: 98052B
Project Title: Traditional Ecological Knowledge - A Consolidated Approach
Name: Chugach Regional Resources Commission

FORM 4B
Personnel
& Travel
DETAIL

4/15/97

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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	

1998	Project Number: 98052B Project Title: Traditional Ecological Knowledge - A Consolidated Approach Name: Chugach Regional Resources Commission	FORM 4B Equipment DETAIL

Prepared:

98052B

Traditional Ecological Knowledge

Project Number:	98052B
Restoration Category:	General Restoration
Proposer:	Chugach Regional Resources Commission
Lead Trustee Agency:	ADF&G, Division of Subsistence
Cooperating Agencies:	No other agencies will receive funding through this project
Alaska SeaLife Center:	
Duration:	1 year; may be continued
Cost FY 98:	$98,800.00
Cost FY 99:	
Cost FY 00:	
Cost FY 01:	
Cost FY 02:	
Geographic Area:	Spill-area wide
Injured Resource/Service	All Resources/Services

ABSTRACT

The project would fund two TEK (Traditional Ecological Knowledge) Specialists to (1) provide technical assistance to restoration project PIs who plan to use, or for whom it would be appropriate to use, TEK, (2) serve as a contact point for spill area communities, the community facilitators and spill area wide coordinator hired under Project /052A, and principal investigators on issues related to TEK, and (3) based upon the results of the evaluation of the feasibility of developing a comprehensive TEK database conducted under 97052B, appropriate measures will be taken to address this component; and (4) organize and coordinate synthesis workshops between PIs and community experts. The TEK specialist would work under the guidance of an Advisory Group.

INTRODUCTION

This project would continue work begun under the Community Involvement and Use of Traditional Knowledge Project (/052). Much progress has been made in making Principal Investigators aware of the availability and value of traditional knowledge. This project would develop a way to use traditional knowledge in the restoration of injured resources currently being researched through EVOS Trustee Council funded projects. This project would provide funds to contract with two Traditional Ecological Knowledge (TEK) Specialists. The TEK Specialists would work under the guidance of an advisory group, composed of a diverse group of individuals familiar with both TEK and the restoration program. In FY 98 the TEK specialists would (1) provide technical assistance to restoration project PIs who plan to use, or for whom it would be appropriate to use, TEK, (2) serve as a contact point for spill area communities, the community facilitators and spill area wide coordinator hired under Project /052A, and principal investigators on issues related to TEK, (3) based upon the results of the evaluation of the feasibility of developing a comprehensive TEK database conducted under 97052B, appropriate measures will be taken to address this component; and (4) organize and coordinate synthesis workshops between PIs and community experts.

NEED FOR THE PROJECT

A. Statement of Problem

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

B. Rationale/Link to Restoration

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

C. Location

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

COMMUNITY INVOLVEMENT

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

PROJECT DESIGN

A. Objectives

1. Renew contracts with the TEK Specialists and continue to work with the TEK Advisory Group established in FY97 to provide guidance and direction for the Trustee Council's TEK effort.

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

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

4. Based upon the results of the evaluation of the feasibility of developing a comprehensive TEK database conducted under 97052B, appropriate measures will be taken to address this component.

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

B. Methods

Two TEK Specialists will be hired or contracted and will work under the guidance of an Advisory Group, the composition of which is described below. ADF&G/Subsistence Division will also be involved in the project.

Interaction between the TEK Specialists and the Principal Investigators may occur in one of two ways. Either the PI will approach one of the TEK Specialists with a request for information, or the TEK Specialists will approach a PI to suggest the use of traditional knowledge. In either case, if both agree a TEK component would be of benefit to restoration, the TEK Specialists and the Principal Investigator will work together to formulate a research tool in order to elicit the desired information. In FY 97, work will be limited to existing restoration projects. The TEK Specialists will work closely with the Spill Area Wide Community Involvement Coordinator (Project /052A) to ensure appropriate community involvement in the TEK effort.

The TEK effort may be summarized as three primary tasks:

1) Collect "New" Data
If the information needed by a Principal Investigator is not found in the existing data, the TEK Specialists will work with the Principal Investigator to formulate a research tool to gather the desired information. In developing this tool, the TEK Specialists will consult with the Advisory Group, and the relevant local facilitator(s) and village council(s).

2) Analyze/Synthesize Data
Once the data is collected, the TEK Specialists will involve local experts to work with the Principal Investigator in analysis and interpretation of the data for presentation to the respondent communities. TEK Specialists will also involve local experts in this regard on other research projects as necessary.

3) Hold Synthesis Workshops
The TEK Specialists will identify PIs who are interested in utilizing TEK expertise and are willing to take part in community-based synthesis workshop with local experts. These workshops will last 2-3 days, will be limited to the PIs, local experts identified and invited by the community, and a facilitator (probably one of the TEK Specialists). The TEK Specialist will prepare participants prior to the workshop by distributing relevant information, discussing the objectives of the workshop with the participants, and creating a list of topics to be covered. The workshops will be held in a setting chosen to encourage interactions between participants both during formal discussions and informally at other times. Following the workshops, the participants will hold a community meeting to share the results of their discussions with community members. The TEK Specialist will also oversee preparation of a workshop report.

TEK Specialist: Duties and Responsibilities

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

2. Inform principal investigators and communities of the existence and objectives of this project.

3. (A) In regard to FY 97 restoration projects, identify those projects for which TEK would have application and value to researchers and work with those project PIs to develop a TEK component for their projects. (B) In regard to FY 98 restoration proposals, initiate contact with PIs at the Annual Restoration Workshop to discuss including TEK components in their project proposals. Review all proposals submitted for FY 98 and develop recommendations for Executive Director re: TEK.

4. Assist PIs in the design and implementation of questionnaires and other research tools to be used in the collection of TEK, the development of data collection methods, and the development of research agreements between the PI and village council as proposed in the draft TEK protocols.

5. Work with the Community Facilitators in identifying residents having specialized knowledge on a particular topic of interest to the principal investigators, and assist in data collection as appropriate.

6. Assist the PIs in interpreting the TEK data collected as well as any data brought in from existing records, and in communicating study findings and results back to participating communities.

7. If deemed appropriate as evidenced by the results of the feasibility study conducted in FY97 regarding the TEK database of resources injured by the oil spill, TEK Specialists and TEK Advisory Group will make recommendations to the Executive Director and Trustee Council on whether or not to develop a comprehensive TEK database of resources injured by the oil spill.

8. Organize and coordinate synthesis workshops as described above.

9. Consult regularly with the Advisory Group to obtain feedback, guidance, and direction on the TEK Program as it develops.

Advisory Group: Composition and Duties

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

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

The advisory group will meet as needed (the budget is based on four quarterly meetings in person, and teleconference meetings every other month) to provide the TEK Specialist with guidance and feedback on the progress and development of the project. The advisory group members will work on a voluntary basis. Travel costs will be provided out of this project.

ADF&G/Subsistence Division: Responsibilities

- Provide general expertise on subsistence uses and oil spill impacts on these uses to assist in the design of research and data gathering instruments, and in the interpretation of study results; and
- Contribute to the annual project report.
- As appropriate, work on development of the database as described above (if deemed necessary by the results of the FY97 objectives.
- Provide support to the TEK Advisory Group, including taking, producing, and distributions notes of meetings, and other project memos and products as needed.
- Compile and maintain reading lists/bibliography of TEK materials.
- Update Handbook developed in FY97, as needed.

C. Cooperating Agencies & Organizations

National Park Service, other Trustee Council agencies

SCHEDULE

A. Measurable Project Tasks for FY98 (October 1, 1997-September 30, 1998)

October 1, 1997	Contract between ADF&G and CRRC renewed
October 1997	TEK Advisory Group in place
	TEK Specialists contracts renewed
November 1997	TEK Specialist initiate contacts with PIs with TEK components in their FY 98 projects; and schedule synthesis workshops
February 1998	Reference guide to existing TEK data completed
January 1998	TEK Specialist attend Annual Restoration Workshop and make contacts with PIs re: including TEK component in FY 99 proposals
April 1998	Hold at least two synthesis workshops
May 1998	TEK Specialist review all proposals submitted for FY 98 and develop recommendations for Executive Director re: TEK
June, 1998	Prepare draft workshop reports
July 1998	Review all projects recommended for funding in FFY '98 to determine which would benefit from a TEK component
September 1998	Prepare final workshop reports and distribute

B. Project Milestones and Endpoints

October 1997	TEK Specialist hired or contracts renewed
November 1997	Synthesis workshops scheduled
April 1998	Synthesis workshops held
September 1998	Workshop reports complete
Ongoing	Provide technical assistance to PIs regarding the collection, interpretation and presentation of TEK

C. Completion Date

April 15, 2002

PUBLICATIONS AND REPORTS

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

PROFESSIONAL CONFERENCES

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

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project is focused more than most on the coordination and integration of the restoration effort. The TEK Specialist will work with the Principal Investigators of other projects, providing a service that is expected to benefit those projects and the restoration effort as a whole. This project will also be closely coordinated with the Community Involvement Project (98052A), and the Youth Area Watch Project (98210).

PROPOSED PRINCIPAL INVESTIGATOR

Patty Brown-Schwalenberg, Executive Director
Chugach Regional Resources Commission
4201 Tudor Drive, Suite 300
Anchorage, Alaska 99508
Phone: (907) 562-6647
Fax: (907) 562-4939

PERSONNEL

Patty Brown-Schwalenberg: Ms Brown is the Executive Director of the Chugach Regional Resources Commission (CRRC). She has worked for the past 13 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 and Wildlife society, Office Manager of the Bering Sea Fisheries Development Fund, and as a private consultant, assisting Alaska Native Communities 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.

TEK Specialist: CRRC has contracted with Dr. Henry Huntington and Dr. Pam Colorado to act cooperatively as the TEK Specialists. 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. Dr. Colorado received her Ph.D. at Harvard University and has been instrumental in promoting the use of Indigenous Science throughout the world. She established the Indigenous Science Institute in cooperation with the University of California at Berkeley and conducts educational training sessions for individuals from as far away as Mexico and Africa in the use of traditional ecological knowledge. We feel that the expertise these two highly qualified individuals bring to the project will assist in exceeding the expectations of this project.

Rita Miraglia: Ms Miraglia has served as the oil spill coordinator for the Division of Subsistence since 1990. As such, she has organized and participated in the subsistence resource collection and testing programs of 1990 and 1991, and participated in the community based subsistence restoration planning process, begun in 1994. She has served as the Division's primary liaison with the Oil Spill Health Task Force. She has been the lead communicator of restoration study findings to communities in the oil spill impact area through community meetings and newsletters. Ms Miraglia has a Masters degree in Anthropology from the State University of New York. Before coming to the Division, she worked for Chugach Alaska Corporation. As a member of CAC's Oil Spill Response Team, Ms Miraglia sat on the Interagency Shoreline Clean-up Committee in Valdez in 1989, an the Cultural Technical Advisory Group in 1990, working to ensure that the concerns of the predominantly Alaska Native communities and Native regional organizations were considered in the oil spill response. Under the present proposal, Ms Miraglia will serve as Project Coordinator for the Division (3 months).

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$15.9						
Travel		$2.5						
Contractual		$72.4						
Commodities		$0.5						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$91.3		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
General Administration		$7.5						
Project Total	$0.0	$98.8						
Full-time Equivalents (FTE)		0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998

Prepared: 1 of 8

Project Number: 98052B
Project Title: Traditional Ecological Knowledge - A Consolidated Approach
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/15/97

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

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Name	Position Description	Step	Budgeted	Costs	Overtime	FY 1998
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						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		3.0	5.3	0.0	
					Personnel Total	$15.9

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 1998
Anchorage-Port Graham/Nanwalek	0.2	1	1	0.1	0.3
Anchorage-Chenega Bay/Tatitlek	1.0	1	1	0.1	1.1
Anchorage-Alaska Peninsula	1.0	1	1	0.1	1.1
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.5

1998

Project Number: 98052B
Project Title: Traditional Ecological Knowledge - A Consolidated Approach
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

Prepared:

4/15/97

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

Contractual Costs:	Proposed
Description	FY 1998
4A Linkage: Contract with Chugach Regional Resources Commission	72.4
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$72.4

Commodities Costs:	Proposed
Description	FY 1998
2 laser printer toner cartridges ($125 @, $250)	0.5
3 boxes IBM PC formatted diskettes ($12 @, $36)	
1 dozen steno pads ($2 @ $24)	
2 dozen ball point pens, 12 black, 12 red ($24)	
Post-it tape flags, assorted colors ($12)	
Post-it notes, assorted sizes ($15)	
1 box manila file folders, third cut ($19)	
1 box hanging file folder ($21)	
Post-it fax memo pads, assorted sizes ($20)	
1 box tyvek envelopes ($50)	
1 box manila envelopes ($29)	
Commodities Total	$0.5

1998

Project Number: 98052B
Project Title: Traditional Ecological Knowledge - A Consolidated Approach
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual & Commodities

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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

1998

Project Number: 98052B
Project Title: Traditional Ecological Knowledge - A Consolidated Approach
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

Prepared:

4/15/97

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

Budget Category:	Authorized FY 1997	Proposed FY 1998						
Personnel		$0.0						
Travel		$17.0						
Contractual		$45.5						
Commodities		$3.3						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$65.8		Estimated FY 1999	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002	
Indirect		$6.6						
Project Total	$0.0	$72.4						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998

Prepared: 5 of 8

Project Number: 98052B
Project Title: Tradition Ecological Knowledge - A Consolidated Approach
Name: Chugach Regional Resources Commission

FORM 4A
Non-Trustee
SUMMARY

4/15/97

1998 EXXON VALDEZ TRUS ;OUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Personnel Costs:						
Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FY 1998
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs:					
Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1998
Anchorage-Port Graham/Nanwalek	0.4	4	12	0.15	3.4
Anchorage-Seldovia	0.3	2	6	0.15	1.5
Anchorage-Tatitlek	0.5	3	6	0.15	2.4
Anchorage-Chenega Bay	0.6	2	6	0.15	2.1
Anchorage-Cordova	0.3	2	4	0.15	1.2
Anchorage-Seward	0.2	2	2	0.15	0.7
Anchorage-Valdez	0.3	2	2	0.15	0.9
Anchorage-Kodiak	0.5	3	9	0.15	2.9
Anchorage-Bristol Bay	0.5	2	6	0.15	1.9
					0.0
					0.0
Includes travel for TEK Specialist, Advisory Group Members, and Select PIs to accomplish objectives of project.					0.0
				Travel Total	$17.0

1998

Prepared:

Project Number: 98052B
Project Title: Traditional Ecological Knowledge - A Consolidated Approach
Name: Chugach Regional Resources Commission

FORM 4B
Personnel
& Travel
DETAIL

4/15/97

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

Contractual Costs:	Proposed
Description	FY 1998
Contracts with Traditional Ecological Knowledge Specialists (Huntington and Colorado)	45.5
Contractual Total	$45.5

Commodities Costs:	Proposed
Description	FY 1998
Supplies	0.5
Telephone	1.2
Workshop Materials	1.6
Commodities Total	$3.3

1998

Project Number: 98052B
Project Title: Traditional Ecological Knowledge - A Consolidated Approach
Name: Chugach Regional Resources Commission

FORM 4B
Contractual & Commodities

1998 EXXON VALDEZ TRUST[illegible] COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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	

1998	Project Number: 98052B Project Title: Traditional Ecological Knowledge - A Consolidated Approach Name: Chugach Regional Resources Commission	FORM 4B Equipment DETAIL

Prepared:

4/15/97

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

Project Number:	98064
Restoration Category:	Research, Monitoring
Proposer:	Kathryn J. Frost, ADFG
Lead Trustee Agency:	ADFG
Cooperating Agencies:	none
Alaska SeaLife Center:	
Duration:	3rd year of a 5-year project
Cost FY 98:	$307,500
Cost FY 99:	$230,000
Cost FY 00:	$130,000
Geographic Area:	Prince William Sound
Injured Resource:	Harbor Seals

RECEIVED
APR 11 1997
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

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

INTRODUCTION

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

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

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

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

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

During FY 96 and FY 97, the objectives of the harbor seal restoration study addressed seven hypotheses regarding the status and trends of harbor seals in PWS, possible causes for the ongoing population decline, and the genetic status of PWS harbor seals. The status of studies relative to these hypotheses is briefly summarized below.

Hypothesis 1: The PWS harbor seal population has stabilized and/or increased since the EVOS. Annual counts of seals at 25 standardized "trend count" haulout sites in PWS were made during August-September 1989-1996. Surveys showed a continued decline of 6% per year through 1996. Counts that had been adjusted for the effects of tide, date, and time of survey were 31% lower in 1996 than in 1989. The results of these analyses were prepared and submitted for publication to Marine Mammal Science and the manuscript is currently being revised (Frost et al. submitted).

Hypothesis 2: A disease agent is causing harbor seals to decline. All seals that were caught and handled in PWS during 1989-1996 were examined for external signs of disease and blood serum was collected for disease assays. Six potential disease-causing agents were included in the tests: phocid herpesvirus (n=102), phocine distemper virus (n=84), *Brucella* spp. (n=80), *Toxoplasma gondii* (n=80), influenza (n=91), and caliciviruses (n=5). Over 300 hundred harbor seals from PWS, southeast Alaska (SEAK), the northern Gulf of Alaska (GOA), and the Bering Sea were tested for various diseases. Sample collection in PWS was funded by this EVOS restoration study. Other sampling and all disease testing was conducted and paid for as part of a NOAA-funded ADFG harbor seal study focusing on SEAK and the northern GOA. Results to date were reported by Lowry et al. (1996) and have been prepared for publication in Zarnke et al. (in press) and Osterhaus et al. (in prep.).

Disease assays indicated that PWS harbor seals were exposed to phocid herpesvirus (58%), phocine distemper virus (1%), the bacteria *Brucella* spp. (30%), and the protozoan *Toxoplasma gondii* (10%). Rates of exposure for PWS seals were similar to those for seals from other parts of Alaska. Results of testing for influenza suggest that Alaskan harbor seals have not been exposed to influenza, which caused the deaths of hundreds of harbor seals along the New England coast in 1979-80 and again in 1991-1992. Furthermore, all tests for caliciviruses, which have been implicated in abortions of California sea lions, were negative for Alaska harbor seals.

The possible significance to PWS harbor seals of exposure to phocid herpesvirus, phocine distemper virus, *Brucella* spp., and *Toxoplasma gondii* is unclear. In most cases titers were low which could be indicative of mild exposure, weak immune reaction, or waning antibody response. Zarnke et al. (in press) concluded that exposure to phocid herpesvirus has been common, widespread, and long term in Alaska and that the lack of documented epizootics suggests that phocid herpesvirus has not been highly pathogenic. Osterhaus et al. (in prep.) suggest that phocine distemper virus has also been enzootic in Alaska for many years, although there have been no documented phocine distemper epizootics in Alaska. Possible effects of *Brucella* spp. on harbor seals are unknown. The most typical result of brucellosis in other species is abortion. *Brucella* has also been isolated from harbor seals in the North Atlantic and from ringed, ribbon and spotted seals and walruses in Alaska. Little is know about the effects of *Toxoplasma gondii* on harbor seals. Van Pelt and Dietrick (1973) described *T. gondii* infection of a harbor seal pup that was captured shortly after birth at Cold Bay and died three weeks later.

To summarize, although some of these agents are known to cause mortalities or have reproductive effects, symptoms of disease have not been documented in Alaska harbor seals. The data collected do not support the hypothesis that disease has been an important factor in the decline of seal numbers in PWS, or other parts of Alaska.

Hypothesis 3: Harbor seals in PWS belong to a separate management stock. Skin samples for genetics studies have been collected from all harbor seals handled in PWS since 1989. This EVOS harbor seal restoration study supported all sample collection in PWS and contributed funds for analytical supplies. Analysis of samples was funded primarily by ADFG's NOAA-funded harbor seal study. Genetics analyses were conducted at the NMFS Southwest Fisheries Science Center (SWFSC) as part of a Master of Science thesis project by Robin Westlake at San Diego State University. Genetics samples were also provided to investigators at other institutions.

Results that include PWS samples appear in Lehman et al (1993), Kappe et al. (1995 and submitted), and Burg et al. (1995).

Over 350 samples have been collected and are available to SWFSC for mtDNA analysis. As of December 1996, 164 Alaskan and 11 Japanese/Russian harbor seals had been sequenced, including samples from SEAK, PWS, the northern GOA, and the Bering Sea. Progress is reported in Westlake et al. (1996a, 1996b). To date, no significant differences have been found between harbor seals in PWS, SEAK, and the northern GOA based on mitochondrial DNA. Possible explanations are that: 1) there is no geographic population structuring; or 2) the population is structured but the power of statistical tests for detecting differences was low due to relatively small sample sizes. SWFSC researchers caution against drawing conclusions about management units for Alaska harbor seals until all sample analysis is complete. This thesis project is expected to reach completion in 1997.

Hypothesis 4: Low pup production may be causing harbor seals to decline. Annual counts were made of pups and non-pups during June 1989-1995. Surveys showed a normal rate of pupping in PWS, compared to other locations around the world, but a continued decline in overall numbers (Frost et al. 1996). This suggested that poor pup production was not responsible for the decline. For this reason, and because surveys in PWS during pupping had less statistical power to detect a trend, pupping-period surveys were discontinued in 1996.

Hypothesis 5: Predation by killer whales is causing the decline or preventing the recovery. A harbor seal population model was developed as part of this project in 1995-1996 (Frost et al. 1996). The final report for the modeling project, including the model itself and a User's Manual, has been completed and is being submitted to the EVOS restoration office under separate cover (Small 1996a & b). As part of this modeling exercise, it was possible to examine the effects of different levels of mortality (such as killer whale predation) on the growth rate of the population. Based on the population model, killer whale predation in PWS (estimated at the equivalent of 377 adult harbor seals annually; C. Matkin, personal communication) could not have caused the initial harbor seal population decline. It is possible, however, that predation could be affecting the recovery of the much-reduced harbor seal population.

Hypothesis 6: Mortality caused by subsistence hunting and/or fisheries-related take is preventing harbor seals from recovering. The model described under Hypothesis 5 was also used to estimate the impact of human-caused mortality (e.g. subsistence hunting, incidental fisheries take, etc.) on the PWS harbor seal population. It is clear from the model that reported levels of harvest and/or incidental take could not have caused the decline that occurred prior to the EVOS (Frost et al. 1996).

The model does predict, however, that if the carrying capacity of PWS to support harbor seals is lower now than it was in the 1980s (e.g. food availability is limiting), and remains at this reduced level, then human-caused mortality of 300 seals per year could cause the population decline to continue. By the year 2005, an annual removal of 300 seals could result in an additional 20% decline in the PWS harbor seal population. In contrast, the annual removal of 100 seals would result in little or no decline.

If carrying capacity increases in the future (food becomes more available and reproduction and survival increase), then the model predicts that the population will begin to grow with annual removals of 100-300 seals. The model predicts that an increase in carrying capacity from 5,281 (the 1995 population estimate) to 8,662 (the 1988 population estimate), with annual removals of 100 seals, could result in a population increase of 2,000-3,000 seals by 2005. With removals of 300 seals/year, the model predicts a smaller increase of 600-2,000 seals by 2005.

In the future, investigators for this project will continue to incorporate updated harvest and incidental take statistics into the harbor seal population model and will continue to inform and work with PWS subsistence hunters through the Alaska Native Harbor Seal Commission.

Hypothesis 7: A change in food availability has caused harbor seals to decline. During 1994-1996, samples for stable isotope, blubber energy, blood chemistry, and fatty acids analyses were obtained from all seals handled during tagging. Morphometric measurements, ultrasound, and measurements of bioimpedence were also obtained from these seals. This included 36 seals in 1994, 42 in 1995, and 39 in 1996. In addition, some blubber samples were obtained from subsistence hunters as part of an EVOS-funded biosampling program. These samples have been analyzed by a variety of investigators in a multi-disciplinary approach to the question of whether food is limiting the recovery of harbor seals. Stable isotope results will be reported by Schell and Hirons as part of EVOS Restoration Project 170 and blood chemistry and blubber energy results by Castellini et al. as part of EVOS Restoration Project 001. Two major components of this harbor seal restoration study have addressed the food limitation hypothesis: satellite-tagging and fatty acids analysis. Methodology for both of these approaches was developed by this restoration project.

Satellite-tags have provided information about locations, movements, and diving of seals, which is helping us to identify feeding areas and understand feeding behavior (Frost et al. 1996). To date, 51 harbor seals have been successfully instrumented with satellite-linked depth recorders (SDRs), including 26 adults (11 males, 15 females), 23 subadults (12 males, 11 females), and 2 female pups (Table 1). Twenty-two of these were tagged in April- May and 29 in September.

Satellite-tagging data clearly indicate substantial individual variation in the way seals make their livings (Frost and Lowry 1994b; Frost et al. 1995 and 1996). Some tagged seals used only a few haulouts and made only short trips away from them to feed. Others made longer trips of several days to almost two weeks. Some of these feeding trips were apparently entirely within PWS and others were in the GOA. Movements between terrestrial haulouts in central PWS and glaciers in northern PWS were not uncommon. Some seals made consistently shallow dives, while others fed in deeper waters and dove to greater depths. The deepest dive by a tagged seal was 404 m, but most dives were to less than 200 m. In general, seals dove more and hauled out less in the winter. They spent a greater proportion of days hauled out in summer, and used more haulout sites during this period. This is the period when pupping, breeding, and molting occur.

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

The SDR data set for 51 harbor seals from PWS is one of the largest of its kind. It is especially valuable because ADFG has similar SDR data from an additional 64 harbor seals instrumented in SEAK and near Kodiak as part of the NOAA-funded harbor seal study (Swain et al. 1996). When the information from these two data sets are synthesized, it will represent the most complete body of information about harbor seal movements and diving/feeding behavior anywhere in the world.

The sample size of satellite-tagged adult and subadult males and females in PWS should now be sufficient to generally characterize the movements and diving behavior of these age groups of seals. However, we have tagged only two seal pups. This is because the SDRs available in the past have been too large to use on pups. Recently small 0.25-watt SDRs were developed and tested. We now have the capability to safely instrument small pups. Consequently, our emphasis in the future will shift to the tagging of newly-weaned pups.

Fatty acids analysis in PWS harbor seals and their prey was initially funded by the EVOS Trustee Council starting in 1994 as a pilot project. The results of the first two years of this study have been written up and accepted for publication in Marine Ecology Progress Series (Iverson et al. in press). In that initial study, fatty acid signatures were used to investigate the diet and spatial scales of foraging in harbor seals and selected prey in PWS and the GOA (Iverson, et al. in press). Blubber samples collected in 1994 and 1995 from 104 harbor seals from PWS, Kodiak Island, and SEAK were analyzed for fatty acid composition. A total of 163 potential prey samples representing 10 taxa were collected and individually analyzed for total fat content and fatty acid composition. Classification and regression tree analysis was used to classify seals and prey according to their fatty acid signatures. Large differences were found in the fatty acid composition of blubber from seals sampled at Kodiak, SEAK and PWS. Additionally, fatty acid signatures distinguished seals from different regions within PWS, as well as from haulout sites only a few kilometers apart. These findings suggested that seals forage very site-specifically.

Prey fatty acid patterns also differed on similarly small spatial scales within PWS. Not only could prey species such as herring and pollock be differentiated from one another using fatty acid signatures, but they could also be distinguished by size-class and location within PWS, reflecting differences in diet with age and as well as with fine-scale habitat. Results from this study were consistent with both satellite data from tagged harbor seals and stomach content analyses of forage fish species in PWS. Although preliminary, analyses suggest that large herring and pollock, as well as flatfish, may have dominated the diet of seals in southern PWS, whereas diets of seals in northern and eastern PWS may have been comprised more of small size classes of herring and pollock, and perhaps other items such as cephalopods, sandlance, cod, and shrimp. Although a more comprehensive data base on the fatty acid composition of all potential prey species is required, along with development of a modeling program, it is clear that fatty acid signature analysis will be an important contribution to understanding marine food webs in PWS and other marine environments.

Proposed work in 1997. During the 1997 field season, satellite tagging, sampling, and monitoring will continue. Research will focus on the hypothesis that the availability of food, particularly to pups and subadults, is limiting the harbor seal population. Aerial surveys will be flown to monitor trends during the molting period in 1997.

During late June and early July 1997, small 0.25-watt satellite tags will be attached to 12 newly-weaned harbor seal pups. We hope to obtain 4-6 months of data from each of these pups. ADFG, as part of the NOAA-funded harbor seal study, will also tag 10 newly-weaned harbor seal pups on Tugidak Island in the northern GOA in summer 1997. This will provide a valuable comparison to the pups we tag in PWS.

Blood, blubber, skin, and measurements will be taken from all seals that are caught during tagging operations regardless of age. Similar samples are being collected by ADFG in SEAK, where harbor seals are not declining, and in the Kodiak region where they have declined more than 90% since the mid-1970s as part of the NOAA-funded harbor seal project. Data will be compared to better understand why seals are doing well in some areas and declining in others.

Work proposed in 1998 and beyond. The research being proposed for 1998-2000 is a more tightly focused extension of harbor seal restoration studies funded by the Trustee Council in 1995-1997. It will build upon previous research findings and incorporate new components to address high-priority issues regarding harbor seal recovery.

We will continue aerial surveys to monitor the trend of harbor seals in PWS during 1998 and 1999. These surveys are relatively inexpensive to conduct, and since PWS harbor seals continued to decline through 1996, we think it is important to continue to monitor their trend. The analysis of trend data is complicated by within- and between-year variability in the number of seals hauled out during survey flights. Because the timing of surveys is constrained by environmental factors such as weather and tides, and also by the biology of the seals (peak periods for hauling out occur for only several weeks per year), it is not possible to eliminate many of the variables that affect seal counts, even with standardized methodology. For this reason, we propose to conduct additional analysis of historical and recent survey data an attempt to overcome some of these inherent difficulties with the variability of aerial survey data. We plan to reanalyze survey data using a hierarchical Bayes (HB) model, develop Bayesian statistical models that relate observed seal count to a number of covariates (including location), and develop a Bayesian approach to trend monitoring.

We propose to attach satellite transmitters to 10 additional harbor seal pups in 1998 to assist with the interpretation of dietary information provided by fatty acid analysis, and to identify areas used by newly weaned pups for feeding. Satellite-tagging will also provide information about dispersal of pups after weaning, and whether or not they leave PWS. Unless something unusual or unexpected develops from pup tagging in 1997 and 1998, we do not propose to attach additional satellite tags in 1999. Data collected from the 51 seals satellite tagged during 1992-1996, as well as the pups that will be instrumented in 1997 and 1998, will be thoroughly.

We will continue to use the harbor seal population model to evaluate ongoing population trends, and will incorporate recent harvest data and estimates of predation, incidental fisheries take, etc. as they are collected. We will also use the model to estimate the impacts of changes in carrying capacity on harbor seals in PWS. We now intend to make the basic model more "user friendly" by adding a button-driven menu and illustrations. We will make it available to the Alaska Native Harbor Seal Commission and to the Youth Area Watch program directors for use in local communities.

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

NEED FOR THE PROJECT

A. Statement of Problem

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

Since 1989, numbers have continued to decline at about 6% per year. There were 31% fewer seals in 1996 than in 1989, and over 60% fewer than in 1984. The reasons for the continuing decline remain unknown, but are thought to relate to food limitation.

B. Rationale

Harbor seals are important to residents of PWS for subsistence. In 1985-1989, harbor seals made up 13%-27% of the subsistence foods harvested in Tatitlek and Chenega Bay. During 1992-1995, these two villages harvested less than half the number harvested annually before the spill. Native residents have noted the scarcity of seals and the impact this has had on subsistence hunting. Harbor seals are also watched and photographed by tourists and recreational users of PWS, and they interact with and are incidentally killed by commercial fisheries.

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

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

C. Location

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

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

COMMUNITY INVOLVEMENT

Investigators for the harbor seal restoration project attended March and November 1996 meetings of the Alaska Native Harbor Seal Commission (ANHSC) and the harbor seal breakout session during the January 1997 EVOS workshop to discuss PWS harbor seal research and population trend. "Harbor Seal Updates" were produced and distributed to PWS subsistence hunters and other interested persons in PWS communities in February and September 1996. . During 1996, this project supported the travel of two PWS Youth Area Watch students from Cordova to Anchorage to attend ANHSC meetings and/or the EVOS workshop, and to facilitate communication between hunters and youth.

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

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

Investigators will continue to attend 1-2 meetings of the ANHSC each year to discuss study results and proposed research. Investigators will assist as requested in developing community-based sampling programs. Biosampling is a cooperative effort of the ANHSC, NMFS, the University of Alaska Sea Grant program, and the ADFG Division of Subsistence. Personnel from this harbor seal project will facilitate sample analysis and communication of results to community residents. The principal investigator will continue to prepare newsletter-type reports of project findings (Harbor Seal Updates) for distribution to community residents and to the Public Advisory Group.

PROJECT DESIGN

A. Objectives

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

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

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

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

5. Determine whether there are differences in diets and important prey species among populations of harbor seals in areas of the Gulf of Alaska where they are continuing to decline (e.g., PWS and northern GOA) and areas where the population is stable or increasing (SEAK).

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

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

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

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

B. Methods

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

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

1. Conduct aerial surveys at PWS trend sites during molting in 1998 and 1999;
2. Re-analyze survey data using a hierarchical Bayes (HB) model and develop HB estimates of the annual number of observed seals.
3. Develop Bayesian statistical models that relate observed seal count to a number of covariates, including location, calendar day, time, height of low tide, time of low tide, and qualitative assessments of wind and sky conditions.
4. Develop a Bayesian approach to trend monitoring, taking into account the covariates.
5. Reevaluate survey data collected since 1989 using HB methods to evaluate whether seal numbers are continuing to decline, have stabilized, or are recovering to pre-spill levels.

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

1. Obtain blood and blubber samples from pups, subadult and adult harbor seals in PWS during two time periods: a) in late June/early July, representing the diets of pups about 2 weeks post-weaning (and therefore of their mothers) and the first over-winter diets for yearling harbor seals, and b) in August/September, a time when pups have lost blubber stores obtained from milk fat consumed during suckling and have begun to forage on their own, and also a time representing the summer diets of other age groups.
2. Analyze blubber samples for fatty acid signatures of individuals and age groups.
3. Measure total body composition (fat, protein, and lean body mass) of pups and juveniles using D20 equilibration as an indicator of individual nutritional status.
4. Use fatty acids signature analysis to determine whether individual, age-related, and interannual differences in diets occur in harbor seals; use this information to examine whether seals from different areas appear to have different diets because of differing prey intake with location or because of different age-group composition.
5. Continue to assess variation in the fat content and fatty acid composition of prey species in PWS, but with a particular emphasis on characterizing size-class and regional differences in the four prey species that are likely of most importance to harbor seals and especially juveniles: herring (*Clupea pallasi*), pollock (*Theragra chalcogramma*), capelin (*Mallotus villosus*), and sandlance (*Ammodytes hexapterus*).
6. Assemble the entire database being gathered in PWS on the fatty acid signatures of predators and prey and, together with a cooperating Scotian Shelf research program, develop mathematical models and associated software programs to quantitatively estimate species and size-class composition of individual harbor seal diets.
7. Estimate the most important prey items (and size classes) in diets of different demographic groups of harbor seals and determine whether diets of pups and small subadults differ

significantly from diets of large subadults and adults and relate this to data obtained previously on characteristics and limits of dive depths in pups, subadults, and adults.

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

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

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

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

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

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

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

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

We are proposing two additional years of field study (1998 and 1999) with final data analysis and reporting to take place in 2000. Findings from this study will be evaluated after each field season. Any modifications to the study approach will be recommended based on findings during the previous field season from this and other PWS studies. In addition to the components outlined in this project description, questions about harbor seal health and condition, stable isotope analyses, and prey availability will be addressed by other Restoration studies.

Aerial Surveys and Analysis

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

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

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

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

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

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

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

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

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

Catching and Sampling Seals

Seals will be caught by entanglement in nets placed near the haulouts. Nets will be approximately 100 m long and either 3.7 or 7.4 m deep with standard floats or float line and light lead lines. Mesh openings will be about 30 cm stretched measure. Nets will be deployed from a 6 m boat assisted by one or two other small boats to assist in maneuvering the net and tending it to ensure that all captured seals are quickly detected and removed (see Frost and Lowry 1994b). Some seal pups may be caught using long-handled dipnets.

When seals become entangled, they will be brought into the boats or to shore, cut free from the tangle net, and placed into hoop nets (large stockings made of 1 cm mesh soft nylon webbing). As necessary, seals will be sedated with a mixture of ketamine and diazepam administered intramuscularly at standard doses (Geraci et al. 1981). Each seal will be weighed, measured, and tagged in both hindflippers with individually numbered plastic tags. Field personnel will collect approximately 50 cc of blood from the extradural intervertebral vein. Ultrasound measurements of blubber thickness will be made whenever possible. Standard blood chemistry panels and virology screens (phocine distemper virus, herpes, and others as indicated) will be run on these samples. The following samples will also be taken: a 0.5 cm x 2.5 cm blubber biopsy for fatty acid analysis and analysis of energy content, whiskers for stable isotope analysis, and a small piece of skin for genetics studies. Ultrasound and blood chemistry panels will be analyzed by Project 001. Virology screens will be coordinated and paid for by the ADFG's NOAA-funded harbor seal study, as will all genetics analyses. Seal pups and small juveniles will be selected for instrumentation with satellite tags, as described below.

Total body composition (fat content, protein content, lean body mass) will be measured on a subset of the pups and juveniles that we sample using isotope dilution with deuterium oxide (D20). D20 is a stable isotope of water, which is widely used as a non-invasive method to measure body water pool size and the rate of water turnover in mammals and other vertebrates (Nagy & Costa 1980; Oftedal & Iverson 1987; Oftedal, Iverson & Boness 1987; Iverson et al.

1993). After administration of a known amount of D2O, the isotope completely equilibrates with all body water of the animal. Measurement of the final dilution of D2O in the body water (dilution space) can then be used to accurately measure total body water content (Oftedal, Bowen & Boness 1993). Body water content is then used to calculate total body fat, protein, and energy stores of the seal, based on the fact that the water and protein contents of lean body mass (fat-free mass) are approximately constant among mammals, particularly among individuals of a given species and age (Pace & Rathbun 1945; Reilly & Fedak 1990; Iverson et al. 1993).

Prior to the onset of the D20 procedure, seals will be weighed to the nearest 0.1 kg, and a blood sample. Any stomach contents of the animal will be evacuated by gastric intubation using a 3/8 inch veterinary stomach tube. A pre-weighed amount (approximately 1g/kg body mass) of deuterium oxide (99.9% purity), contained in a syringe with a three-way stopcock, will be delivered by gastric intubation using a small 12 French stomach tube (to reduce total surface area during delivery). The syringe and stomach tube will then be rinsed with 2 x 5 ml quantities of water, and air blown through the tube as it is withdrawn to ensure complete delivery. The animal will then be held for approximately two hours to permit isotope equilibration. After that, two sequential blood samples, separated by about 20 minutes, will be taken to ensure that equilibration has occurred. Bloods will be centrifuged and sera collected and frozen in airtight cryovials until the time of analysis. Laboratory analyses will be done at Dalhousie University. Total free water will be collected from blood sera by heat distillation, and D2O concentration will be determined by quantitative infrared spectrophotometry according to Oftedal & Iverson (1987) and Oftedal, Iverson & Boness (1987) on a Perkin Elmer Fourier Transfor Infrared Spectrophotometer with integrated data station (Paragon 1000).

Seals will be caught in three regions of PWS to coincide with sampling areas being used by other studies (APEX, herring studies, etc.). These will be Port Gravina; southern PWS near Montague, Green, and Little Green islands; and central PWS near Agnes, Smith, and Seal islands. This will facilitate comparison of data obtained by fish, seabird, and harbor seal researchers about important prey species and responses to changing availability of prey. Hydroacoustic and trawl data will be available from these areas. We will try to catch and sample approximately 40-50 seals total per year, during April-May and August-September. If sample analyses indicate that other areas or seasons should be sampled, we will extend or modify our sampling schedule.

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

Fatty Acids Analysis

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

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

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

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

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

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

Blubber samples archived by ADFG from harbor seals collected in the 1970s will be subsampled, placed in BHT and sent to Dalhousie University for anlaysis. Several of these archived samples were analyzed on a test basis during 1996-1997 to determine whether the blubber was still in suitable condition. The analyses were successful, indicating that some or all of the remaining archived specimens will be useful for this study. There are 365 total archived specimens from 1976-1978, of which approximately 200 are from areas where recent samples have also been collected (southeast Alaska, n = 16; Kodiak, n = 193; Middleton Island, n = 5; and miscellaneous others from the northern GOA). Samples will be prioritized based on age and specific location, to facilitate comparisons with samples from the 1990s. These same samples will be analyzed for lipid and water content, as well as total caloric density, by Castellini et al. (EVOS project 001) thus enabling the two projects to jointly examine and compare the energy content of the blubber and diet in recent and 20-yr-old samples from areas that have and have not declined.

Prey species will be obtained through APEX and other sampling cruises and analyzed at Dalhousie University. We will target our prey collection, where possible, to areas where seals are being sampled and to where other work is being done on prey and seabirds under the APEX program and where trawl survey data are available on abundance and distribution of prey species. We plan to continue to assess variation in the fat content and fatty acid composition of prey species in PWS, but with a particular emphasis on characterizing size-class and regional differences in the four prey species that are likely of most importance to harbor seals and especially juveniles: herring, pollock, capelin, and sandlance. Prey species from the other areas of harbor seal sampling (Kodiak and SEAK) will be obtained as possible through other studies and sources of funding, including in cooperation with the National Marine Mammal Laboratory as part of sea lion studies. Prey species to be analyzed will be chosen based on their collective importance to harbor seals and other apex predators and this project will work with other projects being conducted under APEX to avoid duplicative analyses and to share data and information.

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

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

Modeling of Seal Diet Composition using Fatty acid Signatures

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

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

Satellite-tagging

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

This study has demonstrated that SDRs are an effective means of monitoring the movements and haulout locations of harbor seals in PWS. During 1992-1996, significant data were received from SDRs attached to 51 harbor seals in PWS, including 23 males and 28 females (Table 1). Twenty-six were adults, 23 were subadults, and 2 were pups. SDRs were attached to 18 seals from areas in central PWS that were oiled by the EVOS (Seal Island, Herring Bay, Bay of Isles, Applegate Rocks); four from eastern PWS (Olsen Bay, Gravina Island); one from northwestern PWS (the Dutch Group); and 28 from unoiled sites in southcentral PWS (Port Chalmers, Stockdale Harbor, Little Green Island, and Channel Island). SDRs were operational for up to 10 months, and provided locations for about 80% of those days.

During 1998, SDRs will be attached to 10 harbor seal pups at locations chosen to complement data from 12 pups tagged in 1997 and from adults and subadults tagged during 1992-1996. These will include Olsen Bay (important pupping area and also herring area), southern PWS near Montague, Green, and Little Green islands (herring and fish data from here, and a large number of seals); and central PWS near Applegate Rocks and Seal Island (APEX fish data available, and significant seal haulouts with pups). Actual tagging locations will depend on where seals are present and can be caught.

Emphasis will be placed on instrumenting pups and 1-yr-olds. Depending on the performance of tags in 1997, it is likely that in 1998 seal pups will be instrumented in late July or August.

One-quarter-watt transmitters (10 cm x 5 cm x 3 cm and weighing 170 g) will be attached to the mid-dorsal surface of seal pups by gluing with epoxy resin (Fedak et al. 1984; Stewart et al. 1989). SDRs attached after weaning should remain attached until the next molt, but will not operate that long. A prototype 0.25-watt SDR attached to a harbor seal pup in September 1996 operated until the end of December and sent approximately 12,000 transmissions. Through duty cycling and by limiting the number of daily transmissions, we hope to double the data collection period for 0.25-watt SDRs deployed in 1997 and beyond.

Data will be acquired from the ARGOS satellite receiving system and formatted using software provided by the manufacturer of the transmitters. Each SDR will transmit signals to polar-orbiting satellites whenever the seal is hauled out or when it surfaces sufficiently long for a transmission to occur. An uplink occurs when a satellite is positioned to receive the signal. Information transmitted by the SDR is used by Service ARGOS to calculate the geographic location of the seal. Units will be equipped with built-in programmable microprocessors to collect and summarize data for periods when animals are diving and store it for later transmission, as has been done for crabeater seals, Steller sea lions, and spotted seals (Hill et al. 1987; R. Merrick, personal communication; Lowry et al. 1994a). These data will be stored in six hour blocks and transmitted to the satellite once the six hour data collection period is complete. Sensor information from a pressure transducer and a conductivity switch will be used to indicate when the animal is hauled out. Data from four periods will be stored in memory, providing at least a 24 hour window for transmission before the data are lost. Dive data will be summarized as histograms in depth bins of 4-20 m, 21-50 m, 51-100 m, 101-150 m, 151-200 m, 201-250 m, 251-300 m, 301-350 m, and over 350 m, and duration bins of 0-120 seconds, 121-240 seconds, 241-360 seconds, 361-480 seconds, 481-600 seconds, 601-720 seconds, 721-840 seconds, 841-960 seconds, 961-1080 seconds, and over 1080 seconds. In addition, SDRs will store and transmit the amount of time spent in each depth bin and the total time spent at the surface.

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

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

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

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

C. Contracts and Other Agency Assistance

Survey aircraft will be chartered from the private sector. Charter aircraft for surveys will not require contracts. ADFG maintains a list of qualified air charter operators. Aircraft for surveys will be chosen from this list according to state procedures. Vessels will also be chartered from the private sector. Vessel support for tagging work will use small vessels contracts that will be completed by the Principal Investigator according the state SOP manual.

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

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

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

A Reimbursable Services Agreement will be negotiated with the University of Alaska Anchorage to cover the costs for Master of Science student Tracey Gotthardt. In her graduate thesis, Ms. Gotthardt will correlate the distribution of forage fishes in PWS, as indicated by trawl data collected by APEX, with the movements and diving behavior of satellite-tagged harbor seals.

Bayesian statistical analysis will be conducted as a cooperative effort between Jay Ver Hoef, ADFG, and Edwin J. Green and William E. Strawderman of Rutgers - The State University of New Jersey. This work will be undertaken through a Cooperative Agreement between ADFG and Rutgers. Drs. Green and Strawderman are acknowledged experts in this particular area of statistics (e.g. Green and Strawderman 1991, 1992). Their experience with hierarchical Bayes model will speed the process of obtaining results.

SCHEDULE

A. Measurable Project Tasks for FY 98 (October 1, 1997 - September 30, 1998)

Field work for this project will continue during 1998 and 1999, with final data analysis and submission of a final report in 2000. A schedule of field activities, data analysis, and report preparation is shown in Table 3 and below.

FY 98: October 1, 1997- September 30, 1998 (98064)

October:	Analyze 97 aerial survey data (preliminary)
October/November (1 day):	Meet with hunter representatives at annual ANHSC meeting
October-September:	Analyze SDR tag data
October-December:	Analyze fish distribution/seal diving
October-December:	Finish "user friendly" population model
October-March:	Analyze 97 seal/prey fatty acids samples
December:	Prepare and distribute Harbor Seal Update
January:	Order SDRs for 1998 field season; reserve Argos channels
January-September:	Fatty acids model development
January-March:	Arrange logistics (vessel, plane, contracts, equipment)
January (3-4 days)	Attend Annual Restoration Workshop
February (2-3 days)	Coordination meeting for ADFG and NOAA harbor seal studies
April 15:	Submit "user-friendly" population model
April 15:	Submit annual report (FY 97 findings)
April 15:	Submit renewal proposal
June 1, 1998	Submit final report (masters thesis) on fish distribution/seal diving
June-August:	Bayesian reanalysis of survey data
June 20-July 7 (8 days):	Sample seals in PWS
August 1 -15:	Satellite tag and sample seals in PWS
August-March:	Retrieve Argos SDR data
August 15-30:	Aerial surveys in PWS during molting
September 15-30:	Prepare and distribute Harbor Seal Update

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

October:	Analyze 98 aerial survey data (preliminary)
October/November (1 day):	Meet with hunter representatives at annual ANHSC meeting
October-March:	Retrieve 1998 Argos SDR data
October-September:	Analyze SDR tag data
October-March:	Analyze 98 seal/prey fatty acids samples
October-March:	Fatty acids model development
December:	Prepare and distribute Harbor Seal Update
January-March:	Arrange logistics (vessel, plane, contracts, equipment)
January (3-4 days)	Attend Annual Restoration Workshop
February (2-3 days)	Coordination meeting for ADFG and NOAA harbor seal studies
April 15:	Submit annual report (FY 98 findings)
April 15:	Submit renewal proposal
June 1	Submit final report (masters thesis) on fish distribution/seal diving
June 20-July 7 (8 days):	Sample seals in PWS
August 1 -15 (8 days):	Sample seals in PWS
August 15-30:	Aerial surveys in PWS during molting
September 15-30:	Prepare and distribute Harbor Seal Update

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

October:	Analyze 99 aerial survey data (preliminary)
October/November (1 day):	Meet with hunter representatives at annual ANHSC meeting
October-March:	Analyze 98 seal/prey fatty acids samples
December:	Prepare and distribute Harbor Seal Update
January (3-4 days)	Attend Annual Restoration Workshop
January-June:	Final SDR tag data analysis
January-June:	Final trend analysis 1989-1999
January-June:	Final fatty acid analysis and interpretation
April-September	Final report and manuscript preparation
31 September:	Submit final report

B. Project Milestones and Endpoints

Objective 1

August 15-30, 1998-1999:	Conduct aerial surveys at 25 sites in PWS
September 1998-2000:	Prepare Harbor Seal Updates for hunters to describe trend
September 1998:	Submit manuscript describing Bayesian trend analysis
April 15, 1998-2000:	Submit population trend analysis as part of annual reports
June 2000:	Submit manuscript describing 1989-99 PWS harbor seal trend

Objective 2

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

Objectives 3 -7

January 1998:	Paper on fatty acids work at 12th Biennial Marine Mammal Conf.

June-August, 1998-1999:	Sample 30-50 harbor seals for blubber fatty acids
June-August, 1998-1999:	Sample 20 seal pups and juveniles using D20 for body composition
October-September,1998-99:	Analyze 80-100 recent harbor seal blubber samples for fatty acids
October-September,1998-99:	Analyze 100-200 archived harbor seal samples for fatty acids
October-September,1998-99:	Analyze 200-300 prey samples for fatty acids
July 1998:	Submit manuscript describing fatty acids work
October 1998:	Submit manuscript describing D20 studies of seal pups
November 1999:	Paper on fatty acids work at 13th Biennial Marine Mammal Conf.
September 2000:	Submit manuscript describing fatty acids work

Objective 8

January 1998:	Paper at 12th Biennial Marine Mammal Conf on seal movements
February 1998:	Submit manuscript on PWS seal movements
August 1998:	Attach SDRs to 10 seal pups in PWS
November 1999:	Paper at 13th Biennial Marine Mammal Conf on PWS seal diving
May 2000:	Submit manuscript on diving and movements of seal pups in PWS

Objective 9

April 15, 1998:	Distribute population model to ANHSC, Youth Area Watch
September 1998-2000:	Prepare and distribute Harbor Seal Update describing study results
November? 1998-1999:	Attend ANHSC meetings to discuss status and studies with hunters
December 1998-1999:	Prepare and distribute Harbor Seal Update describing study results

D. Completion Date

This project will continue for three fiscal years, FY 98-FY 00. Field work and laboratory analyses will be conducted during FY 98 and FY 99. Final data analyses will be conducted and a final report prepared in FY 00.

PUBLICATIONS AND REPORTS IN FY 98

1. Oral/poster presentations at EVOS Restoration Annual Workshop (January 1998)
2. Oral/poster presentation(s) at Twelfth Biennial Conference on the Biology of Marine Mammals, Monaco - fatty acids, tagging (January 1998)
3. Submit manuscript on PWS seal movements (February-June 1998)
4. Annual report for FY 1997 studies; will include results of molting surveys including progress of Bayesian covariate and trend analyses; analysis of data for SDRs deployed on pups in June-July 1997; status report on 1997 fatty acid analyses (April 1998)
5. User friendly population model (April 1998)
6. Manuscript describing fatty acids work (July 1998)
7. Report of field activities for August surveys and pup/juvenile tagging and sampling (September 1998)
8. Manuscript describing Bayesian trend analysis (September-December 1998)

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

PROFESSIONAL CONFERENCES

Project investigators plan to attend the 12th Biennial Conference on the Biology of Marine Mammals in Monaco in January 1998. This conference is sponsored by the Society for Marine Mammalogy and is the largest marine mammals conference in the world. Abstracts will be submitted and it is anticipated that oral or poster presentations will describe the results of fatty acids (Iverson) and satellite-tagging studies (Frost or Lowry). Results of other studies using samples from PWS provided by this restoration study are also likely to be reported but travel will not be funded by this grant.

NORMAL AGENCY MANAGEMENT

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

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

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

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

The statistical methods developed to analyze survey data from PWS will have great application to harbor seal surveys in other regions of Alaska and elsewhere. Other investigators should be able to design more reliable and cost-effective surveys using methodology developed through this Trustee Council-funded project. Similarly, the application of fatty acids analysis to investigations of diet and changes in diet is likely to have significant and far-reaching effects on our ability to investigate the trophic dependencies and interactions of many species. Already, techniques developed as part of this project appear to have application for studies of fish movements and stock identity.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

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

Project 064 is a multidisciplinary, inter-agency undertaking. Surveys and satellite tagging will be conducted by ADFG; lipid analyses and interpretation by Dalhousie University; blood chemistry analyses at UAF (as part of 001); and Bayesian statistical analysis by ADFG and Rutgers University. Inclusion of interdisciplinary components within the same project will ensure that data are shared and interpreted in an interdisciplinary manner.

Project 064 (this project) will provide logistics, the MMPA permit to conduct sampling, and access to seals and samples for this study and the study conducted by Dr. Michael Castellini entitled "Condition and Health of Harbor Seals" (Project 001, UAF). Archived harbor seal data and blubber samples have been and will in the future be provided to Castellini/UAF for use in analyses of body condition and blubber. Subsamples of these same archived ADFG harbor seal blubber samples will be sent to Dalhousie University for fatty acids analysis. It will be very useful to have historical fatty acids and blubber quality results from the same individuals. Harbor seal investigators at ADFG and UAF have been working successfully together for the last five years on harbor seals in PWS and elsewhere, and future collaborations should be equally productive. Regular meetings and seminars are held by marine mammal investigators at UAF and ADFG Fairbanks to exchange information and ideas.

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

Prey samples for fatty acid analysis have been and will continue to be obtained through PWS System Investigation studies and the APEX study. Species to be analyzed have been chosen based on their collective importance to harbor seals, seabirds, and killer whales Information on distribution and movements of harbor seals, and diving behavior, will be shared with PWS Sound Investigation modeling studies to look at energy flow within PWS, and with forage fish investigators who may examine the effects of predation on fish population dynamics.

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

This harbor seal study will obtain samples of prey and incorporate results from Herring (ADFG) and SEA studies being submitted under the PWS System Investigation, and from the study Apex Predator Ecosystem Experiment. Prey samples from the GOA and SEAK will be obtained on an opportunistic basis, in cooperation with other ADFG harbor seal studies and with National Marine Mammal Laboratory (NMML) sea lion projects. These samples will be analyzed with non-EVOS funding, but analyses will be included in the results of the project. Fatty acids analysis in the future will emphasize pollock, herring, capelin, and sand lance. These species are important to seabirds and to harbor seals. The NMFS Auke Bay laboratory is submitting a proposal for FY 98 that will investigate fatty acid profiles and lipid class analysis of herring and other forage fishes. That study plans to conduct detailed sampling and fatty acids analysis of herring (and perhaps others) in northeastern (Port Fidalgo) and southwestern PWS. Investigators of that project and this harbor seal study will coordinate to eliminate overlap in sample analysis. The intent is for the projects to concentrate in different areas/sites and therefore to augment the sample base for each project. For example project 064 will also emphasize samples from southcentral PWS, adding to the proposed Auke Bay work in the southwestern sound. We will analyze samples from Port Gravina in the northeastern sound, thereby extending Auke Bay's work in Port Fidalgo. Project 064 will also share some harbor samples with Auke Bay personnel for duplicate analysis. This will provide a basis through which to ensure that results of analyses conducted by different laboratories are the same and can therefore be compared and combined. This is especially important as fatty acids studies become more prevalent and are conducted by a variety of laboratories.

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

ADFG receives funding from NOAA to conduct complementary studies of harbor seals in the northern GOA and SEAK. This funding provides an "economy of scale" for many aspects of both studies. For example, disease and genetics analyses of PWS seals have been done at minimal or no cost to this study, but are instead provided through the NOAA-funded harbor seal study.

Equipment is shared and analytical techniques and software developed by one project can be used by the other.

EVALUATION OF CHANGES IN CONTINUING PROJECTS

Major changes proposed for this project in FY 98 and beyond include cessation of satellite-tagging of adult and older subadult seals and elimination of disease, genetics, and modeling components of the study (these types of investigations may be incorporated in the NOAA-funded harbor seal study). The major focus in FY 98 will be on addressing hypotheses related to food limitation and population trend. This focus will continue in the form of fatty acid analysis, analysis of historical fatty acid samples from Kodiak and SEAK, and satellite tagging of pups, with a considerable increase in effort devoted to data analysis. Annual molt-period surveys will continue. Survey analysis will include a Bayesian approach that should eliminate some problems with variance associated with so many count locations and the variety of covariates. There will be continued emphasis on working with subsistence hunters to evaluate the impact of subsistence hunting on the harbor seal population, and on sharing the harbor seal population model with the users.

PROPOSED PRINCIPAL INVESTIGATOR

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PERSONNEL QUALIFICATIONS

Kathryn Frost (the principal investigator) has conducted research on marine mammals in Alaska since 1975. She has undertaken extensive research on natural history and ecology of seals, including aerial surveys; studies of food habits and trophic interactions; and studies of habitat use using satellite tags. She has conducted extensive aerial surveys of harbor seals in PWS and boat-based observations and sampling of harbor seals as part of NRDA studies following the EVOS. She has conducted satellite tagging studies of harbor seals in PWS from 1991 through 1996.

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

Rob DeLong is an Analyst Programmer for ADFG. He has developed custom software for the analysis of location and dive data from satellite-tagged seals. He was responsible for programming a PC-compatible Geographic Information System (PC ArcInfo and ArcView) that is used in presenting seal location and movements information. Mr. DeLong is also accomplished in seal catching and tagging techniques.

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

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

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

The following is a list of key people and their responsibilities:

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

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Table 1. Harbor seals instrumented with SDRs and sampled during 1992-1996.

Location	Date	SDRs AdM	SubM	AdF	SubF	DNA	Blood	Fat	Whiskers
Northern PWS									
Dutch Group/Lone I	May 95		1			5	5	5	5
Northeastern PWS									
Gravina Island	Sep 94		1			3	3	3	3
	Sep 95				2 (1 p)	2	2	2	2
Olsen Bay	May 95				1	2	2	2	2
	May 96					4	4	4	4
Central PWS									
Applegate Rocks	May 92		3	1			5		
	May 93	2				5	5		
	Sep 93					1	1		1
	Sep 95					2	2	2	2
	May 96				1	2	2	2	2
	Sep 96				1	3	3	3	3
Bay of Isles	Sep 93	1				1	1		1
Seal Island	May 92					1	3		
	May 93	3		1		7	7		
	Sep 93	2	1	1		10	10		10
	May 96		1			3	3	3	3
	Sep 96					4	4	4	4
Southcentral PWS									
Channel Island	Sep 93	1				3	3		3
	Sep 94	1	1		1	13	11	13	12
	May 95					6	6	6	6
	Sep 95					1	1	1	1
	May 96					1	1	1	1
	Sep 96		2	1	1	5	5	5	5
Green Island	Apr 94					1	1		1
Little Green Isl.	Apr 94					1	1	1	1
	Sep 95		1	1		9	9	9	9
	May 96				2	6	6	6	6
Chalmers/Stockdale	Apr 94					8	8	7	8
	Sep 94			3	1	10	10	10	10
	May 95	1		2	1	9	9	9	9
	Sep 95			2	1	6	6	6	6
	May 96			2		6	6	6	6
	Sep 96		1	1	1 (p)	5	5	5	5
	TOTAL	**11**	**12**	**15**	**13**	**145**	**150**	**115**	**131**

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

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

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

	Oct-Dec 96			Jan-Mar 97			Apr-Jun 97			Jul-Sep 97		
FY 97: 1996-97 (97064)												
Satellite/VHF tag pups									F	F		
Sample seals, pups and others (FAs)									F	F		
Work on "user friendly" pop model									F	F		
Aerial surveys during the molt period											F	
Retrieve ARGOS SDR data											X	X
	Oct-Dec 97			Jan-Mar 98			Apr-Jun 98			Jul-Sep 98		
FY 98: 1997-98 (98064)												
Analyze 97 survey data	A											
Meet with HS Commission		X										
Distribute HS Update			X									X
Retrieve ARGOS SDR data	X	X	X								X	X
Analyze fish distribution/seal diving	A	A	R									
Finish "user friendly" pop model	X	X	R									
Order SDRs for 1998 field season				X								
Attend Restoration Workshop				X								
Coordination ADFG NOAA			X									
Reserve ARGOS satellite channels					X							
Arrange logistics				X	X	X						
Analyze 97 seal/prey FA samples	L	L	L	L	L	L						
Fatty acids model development				A	A	A	A	A	A	A	A	A
Analyze SDR tag data	A	A	A	A	A	A	A	A	A	A	A	A
Prepare annual report and proposal				R	R	R						
Bayesian reanalysis of survey data									A	A	A	
Sample seals - pups and others(FAs)									F	F		
Satellite tag pups										F		
Aerial surveys during molt period											F	
	Oct-Dec 98			Jan-Mar 99			Apr-Jun 99			Jul-Sep 99		
FY 99: 1998-99 (99064)												
Analyze 98 survey data	A											
Meet with HS Commission		X										
Distribute HS Update			X									X
Retrieve ARGOS SDR data	X	X	X	X	X	X						
Attend EVOS workshop				X								
Arrange logistics				X	X	X						
Analyze 98 seal/prey FA samples	L	L	L	L	L	L						
FA model development	A	A	A	A	A	A						
Prepare annual report and proposal				R	R	R						
Analyze 98 SDR tag pup data							A	A	A	A	A	A
Sample seals - pups and others (FAs)									F	F	F	
Aerial surveys during molt period											F	

Table 3. Continued.

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

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1997	Proposed FFY 1998					
Personnel	$139.4	$123.5					
Travel	$8.2	$9.0					
Contractual	$83.9	$103.0					
Commodities	$59.5	$46.3					
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS				
Subtotal	$291.0	$281.8	Estimated FFY 1999	Estimated FFY2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003
General Administration	$26.8	$25.7					
Project Total	$317.8	$307.5	$230.0	$130.0			
Full-time Equivalents (FTE)	1.8	1.8					
	Dollar amounts are shown in thousands of dollars.						
Other Resources							

Comments: This project is a more tightly refocused extension of harbor seal restoration studies funded by the Trustee Council in 1995-1997 as project 064. It will build upon previous research findings and incorporate new components to address high-priority issues regarding harbor seal recovery. The amount budgeted for FFY 98 (307.5) exceeds the amount originally projected for this study (150.0). This is because, per invitation by the Trustee Council, it includes expanded work on fatty acids in harbor seals and their prey.

None of the project funds are required for NEPA compliance. Permits to conduct this work are obtained from NOAA under terms of the Marine Mammal Protection Act. Costs for workshop and conference attendance are identified under travel costs.

This project achieves major cost savings by collaborating with other studies and agencies to conduct this work. For example, ADF&G receives funds to conduct harbor seal studies in other parts of Alaska. This enables investigators to share costs for equipment, computers and software, as well as for developing new methodologies and approaches to data analysis. Costs for fatty acid model development will be shared by this and Scotian Shelf research projects. Fatty acid samples to be used by this study for comparisons between PWS and other geographic areas will be provided by other ADF&G harbor seal studies, and also by National Marine Mammal Lab/NOAA personnel. Analysis of samples for disease and genetics are funded by other contracts, but results are made available to this project.

1998

Prepared: 8-Apr-97

Project Number: 98064
Project Title: Monitoring Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: AK Dept. of Fish & Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Personnel Costs: Name	Position Description	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1998
11-2115	WBIII, Program Coordinator and Mngt	18K	9.0	6.5		58.5
11-2113	WBIII,Permits, Data Analysis&Interpretation	18L	4.0	6.9		27.6
11-2137	Analyst Programmer III - GIS programming	17E	1.0	5.7		5.7
11-2206	Biometrician II - survey statistical analysis	19E	1.0	6.4		6.4
Vacant	WBI, data analysis and graphics	14A	5.0	4.0		20.0
11-2229	Biometrician II - sat tag statistical analysis	19A	1.0	5.3		5.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		21.0	34.8	0.0	
					Personnel Total	$123.5

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1998
Fbks-Cordova for Aug surveys, 1 person	0.5	1	12	0.1	1.7
Fbks-Anchorage, tagging, 2 persons x 1 field trip	0.2	2	2	0.1	0.6
PWS-Anchorage 1-way charter, crew rotation	0.1	1	0	0.0	0.1
Portage-Whittier by train (2 vehicles per trip)	0.8	2	0	0.0	1.6
Fbks-Portage, personal vehicles	0.3	2	0	0.0	0.6
Fbks-Anchorage, Harbor Seal Commission, 1 person	0.2	2	2	0.1	0.6
Fbks-Anchorage, annual workshop, 1 person	0.2	1	5	0.1	0.7
Fbks-Anchorage, workshop no advance, 1 person	0.3	1	3	0.1	0.6
Fbks-Anchorage, coordination committee, 1 person	0.2	2	2	0.1	0.6
Fbks-Monaco, Marine Mammal Conference, 1 person	1.0	1	9	0.1	1.9
				Travel Total	$9.0

1998

Prepared: 8-Apr-97

Project Number: 98064
Project Title: Monitoring Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: AK Dept. of Fish & Game

FORM 3B
Personnel
& Travel
DETAIL

1997 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Contractual Costs:	Proposed
Description	FFY 1998
NOAA contract and ARGOS expenses for ARGOS satellite data, new FY 98 tags	12.0
Print/graphics (slides for workshops, report production, summary for villages)	0.3
Long distance phone calls	0.5
Postage (DHL, courier, etc.)	0.2
Trailer parking & launch fees, Whittier ($100/trip x 2 trips)	0.2
Aircraft charter 40 hrs @ $.23/hr (1 survey during fall molt + track VHF tags)	9.2
Vessel charter for tagging/sampling @ 1.7/day x 7 days x 2 trips	23.8
Lipid analysis contract with Dalhousie University	40.8
Freight and shipping of samples	1.0
UAA RSA for graduate student	5.0
Rutgers RSA for Bayesian survey analysis	10.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$103.0

Commodities Costs:	Proposed
Description	FFY 1998
Fuel for boats and skiffs	1.0
VHF flipper tags, 10 @ $200	2.0
Biopsy punches, flipper tags, epoxy. tag supplies, film, net	1.0
Small boat supplies (propellers, oars, oil, etc.)	1.0
Laboratory supplies (D2O, cryovials, vacutainers, etc.)	1.0
Repair supplies for skiffs, net, etc.	1.0
10 satellite tags @ $3.8/unit (from Wildlife Computers)	38.0
Misc. field and meeting supplies (waterproof notebooks, bindings, marine charts, batteries, etc.)	0.3
Computer supplies and software for graphics, GIS, and other analyses	1.0
Commodities Total	$46.3

1998

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FORM 3B
Contractual &
Commodities
DETAIL

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		New Equipment Total	$0.0

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

1998

Prepared: 8-Apr-97

Project Number: 98064
Project Title: Monitoring Habitat Use and Trophic Interactions of Harbor Seals in Prince William Sound
Agency: AK Dept. of Fish & Game

FORM 3B
Equipment
DETAIL

98076

Project Title: Effects of Oiled Incubation Substrate on Straying, Marine Survival, and Gamete Viability of Wild Pink Salmon

Project Number:	98076
Restoration Category:	Research
Proposer:	Alex Wertheimer, Ronald Heintz, John Thedinga NMFS Auke Bay Laboratory ABL Program Manager: Dr. Stan Rice NOAA Program Manager: Bruce Wright
Lead Trustee Agency:	NOAA
Cooperating Agencies:	
Alaska SeaLife Center:	
Duration:	1 year
Cost FY98:	$272.2 K (234.6 K plus 37.6 K carryover from FY97)
Cost FY99:	
Cost FY00:	
Cost FY01:	
Cost FY02:	
Geographic Area:	Little Port Walter, Baranof Island, Southeast Alaska
Injured Resource:	Pink salmon

ABSTRACT

This project examines the effects of oil exposure during embryonic development on the straying, marine survival, and gamete viability of pink salmon. The objectives are to conduct a related series of controlled experiments on straying of pink salmon to determine the role of oil and other factors on straying so that field studies of straying in PWS after the spill can be interpreted; to determine if the return rate of pink salmon to adult is reduced when they have been exposed to oiled gravel during embryonic development; and to continue investigations into whether such exposure causes heritable damage to reproductive fitness of pink salmon.

INTRODUCTION

This project examines the effects of oil exposure during embryonic development of pink salmon on the straying, marine survival, and gamete viability of returning adults. A series of controlled experiments will determine the impact of oil exposure on straying, as well as the effects of other factors (marking, stock, and transplant), so that measurements of straying in PWS after the spill can be interpreted, and the significance of straying on management and restoration strategies can be evaluated. We will also determine if oil exposure during embryonic development reduces the return rate of pink salmon to adult. It continues the investigations into whether such exposure reduces the gamete viability of surviving adults, and if such damage is heritable. This Restoration Project has combined Projects --076 and --191B. These projects were closely related studies on direct and indirect toxic effects of crude oil on pink salmon exposed as embryos in oiled gravel. They were combined to achieve logistic efficiency and cost savings.

This project required marking several hundred thousand fry from wild and experimental treatment groups in 1996 (Table 1). These fry were the progeny of pink salmon collected and spawned for the experiments in 1995. For the exposure experiments, fertilized eggs were incubated in a controlled simulation of oiled intertidal habitat which occurred in Prince William Sound (PWS) after the *Exxon Valdez* oil spill. Fry from the oil-exposed and control groups were marked to identify treatments, and then released to migrate to the Gulf of Alaska. Corresponding groups of wild fry were also captured and marked.

Returning adults from these groups will be recovered in natal streams, other streams within 50 km of the natal streams, and in an adjacent hatchery fishery and escapement in 1997. Recoveries of tagged adults will be used to determine if oil exposure causes differences in straying and marine survival. Escapement and sampling rates in natal and non-natal streams will be estimated so that actual straying rates within the sampling region can be estimated, and the effects of oil, marking, population, and geographic factors on straying rate can be evaluated. Adults from the oil-exposure experiments that return to the release site will be identified as to treatment and then spawned. The fertilized eggs will be incubated in a clean environment. Survival of their progeny to the fry stage will be measured to determine if exposure to oil during incubation impaired reproductive viability.

Progeny of adults returning from Project 96191B were also tagged and released to examine the cross-generational inheritance of reduced reproductive viability due to oil. Two groups were marked: (1) progeny of returns from embryos exposed to oil in 1993/1994; and (2) progeny of the respective controls. These fry, the F-1 offspring of the original parental exposure, had been incubated in freshwater with no additional hydrocarbon exposure. Marked adults from these groups will be recovered at Little Port Walter (LPW), identified at spawning, and mated to produce F-2 offspring. Survival of these F-2 embryos will be analyzed to determine whether reproductive impairment was inherited.

This is the final year of a large multi-year study requiring significant logistic support for operations at remote sites. The study is located in southeast Alaska because of the possible influence of prior or continuing oil contamination of pink salmon in PWS. The project was initiated in FY95 and will extend over four years. Annual reports will be prepared each year. Most field work will be completed in FY97. Activities in FY98 will focus on the completion of stream survey operations; evaluation of gamete viability of spawners from experimental groups; data analysis; and preparation on a final report summarizing the results of the study and the analysis of the restoration objectives. A synthesis of the results with previous field studies on pink salmon straying in PWS will also be prepared to evaluate the impacts of oil on straying of pink salmon, and to assess the implications of direct and indirect damage from crude oil to management and restoration strategies for pink salmon in PWS.

NEED FOR THE PROJECT

A. Statement of Problem

Pink salmon were injured at several life-history stages during and shortly after the oil spill. Evidence of long-term damage from the toxic exposures of 1989 continues to build, and a thorough evaluation of the toxic contribution to pink salmon recovery problems became even more important when there was no explanation for the precipitous decline in pink salmon and herring in 1993. Three areas of continuing concern are the impacts of oil exposure on: (1) homing and straying behavior; (2) survival of emergent fry in the marine environment; and (3) reproductive viability of exposed fish and their offspring.

Straying was a major concern during the spill; the Trustees supported a multi-million dollar effort to assess straying, and substantial straying of wild and hatchery stocks was observed. Unfortunately, the interpretation of that study is severely limited for several reasons. Consequently, the amount of straying caused by oil is not known, natural straying rates are not known, and straying information cannot be used to develop or adjust restoration or management strategies.

B. Rationale

Pink salmon will be considered recovered when population indicators, such as growth and survival, are within normal bounds and there is no statistical differences in egg mortality between oiled and unoiled streams. Understanding the toxic effects of the 1989 oiling is a major component of the Trustee Council's program to restore pink salmon. Results from Natural Resource Damage Assessment and Restoration Studies following the spill indicate that the toxic exposures of 1989 have caused persistent, long-term damage to pink salmon. Field studies in PWS after the *Exxon Valdez* oil spill have demonstrated differences in embryo survival between oiled and non-oiled streams. In addition, laboratory studies have shown that differences in survival between oiled and non-oiled streams may be heritable (Restoration Study 94191A). Long-term (7-8 months) intra-gravel exposure of developing pink salmon eggs and alevins caused retarded development, altered emergence timing, decreased survival to eyeing and emergence, and an increased occurrence of gross lesions at emergence; it also had the surprising effect of delayed impacts on marine growth (Restoration Study 95191B). These developmental abnormalities from exposure to oil could persist and affect the behavior and fitness of the fish during subsequent life-history stages, including: (1) homing and straying; (2) survival of emergent fry in the marine environment; and (3) reproductive viability of exposed fish and their offspring.

Straying of pink salmon was a major concern following the spill. The Trustees supported a large hatchery and wild stock marking effort, and substantial straying of wild and hatchery stocks was observed. The ability of salmon to home (to return to their natal stream to spawn) is probably the most well-known and remarkable characteristic of these fish. Not all salmon return to their natal stream, however; some stray to non-natal streams to spawn. Some degree of straying is important to salmon populations; it is a mechanism for colonization of new habitat, as well as for the recolonization of habitat that has been damaged and subsequently restored. However, disruption in the normal amount of straying could have adverse impacts on the genetic structure of locally-adapted salmon populations. If high straying rates for pink salmon occur naturally in PWS, then the genetic structure of the populations in PWS should be relatively homogeneous, and large-scale mixing of wild stocks and the hatchery stocks derived from them should be of minor concern. Restoration of damaged pink salmon runs would thus be expected to occur naturally through recolonization from healthy stream systems. However, if the presence of oil increased straying from normally low levels, then the genetic diversity among and within wild stocks could be jeopardized from induced straying, and the genetic damage hypothesized to occur as a result of incubation in oiled substrate could be passed on to pink salmon in streams originally not contaminated by oil from the *Exxon Valdez*.

Straying rates for wild pink salmon observed in PWS in 1991 averaged 26% and ranged from 8-54% for fish from both oiled and non-oiled streams, based on coded-wire tag (CWT) recoveries in natal and non-natal streams. These straying rates seem high in relation to the concept that salmon normally home. Unfortunately, interpretations of that research are confused because even the wild stocks from non-oiled streams (controls) had to pass through oiled areas, and, thus, were not true controls. Also, marking the fish with CWTs may have affected their straying behavior. Normal levels of straying are not known for pink salmon. Consequently, the amount of straying caused by oil is not known, and straying information cannot be used to adjust restoration or management strategies. This study will conduct controlled straying experiments to permit an evaluation of oil on straying, and to examine the effect of tagging, stock, and transplant on straying. To avoid the confounding effects of prior or continuing exposure to oil, the experiments need to be carried out in a geographic region remote from PWS. By identifying the effects of the various factors on straying, however, the results of these experiments can be directly applied to interpret the previous straying study in PWS.

Pink salmon incubated in oiled gravel experience long-term effects that may lead to reduced fitness but a rigorous demonstration remains to be made. Restoration Study 95191B demonstrated that pink salmon incubated in oiled gravel had reduced growth rates, and matured at a smaller size. In addition, there was strong evidence for reduced marine survival and gamete viability, but statistical analysis failed to reveal differences because of limitations imposed by the experimental designs. These are important findings that support the lower embryo survival in oiled streams observed by Bue et al. (1996) and represent the first observations of long-term effects of oil on an economically important species. The large numbers of fish proposed for release in this study will provide adequate numbers of surviving adults to overcome the limitations of the experimental designs in the Restoration Study 95191B. Thus, the observations of reduced growth, marine survival and gamete viability may be corroborated. In addition, we propose to demonstrate the heritability of these effects by coded-wire tagging and releasing the offspring of the fish exposed in Restoration Study 95191B. These fish have been incubated in uncontaminated environments since they were spawned in 1995, and their growth, marine survival and gamete viability will be evaluated when they return in 1997.

C. Location

The project will be implemented at LPW (Figure 1), a research facility of the NMFS Auke Bay Laboratory (ABL). This location is appropriate because of the logistic and infrastructural support the ABL and the LPW station provide for this complex array of experiments. It is also necessary to examine the response of pink salmon straying to oil exposure at a geographic locale remote from PWS, to eliminate the confounding effect of prior or continuing oil exposure. For the exposure experiments and the F-1 progeny, gametes were collected at Lovers Cove Creek and Sashin Creek, Baranof Island, southeast Alaska. The eggs were incubated, and resulting fry tagged at LPW, near the mouth of Sashin Creek, 10 km from Lovers Cove Creek. Returning adult pink salmon will be recovered from streams on the eastern coast of Baranof Island and the west coast of Kuiu Island, within 50 km of LPW, as well as at the weir on Sashin Creek.

Technical support provided at this location includes the use of the research station at LPW as a base for the fieldwork. This station will provide housing for project personnel, hatchery facilities for egg incubation, a weir across Sashin Creek for recovery of adult pink salmon, equipment for recovering and decoding of CWTs, and facilities for holding and spawning of adult pink salmon. The ABL provides tagging machines, vessel support, computer services, analysis of GC/MS samples, and communication and administrative support. Materials and personnel will be transported to and from LPW via the NOAA vessel R/V *John N. Cobb*, as well as contracted air taxi charters. The *John N. Cobb* will also be provided to support stream survey operations.

COMMUNITY INVOLVEMENT

Scientists involved in this study will regularly present progress reports and results in scientific and public forums, including the annual workshop. They will be available to talk with interested public and will provide information for Trustee Council newsletters and annual reports as appropriate.

This project will be located in southeast Alaska outside of the spill affected area because of the need to avoid the confounding effects of previous or continuing oil contamination in PWS. However, it will require substantial labor for fish marking and stream surveys, as well as contracts for vessel charters. Agency hiring restrictions may limit us to contract hires for the intensive labor needs. In the first three years of this project, we have contracted people from communities in the area of the study (Juneau, Sitka, Petersburg, and Port Alexander), and anticipate similar contractual arrangements in FY98 for labor. We have also given the Port Alexander School a standing invitation for bringing students to the facility to view the operations and learn about scientific inquiry in general and oil toxicity studies on salmon in particular. We will continue to provide information to interested public (primarily fishermen) who visit the station; we will be displaying at the facility the posters developed for the Restoration Workshop for 95191B, 95076, and 96076 as interpretative tools.

PROJECT DESIGN

After the unexpected decline of pink salmon in 1993, two major research thrusts emerged: (1) evaluation of the ecosystem and its ability to support recovery of populations (SEA plan) and, (2) evaluation of long-term damage from earlier oil exposure. Long-term damage was not originally suspected, even though there was ample evidence of short-term damage such as reduced embryo survival (Bue et al. 1996), reduced marine growth (Wertheimer and Celewycz 1996; Willette 1996), and population effects (Geiger et al. 1996). Bue et al. (1996) found that elevated egg mortalities continued in oiled streams beyond the initial years of heavy oiling in intertidal spawning zones. They hypothesized that these persistent effects resulted from heritable damage passed on to subsequent generations. One model of how oil contamination could cause this damage is based on the biology of pink salmon egg-alevin development: Pink salmon spawn in contaminated intertidal zones of streams; the embryos incubate in contaminated streams for 7-8 months; and oil, which is extremely lipophillic, is readily absorbed into the large yolk reserves of the embryos. This exposure then causes both lethal and non-lethal damage to developing embryos. The non-lethal damage can result in subtle developmental changes with potentially large implications in later life history stages, such as reduced marine survival and increased straying.

This model of exposure and damage is supported by controlled laboratory exposures to pink salmon eggs at LPW. This research, stimulated by the Alaska Department of Fish and Game (ADFG) field studies, has shown that long-term (7-8 months) intra-gravel exposure of developing pink salmon eggs and alevins caused the predicted short-term effects (retarded development, altered emergence timing, decreased survival to eyeing and emergence, an increased occurrence of gross lesions at emergence) and also had the surprising effect of delayed impacts on marine growth (Restoration Study 94191B). These developmental abnormalities from exposure to oil could persist and affect the behavior and fitness of the fish during subsequent life-history stages, including (1) homing and straying; (2) survival of emergent fry in the marine environment; and (3) reproductive viability of exposed fish and their offspring.

Straying

Substantial straying was observed in PWS after the oil spill in 1991 in a large tagging effort of both wild and hatchery pink salmon (Sharp et al. 1995). Interpretations of the study are confused because of concern that tagging caused some of the straying (Habicht et al. *In review*), and because even the wild stocks from non-oiled streams (controls) had to pass through oiled areas and were thus not true controls. Normal levels of straying are not known for pink salmon, therefore it is difficult to evaluate the consequences of the observed straying. This study will conduct controlled experiments to permit an evaluation of the effects of oil incubation, tagging, stock, and transplant on straying. To avoid the confounding effects of prior or continuing exposure to oil, the experiments need to be carried out in a geographic region remote from PWS. By identifying the effects of the various factors on straying, however, the results of these experiments can be directly applied to interpretation of the previous straying study in PWS.

Straying rates for wild pink salmon observed in PWS in 1991 averaged 26% for fish from both oiled and non-oiled streams, based on coded-wire tag (CWT) recoveries in natal and non-natal streams (Sharp et al. 1995). Straying was highly variable, ranging from 8% to 54% for the six wild populations marked; straying rates were higher on average for wild fish than for hatchery fish. These high straying rates were surprising, but interpretation and use of the data were severely limited for several reasons. First, natural straying rates for pink salmon are not known for PWS or other areas. Second, the "controls" were wild stocks from non-oiled streams, but these fish had to migrate along contaminated shores, and were not true controls. Thus no measure of normal rates exists. Furthermore, if oil contamination continues, or heritable damaged was indeed passed on, then "normal" rates cannot now be measured in PWS. Third, concern exists that placing CWTs in small pink salmon fry may cause damage responsible for some or most of the straying. Consequently, while substantial straying was measured in both oiled and non-oiled areas, clear interpretation of the results is not possible, and the significance of the measured straying remains unknown.

Straying rates of 26% seem high in relation to the concept that salmon normally home. However, virtually no other quantitative information exists on straying rates of wild pink salmon in their natural range for comparison. Reported straying rates in other species of salmon are highly variable. Examples are: Labelle (1992) observed an average straying rate of 2% for five stocks of wild and enhanced coho salmon, with a range of 0-11%; straying rates tended to be lowest for hatchery fish and highest for stocks subjected to certain supplementation practices. Pascual and Quinn (1994) reported highly precise homing of hatchery chinook salmon to the Columbia River even if the fish were transplanted into the river. However, straying within the river was extremely variable among hatcheries, ranging from 1% to 95%, and was influenced by both environmental and genetic factors (Pascual and Quinn 1994). Tallman and Healey (1994) measured the straying rates for chum salmon in two streams located 2 km apart in the same bay; the straying rate from Walker Creek to Bush Creek was about 50%, while the straying rate from Bush Creek to Walker Creek was less than 2%.

The ability of salmon to home (to return to their natal stream to spawn) is probably the most well-known and remarkable characteristic of these fish. This tendency permits the establishment of discrete, locally adapted populations which are the basis of the stock concept in salmon management (McDonald 1981). Not all salmon return to their natal stream, however; some stray to non-natal streams to spawn. Straying is in itself a highly adaptive behavior. It is a mechanism for the colonization of new habitat (Milner and Bailey 1989), as well as for the recolonization of habitat that has been damaged and subsequently restored (Roys 1971; Leider 1989). Alexanderdottir (1987) and Quinn (1984) have speculated that pink salmon, which do not have overlapping generations because of their two year life cycle, may have relatively high rates of straying to provide a spatial population structure as a buffer against the risks inherent in a fluctuating environment.

The occurrence of strays in a spawning population does not necessarily mean that the strays are successful in transferring genetic information into the population. Tallman and Healey (1994) found that the gene flow was substantially lower than the straying rate among three populations of chum salmon, suggesting that strays have lower reproductive success than the native fish. However, higher gene flow was associated with higher straying rates. The rate and pattern of straying can still be considered indicative of the potential level of genetic interaction among populations and of the capacity of the species for recolonization of a site (Pascual and Quinn 1994).

Three possible explanations have been proposed for the high rates of straying observed for pink salmon in PWS. One is that oil exposure of the embryos induced high straying. No information exists on whether the developmental abnormalities associated with such exposure could also include deterioration of imprinting and homing. Previous research on the effects of oil on straying has focused on exposing returning adult salmon to oil for a short period of time (1-2 hours). Short-term exposure to oil had no deleterious effect on homing of either chinook salmon (Brannon et al. 1986) or coho salmon (Nakatani et al. 1985). Short-term oil exposure did cause temporary disorientation in migrating adult pink salmon, but did not prevent the eventual return to the home stream (Dames and Moore 1989). Straying rates observed in PWS by Sharp et al. (1995) were similar for fish from both oiled and non-oiled streams; however, the results were confounded because fry from non-oiled streams may have been exposed to oil as they migrated along oiled beaches.

The second explanation is that CWTs contributed to the observed straying rates. Morrison and Zajac (1987) reported that improperly injected CWTs can damage the olfactory nerves of small chum salmon.

Pink salmon fry are smaller than chum salmon fry, and thus may be more easily damaged by tag injection. Habicht et al. (*In review*) found that a higher proportion of the tags from pink salmon that had strayed in PWS were not in the ideal location in the head relative to the locations of tags of fish that had homed.

The third explanation is that the straying rates observed were indeed representative of wild stocks in PWS. Sharp et al. (1995) speculated that pink salmon originating from the intertidal reaches of streams may not imprint as strongly as do pink salmon spawned in upstream reaches of a stream, and may thus return to a general region rather than a specific stream. Up to 75% of pink salmon spawning in PWS occurs in intertidal stream reaches. Pascual and Quinn (1994) also found that chinook salmon released into tributaries to the estuary of the Columbia River had higher straying rates than did the same group of fish released from locations higher upstream, suggesting that longer migration time or distance in freshwater may improve imprinting and homing. For pink salmon returning to LPW from Project 95191B that were recovered, Wertheimer et al. (1996) estimated straying rates of 3.7-15%, depending on the assumptions used about frequency of strays in pink salmon escapements within approximately 30 km of LPW. If 80% of pink salmon strays occur within 30 km of the natal stream (Sharp et al. 1995), then total straying rates of 95191B pink salmon could have been as high as 19%. However, these observations are also confounded by coded-wire tagging and by transplant of gametes from their parental origin.

The degree of straying of wild pink salmon is an important issue in the restoration and management of wild pink salmon populations in PWS. Information on the spatial patterns of straying, and the factors that affect them, can have direct bearing on such issues as the genetic interaction of wild and hatchery stocks (Pascual and Quinn 1994). If high straying rates occur naturally, then the genetic structure of the populations in PWS should be relatively homogeneous, and large-scale mixing of wild stocks and the hatchery stocks derived from them should be of minor concern. Restoration of damaged pink salmon runs would thus be expected to occur naturally through recolonization from healthy stream systems. However, if the presence of oil increases straying from normally low levels, then genetic diversity among and within wild stocks could be jeopardized from induced straying, and the genetic damage hypothesized to occur as a result of incubation in oiled substrate could be passed on to pink salmon in streams originally not oiled by the *Exxon Valdez*.

Return Rate

The average return rate was lowest for fish that were exposed to the highest dose of oil in Project 95191B. In 1993, pink salmon were incubated in gravel contaminated with three different amounts of oil and uncontaminated gravel. When they emerged in 1994, they were coded-wire tagged and released. There were four batches of coded-wire tagged fish, and each dose was represented by a single tag code in a batch. Mean survival among groups of unexposed fish was 2.0±0.7% compared to 1.6 ±1.1% for groups of fish exposed to the highest dose (281 μg oil/g gravel), and within batches, fish exposed to the highest dose experienced the poorest survival three out of four times.

Gamete Viability

Offspring of parents exposed to oil during Project 95191B had the lowest average survival to eyeing. Three separate experiments were performed, and average offspring survival among progeny of fish exposed to the highest dose was lowest in all three experiments, with differences between unexposed and high dose groups as great as 25%. Unfortunately, statistical verification of the results was prevented in each of the experiments by limitations in the experimental designs. In the first case, the design did not account for an observed interaction between spawning date and treatment, and the two remaining experiments were underpowered. However, the consistency of the results coupled with the field observations (Bue et al. 1996) and reductions in growth indicates the need for more detailed analysis. The designs of the three experiments were hampered by the relatively small numbers of returning fish, but the present study is designed to remedy the problem by releasing much larger numbers of exposed fish.

The primary objective of Study 95191B was to evaluate the heritability of the long-term damage acquired by pink salmon incubated in oiled gravel. This is now included as an objective of 98076. Parents (P1) that were incubated in oiled gravel beginning in 1993 were spawned when they matured in 1995. Their offspring (F1) were incubated in a clean environment and were coded-wire tagged and released in the spring of 1996. When the F1 mature in 1997, they will be spawned and the survival of their offspring (F2) will be evaluated. Any differences in survival of the F2 will be related to differences in the exposure histories of the P1 generation.

A. Objectives

This project has seven major objectives related to straying of pink salmon. The design also permits evaluation of two additional major objectives concerning the effects of oil exposure during incubation on marine survival and gamete viability.

1. Determine if oil exposure during incubation affects straying of pink salmon.
   Hypothesis: Oil exposure during embryonic development increases the straying of pink salmon.

2. Estimate natural straying rates of two stocks of pink salmon. Accomplishing this objective requires a sampling program that can estimate the total strays within a specific geographic area, and evaluation of the influence on straying of such factors as tagging, stock, and transplant (Objectives 3-6).

3. <u>Determine if coded-wire tagging of pink salmon fry affects straying rate.</u>
Hypothesis: Coded-wire tagging of pink salmon fry increases the straying of pink salmon.

4. <u>Determine if stock type affects the straying rate of pink salmon.</u>
Hypothesis: Stock origin (upstream vs. intertidal) affects the straying rate of pink salmon.

5. <u>Determine if first-generation transplant affects the straying rate of pink salmon.</u>
Hypothesis: Transplant of gametes from a stream to a hatchery incubation and release site affects the straying rate of pink salmon.

6. <u>Develop a synthesis of pink salmon straying research, including the results of this study and use it to evaluate the implications for management and restoration strategies.</u>

7. <u>Determine if oil exposure during incubation affects the return rate of pink salmon fry.</u>
Hypothesis: Oil exposure during embryonic development decreases the marine survival of pink salmon.

8. <u>Determine if oil exposure during incubation affects the gamete viability of pink salmon.</u>
Hypothesis: Oil exposure during embryonic development decreases the gamete viability of pink salmon.

9. <u>Determine if reduced reproductive viability due to oil exposure during incubation is heritable.</u>
Hypothesis: Reduced gamete viability caused by exposure to oil during embryonic development is heritable; progeny of exposed parents will have lower gamete viability than progeny of unexposed parents.

B. Methods

<u>a. Overview</u>

This project has been designed to examine the effects of oil exposure during embryonic development of pink salmon on: 1) straying rate, 2) marine survival, and 3) gamete viability of returning adults. Pink salmon gametes were taken from fish returning to Lovers Cove Creek, an intertidal spawning population on southeast Baranof Island (Figure 1), and from fish returning to LPW from 95191B releases. The embryos were incubated at LPW near the terminus of Sashin Creek. The embryos from Lovers Cove Creek were placed in a controlled simulation of oiled intertidal habitat which occurred in PWS after the *Exxon Valdez* oil spill. Fresh water and salt water for incubation were provided from Sashin Creek and the LPW estuary, respectively. The embryos from 95191B returns were incubated in freshwater with no additional exposure to crude oil. Fry were tagged with CWTs to identify treatments (Table 1) and released to migrate to the Gulf of Alaska (Objectives 1, 7, 8, 9). Returning adults will be recovered at the release site, from the Armstrong Keta. Inc. (AKI) hatchery brood stock return, and at other streams within 50 km of the release site. The cost-recovery fishery at AKI hatchery will also be sampled as a proxy for the commercial fishery. Recoveries of tagged adults will be used to determine treatment-specific straying rates and marine survival. Tagged adults returning to the release site will be held and spawned, the tags decoded to identify treatment, and the fertilized eggs will be incubated in a clean environment to determine gamete viability of fish from the original treatment groups.

Because the effects of oil incubation on straying may be confounded by other factors that could affect straying, the influence of CWTs, stock, and transplant on straying will also be experimentally tested. These comparisons will utilize wild fry emigrating from both Sashin Creek and Lovers Cove Creek, as well as pink salmon fry from the control group of the oil-exposure experiment. The CWT effect will be examined by comparing straying rates of two groups of CWT fry with similar fish marked with fin clips only (Objective 3). The stock effect will be tested by comparing straying rates of Sashin Creek wild emigrants and Lovers Cove Creek wild emigrants (Objective 4). The transplant effect will be tested by comparing straying rates of Lovers Cove Creek wild emigrants with the control group of the oil-exposure experiment (Objective 5). These comparisons will also be repeated for both brood years.

A deterministic model was used to determine the power to detect differences in straying and return rate between oil-exposure treatment groups at the release group sizes and sampling regimes proposed. A number of assumptions were necessary to simulate the numbers of strays available for recovery, including marine survival, effects of oil exposure and marking and tagging on survival, straying rate, and sampling rate in non-weired streams. Details of this model, and of the sampling protocols for returning adults, were presented in the DPD for 97076. Sampling protocols and breeding designs for returning results are reiterated here to incorporate modifications that have been made to the design.

b. Adult recoveries

Sashin Creek Recoveries. To assess the rate of homing vs. straying behavior, returning marked pink salmon will be recovered from natal and non-natal streams on Baranof Island and Kuiu Island (Figure 1). Quantitative sampling will be focused on streams within 30-35 km of Sashin Creek (Table 2). The sampling period will extend from mid-August through mid-October, 1997.

Two of the streams to be sampled have weirs--Sashin Creek and the AKI hatchery brood stock raceway at Jetty Lake Creek in Port Armstrong. Close to 100% of the fish returning to these locations will be sampled. The fish returning to AKI as brood represent 40% of the estimated pink salmon escapement within 30-35 km of Sashin Creek (Table 2). AKI Hatchery personnel will be contracted to examine all pink salmon that enter the facility and are spawned, in order to identify and recover strays from the various treatment groups. Any fish with a missing adipose fin will be retained for scanning for CWT and examination for missing pelvic fins.

All pink salmon entering Sashin Creek will be checked for missing adipose fins. The weir will be operated so that fish cannot leave after entering, in order to provide a precise count of the number of fish in the creek. Fish with adipose fins will be passed into the creek. Fish without adipose fins will be checked for a missing pelvic fin. Pink salmon entering Sashin Creek that are missing a right pelvic fin were marked as wild fry emigrating from Sashin Creek. These fish will be sexed, measured, and passed into the stream. All other fish with adipose clips will be retained until mature for spawning. These pink salmon will be marked with an individually coded Floy tag, so that return timing can be determined for each treatment when the fish are killed and spawned. The fish will be placed in a temporary holding pen adjacent to the weir, and transferred at high tide to estuarine netpens where they will be held until maturity. At that time, the fish will be killed, scanned for a tag, and the tag removed and decoded (if present). A CWT fish will be considered to have homed to Sashin Creek, unless the fish is from the Lovers Cove wild fry group.

Eight unweired steams within 30-35 km of Sashin Creek will be sampled for frequency of tagged fish and estimation of total escapement. These streams represent 60% of the estimated total escapement within 30-35 km of Sashin Creek (excluding the return to Sashin Creek from the total). Thus 86-90% of the total escapement within this distance will be sampled quantitatively (Table 2). Based on the observations of stray pink salmon in PWS, we assumed that the number of strays will decline with increasing distance from the natal stream. Sharp et al. (1995) recovered 79% of their total strays 30 km or less from the natal stream. We used this figure to estimate the number of strays that will be available in pink salmon streams within approximately 30 km from LPW, and developed a sampling design to intensively sample fish in streams within this distance. We assume that strays will be distributed proportionately to the escapement within this 30-km area. More distant sites will also be sampled, but at a lower effort.

A four-person crew based at LPW will sample Lovers Cove Creek and Borodino Creek. The streams will be accessed from LPW using a 5.1-m Boston Whaler skiff, and will be checked twice weekly from September 1-October 15. Each carcass will be counted, checked for a missing adipose fin, and checked for a Ketchum operculum tag. The operculum tag is a critical component of the escapement estimation technique for each stream, described below. If a fish is missing the adipose fin, the entire fish or the head and the pelvic girdle (with fins attached) will be removed for later scanning for the presence of a CWT or a pelvic fin clip. At the time of sampling, the condition of the head and the number of eyeballs present will be noted to determine if differential loss rates of coded-wire tags are associated with carcass condition. If a fish is not fin-clipped, it will be cut in half to identify as already sampled on subsequent surveys. In addition to the systematic sampling of these two streams, this crew will check carcasses in other minor pink salmon streams from Port Herbert to Port Conclusion as time permits. This sampling will be for frequency of tags only; escapements will not be estimated. On these streams, carcasses will be counted, checked for fin-clips, fin-marked carcasses will be retained, and unmarked carcasses will be cut in half.

The other six unweired streams to be sampled systematically are located 20-33 km from Sashin Creek. These include watersheds on the east coast of Baranof Island and the west coast of Kuiu Island (Figure 1). The 30-km arc does not intersect all of Tebenkof Bay on Kuiu Island. Tebenkof Bay has four major embayments. We included in Stratum 2 streams in those embayments (Piledriver Cove and Thetis Bay) that are intersected by the 30-km arc, even if the streams were slightly (< 3 km) east of the arc. These streams will be sampled by four-person crews based on two charter vessels for both the occurrence of tagged fish and to estimate total escapement. The vessel-based operation will allow safe transit of Chatham Strait to sample streams in Tebenkof Bay, Port Malmesbury, and Patterson Bay (Figure 1). The crew will be able to sample during the day, then move safely to the next location after completing a survey. Each crew will be responsible for three of the streams.

Other pink salmon streams located 35-50 km from Sashin Creek will be sampled for frequency of tagged fish on an intermittent basis. These include watersheds on the east and west coast of Baranof Island, and on the west coast of Kuiu Island. The stream with the largest ADFG escapement index count in each of four bays will be sampled: Red Bluff Bay, Rowan Bay, Bay of Pillars, Gut Bay, and the inner portion of Tebenkof Bay. If time permits, streams in Table Bay on southwest Kuiu Island and Puffin Bay and

Branch Bay on southwest Baranof Island will also be surveyed (Table 3). The survey crews will not attempt to estimate escapement for these streams; the emphasis will be on checking carcasses for tags and tag occurrence rate as a check of the assumption that stray recovery rate is proportionate to distance from natal stream. It may be possible, however, to get a rough estimate of sampling proportion using ADFG aerial survey counts for streams on which escapements were estimated, and generating an average expansion factor for the sampling year for the aerial surveys.

These streams will be sampled by the charter vessel crews when and if time permits. Because of differences in run timing some of the systems, we expect periods when time requirements for systematic sampled streams are low, and the more distant streams can be included in the sampling. In addition, the NOAA vessel *R/V John N. Cobb* will be used to support a sampling crew for these more distant streams over the period September 19-30. This survey crew will count and examine as many pink salmon carcasses as possible for a missing adipose fin. If a fish is missing its adipose fin, the fish will be retained for later scanning for the presence of a CWT or a pelvic fin clip. Carcasses with adipose fins will be cut in half so that they can be identified on subsequent surveys as having been previously examined .

Tag Location. The location of CWTs within the heads of returning adult pink salmon will be examined to determine whether straying was influenced by where the tag was placed within the snout. Heads from adipose fin-clipped adults will be X-rayed so that tag location in fish that stray can be compared with tag location in fish that home. Samples of up to 100 heads will be X-rayed from each of three recovery categories--Sashin Creek, Lovers Cove Creek, and other area streams. The samples from Lovers Cove Creek and the other area streams will be from spawning or spawned-out fish. At Sashin Creek, however, because all adipose fin-clipped fish returning to the weir will be held alive after capture, and the tag will be removed and decoded at spawning in order to identify the treatment group, only fish that die in the holding net prior to spawning will available to X-ray for tag location.

Estimation of Escapement. In the 97096 DPD, we proposed estimating escapement into the systematically sampled unweired streams with a carcass mark/recapture approach that has been previously applied for pink salmon (Parker 1968) and chinook (Sykes and Botsford 1985). However, this technique was used in an unrelated study of pink salmon in the Auke Bay area in 1996, and was found to seriously underestimate the pink salmon escapement into short streams with significant intertidal spawning (Don Mortensen, Auke Bay Laboratory, personal communication). As a result, we have modified our approach, and will use a Petersen or Schaefer estimate based on tagging live fish and recovering marked carcasses. Simulation modeling was used to determine appropriate mark rates (Appendix 1). Fish will be captured by seining in the upper intertidal, so that both upstream and intertidal spawners will be represented. Up to 300 fish will be marked each week, using cryptic operculum tags. Both operculums will be tagged, so that tag loss rates on carcasses can be computed. The tags will be individually numbered, which will allow use of either the simple Petersen or Schaefer estimator (Appendix 1). A variance estimator is available for the simple Petersen approach; bootstrapping can also be used to develop empirical 95% confidence intervals for the estimate (Appendix 1).

c. Fisheries Recoveries

The number of fish harvested in the commercial fishery is not critical to our estimates of return rate and straying if the assumed survival rates are representative of post-fishery survival, and if the treatment groups are equally distributed in the fisheries. However, if oil does affect homing behavior, then exposed groups might mill around more and thus be differentially vulnerable to the fishery. Pink salmon returning to Sashin Creek are thought to enter Chatham Strait from the south (Hoffman 1982). Adult tagging studies indicate that some Sashin Creek fish move up Chatham Strait as far as Frederick Sound before returning to their natal stream. Fish harvested in lower Chatham Strait, however, are exclusively of lower Chatham origin (Hoffman 1981). Over the last four years, pink salmon harvest in area 109 from Frederick Sound to Cape Ommaney has averaged 17 million fish (pers. comm., H. Savikko, ADFG, Juneau). Fishery exploitation of Sashin Creek pink salmon is thought to be around 30% (pers. comm., Ben Van Alen, ADFG, Juneau). We estimate that the tag incidence rate for each treatment would be 1 in 30,000-50,000 fish in the general harvest area.

Sampling this large and widely-dispersed fishery would be expensive and difficult. At this time, we propose instead to sample the AKI Hatchery cost-recovery fishery as a proxy for the common property fishery. Projected harvest for this fishery is 1,000,000 pink salmon (pers. comm., Dana Owens, Armstrong Keta Inc., Juneau). We can reasonably expect to cost-effectively sample up to 30% of this harvest to test whether treatment groups were exposed to differential harvest rates. No estimate of the power of the test is possible. At this time, AKI plans to deliver its fish to a floating processor located near the hatchery (pers. comm., Dana Owens, Armstrong-Keta Inc., Juneau). Sampling this harvest will require arranging with the processor to permit two samplers to examine pink salmon and remove those with a missing adipose fin as the fish are delivered to the processing lines. The samplers will be housed at Port Armstrong or on the processor for the duration of the harvest (3-4 weeks); fish with missing adipose fins will be picked up and taken to LPW for examination for tags and fin clips and tag recovery and decoding at least twice weekly.

d. Analysis of Straying and Survival

The G-test of independence (Sokal and Rohlf 1981) will be used to test for statistical differences (P = 0.05) in straying between treatments for the oil-exposure and tagging-effects experiments (Objective 1, 3). The number of strays observed in all escapement sampling strata and the number of homing fish recovered at Sashin Creek weir will be compared between treatments. For the oil-exposure test (Objective 1), if a significant difference is detected between the three groups, all three possible paired comparisons will be made, with the rejection criterion adjusted for multiple comparisons so that overall $P = 0.05$. For the effect of tagging experiment (Objective 3), two-way contingency tables comparing the CWT and fin-marked releases will be analyzed.

Comparisons of straying rates between Lovers Cove Creek wild fish and Sashin Creek wild fish (Objective 4), and Lovers Cove Creek wild fish and transplanted Lovers Cove Creek fish (Objective 5) cannot be tested with the G-test because we will not have a complete count of the number of homing fish at Lovers Cove Creek. The total homing to Lovers Cove must be estimated by expanding observed tags by the sampling fraction. Comparisons for these objectives must thus be made using the estimated straying rates and associated variances, rather than observed recoveries.

Straying rates will be estimated for the various treatment groups by estimating the total number of strays. S, in non-natal streams within the 30-km sampling region, and the total number of homing fish, H, in the natal stream (Objective 2). S is calculated by

$$S_j = (\Sigma s_{ij}) / p,$$

where s_{ij} is the estimated number of strays for a particular treatment, j, in each non-natal stream surveyed, I, and p is the proportion of the escapement sampled within 30 km. Each s_{ij} is the observed number of strays expanded for the proportion of the escapement sampled for tags in stream I. H is the count of homing fish to Sashin Creek for all treatments, except Lovers Cove Creek wild fish; in that case, H is the observed number of homing fish in Lovers Cove Creek, expanded for the proportion of the escapement sampled for tags. The straying rate, f, is then

$$f_j = S_j / (S_j + H_j).$$

The variance of this proportion can be calculated from the variances of S and H. For S,

$$\mathrm{var}(S_j) = \Sigma \mathrm{var}(s_{ij}).$$

The variance of each s_{ij} is derived from the variance of the escapement estimate used to calculate the proportion sampled for tags in stream I. For H, var (H) = 0 for Sashin Creek, because H is a total count. At Lovers Cove Creek, the variance of H is also derived from the variance of the escapement estimate used to calculate the proportion sampled. Variance of f is then

$$\mathrm{var}(f_j) = [H^2(\mathrm{var}(S)) + S^2(\mathrm{var}(H))]/(S + H)^4.$$

A linear logistic model will be used to describe the relationship between straying rates and various factors, following the model used by Labelle (1992) for coho salmon. The objective is to predict the probability of straying for particular combinations of treatment, population, and geographic factors. The model used is

$$E[S/(S+H)] = \exp(b_0 + b_1 x_1 + b_2 x_2 + \ldots) / [1 + \exp(b_0 + b_1 x_1 + b_2 x_2 + \ldots)]$$

where f is the frequency of straying, b_n are parameters estimated by the model, and x_n are the predictor factors. We will use oil treatment, mark type, stock, transplant, distance from natal stream, direction from natal stream, and magnitude of non-natal stream as predictor factors.

Effects of oil exposure on return rate (Objective 7) will be tested using the G-test. The contingency table for the comparison will be a 2 x 3 table, comprised of the three groups and the number of survivors and non-survivors for each group. The number of survivors for a treatment will be the sum of the observed number of tags at Sashin Creek weir, the observed number of tags recovered as strays, and the observed number of tags in the AKI fishery. The number of non-survivors for a treatment will be the number of "good" tags released (the number of fish tagged for a treatment adjusted for tag retention) minus the number of survivors. If a significant difference is detected between the three groups, the three possible paired comparisons will be made, with the rejection criterion adjusted for multiple comparisons so that overall $P = 0.05$.

In addition to return rate, the size, fecundity, return timing, and sex ratio of the treatment groups will be compared. Analysis of variance will be used to examine size, fecundity, and timing. A G-test similar to the one for return rate will be used to analyze sex ratios.

e. Reproductive viability

Reproductive viability will be determined for two groups of returning spawners: (1) the P-1 fish that were exposed to oil in 1995 as embryos; and (2) the F-1 fish whose parents were exposed to oil as embryos in 1993. The maturing adults will be checked every 3-4 days for ripeness, starting September 8. Ripe fish will be killed and bled, and labeled by the Floy tag number (designating capture time). The fish will be measured and eggs or milt extracted and put on ice, identified by fish. If the fish is LV clipped, origin is from the P-1 controls. If the fish has a CWT, the tag will be extracted and decoded so that the fish can be identified as to P-1 or F-1 treatment.

P-1 returns. Two experiments will be performed to evaluate the reproductive viability of the P-1 fish. The objective of the first experiment will be to determine the average offspring survival within dose of parents exposed to different amounts of oil during incubation. The objective of the second experiment will be to estimate how much of the variability in offspring survival is due to individual variation and male/female effects. The benefit of the first experiment is that all the possible crosses within an exposure group can be made and the overall average survival measured. The primary source of variation will be measurement error and no information will be available on individual variation. The benefit of the second experiment is determine individual variability and thus provide control for the interpretation of the results of the first experiment, as well as male and female effects. The first experiment will measure survival to fertilization and eyeing. The second experiment will measure embryo survival to fertilization, eyed, and emergent fry stages. The numbers of defective or dead progeny will be compared between treatment groups. Because these gametes will not be incubated in an oiled environment, any observed increases in mortality or defective individuals can be attributed to oiling effects upon the first generation. To provide gametes for the two experiments, each P-1 female will be split into two groups: approximately 400 eggs will be allocated to Experiment 1, and 800 eggs to Experiment 2.

Average offspring survival will be estimated in the first experiment by measuring the survival in pools of gametes comprising all the possible pairwise crosses. On each day of spawning, two egg pools will be formed per treatment. Depending on the number of spawners available, each egg pool will consist of 6-11 females. Equal subsamples of approximately 100-150 embryos will be randomly selected from the egg pools; the number of subsamples formed from an egg pool will be equal to the number of females contributing to it. Each subsample of eggs from the pool will be fertilized with milt from a different male from the same treatment group. After mixing with milt, the eggs will be repooled, then placed in an individual cell within a Heath tray for incubation to the eyed stage. Thus, the average survival of a treatment group on a given day will be the mean of the average survivals in each of the two subgroups. We will plan for a maximum of 12 pools of embryos per treatment. This will require 96 cells per treatment, assuming an average of 8 pairs of spawners per pool. By using trays partioned into eight cells, 36 trays in three stacks will be required for Experiment 1.

The estimates of mean survival of the treatment groups will be compared with t tests after assuming that variability between groups of like-treated incubators is negligible. A t test between, for example, treatment 1 and 2, when there are d spawning days, q treatments, p subgroups per treatment, and r cells per subgroup will have the following form:

$$t_{((p-1)\cdot q\cdot d)\,df} = \frac{\frac{1}{d}[\overline{sv_{11}} + \ldots \overline{sv_{1d}} - \overline{sv_{21}} \ldots - \overline{sv_{2d}}]}{\sqrt{\frac{1}{d^2} * \frac{s_c^2}{p*r} * 2 * d}}$$

where,

$\overline{sv_{ij}}$ = Survival rate for treatment I on day j

s^2_c = Combined Between-Pools Mean Square obtained by ANOVA.

Comparisons will be made between each of the doses and the control and the overall α will be maintained at 0.05.

For the second experiment, fish from each oil dose and from the control will be mated using a fully-crossed half-sib design (Falconer 1981). In this design, approximately 400 eggs from each exposed female and control female are each split into two aliquots. One aliquot from each female is fertilized with aliquots of sperm from the same oil-exposed male, and one aliquot from each female is fertilized with aliquots of sperm from the same control male. This 2 x 2 breeding matrix will be replicated so that every female is represented in a breeding matrix or until there are 100 breeding matrices for each treatment, whichever is greater. Each half-sib family will be incubated in an individual, fry type container placed in a Heath tray. Nine containers can be put into a single tray. For 100 replicates of the two possible crosses (low dose X control and high dose X control), a total of 800 individual containers and 90 trays in six stacks will be required.

F-1 returns. Because fewer fish from the F-1's are expected, the F-1 experiment will use only fully crossed half-sib design. This design will permit filling out replicates of the spawning matrix when less fish are available than are needed for the pooled design of P-1 Experiment 1. This 2 x 2 breeding matrix will also be replicated so that every female is represented in a breeding matrix or until there are 100 breeding matrices for each treatment, whichever is greater. For 100 replicates, a total of 400 individual containers and 45 trays in three stacks will be required.

Embryos should have reached the eyed-stage of development by early November. At that time, the embryos will be shocked to coagulate the yolk of dead eggs, and live and dead eggs counted to assess survival. Live embryos from the P-1 and F-1 half-sib replicates will be returned to their containers and incubated until April. At that time, the number of fry will be enumerated from each container to determine survival to the fry stage, and the number of gross lesions and abnormalities will be counted.

Cooperating Agencies, Contracts and Other Agency Assistance

Experimental design to determine oil exposure impacts has been developed with ADFG and UAF researchers. UAF researchers will be directly involved with the breeding experiment analysis.

SCHEDULE

A. Measurable Project Tasks for FY 98

October :	Complete stream surveys and weir sampling.
November:	Evaluate gamete survival to eyed stage.
December:	Data analysis on return rates and characteristics, straying, and reproductive viability.
January:	Present preliminary analyses at EVOS workshop.
April:	Evaluate gamete survival to emergent fry stage.
April:	Complete 1997 Annual Report.
September:	Complete Draft of Final Report.

B. Project Milestones and Endpoints

Milestones	Completion Date
Spawning of 1995 brood adults	Completed
Oil exposure of 1995 brood embryos	Completed
Marking of 1995 brood fry	Completed
Recovery of 1995 brood marked fish	Oct 1997
Estimation of 1997 natal, non-natal stream escapements	Oct 1997
Spawning of 1997 brood adults	Sep 1997
Determination of 1997 brood gamete viability	Apr 1998

Endpoints

1. Objective 1: Determine if oil exposure during incubation affects straying of pink salmon.
   Completion Date: **January 1998.**

2. Objective 2: Estimate natural straying rates of two stocks of pink salmon. Accomplishing this objective requires a sampling program that can estimate the total strays within a specific geographic area, and evaluation of the influence on straying of such factors as tagging, stock, and transplant (Objectives 3-6).
   Completion Date: **January 1998.**

3. Objective 3: Determine if coded-wire tagging of pink salmon fry affects the straying rate of pink salmon.
   Completion Date: **January 1998.**

4. Objective 4. Determine if stock type affects the straying rate of pink salmon.
Completion Date: **January 1998.**

5. Objective 5. Determine if first-generation transplant affects the straying rate of pink salmon.
Completion Date: **January 1998.**

6. Objective 6. Develop a synthesis of pink salmon straying research, including the results of this study, and use it to evaluate the implications for management and restoration strategies.
Completion Date: **December 1998.**

7. Objective 7. Determine if oil exposure during incubation decreases the marine survival of pink salmon fry.
Completion Date: **January 1998.**

8. Objective 8. Determine if oil exposure during incubation decreases the gamete viability of pink salmon.
Completion Date: **July 1998.**

9. Objective 9. Determine if reduced reproductive viability due to oil exposure during incubation is heritable.
Completion Date: **July 1998.**

C. Completion Date

This project will extend over the entire life-history of the 1995 brood of pink salmon and will also include the egg/alevin life-history stage of their progeny. Oil exposures and marking of experimental groups will be completed in 1996. Recovery of returning adults will be completed in 1997. Evaluation of the viability of gametes of returning adults will be completed in 1998. The final report summarizing the results and detailing the accomplishment of the project's restoration objectives will be submitted in 1998.

PUBLICATIONS AND REPORTS

In FY98, six peer-reviewed publications are planned:

Wertheimer et al. Homing and straying of pink salmon exposed to oiled gravel during embryonic development.

Wertheimer et al. Effects of incubation in oiled substrate on the return rate, size, and migration timing of pink salmon.

Thedinga et al. Effects of coded-wire tagging and transplant on the homing and straying behavior of two stocks of pink salmon.

Heintz et al. Effects of incubation in oiled substrate on the reproductive viability of pink salmon.

Heintz et al. Heritability of reproductive damage in pink salmon caused by incubation in oiled substrate

Maselko et al. Comparison of Peterson and Schaefer mark/recapture approaches for assessing pink salmon escapements.

Annual progress reports will be submitted in April of 1996, 1997, 1998.

1996 annual report:	Details of the spawning of adult pink salmon in September, 1995, and the incubation of embryos (1995 brood). **Completed.**
1997 annual report:	Details of the tagging and release of pink salmon fry (1995 brood); analysis of 44 GC/MS samples (1995 brood); survival of embryos to fry emigration by treatment.
1998 annual report:	The recovery and spawning of adult pink salmon (1995 brood) in September and October, 1997; and preliminary analysis of straying rates, marine survival, and gamete viability of the 1995 brood.

The final report will be submitted in December, 1998.

PROFESSIONAL CONFERENCES

American Fisheries Society 1998 Annual Meeting

NORMAL AGENCY MANAGEMENT

NOAA/NMFS has statutory stewardship for all 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 a cooperative venture with the Trustee Council.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Research by NMFS on effects of oil exposure to pink salmon has been closely coordinated with concurrent research efforts by ADFG and UAF. This project has combined Restoration Studies --191B and --076 to ensure full coordination and economic efficiency. ADFG and UAF researchers will participate in the design of the breeding experiments.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This project has continued to evolve since its original funding in FY95. Substantial changes have been made in response to peer review comments and the results of the field operations. In 1997, the project was reduced from a two brood-year study ending in 1999 to a one brood-year study ending in 1998. This was done to constrain costs of the 076 research. The 1995 field work identified the need for increased effort on stream surveys for recovering tagged fish and estimating escapements (Wertheimer et al. 1996). Additional changes to the sampling protocols in FY-97 have been identified above under Project Design.

PROPOSED PRINCIPAL INVESTIGATOR

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PERSONNEL

GM-13 Fishery Biologist - Alex C. Wertheimer. BS Fisheries Science, Oregon State University (1979); MS Fisheries Science, University of Alaska (1984). Currently employed by National Marine Fisheries Service, Auke Bay Laboratory as a Supervisory Fishery Biologist, Task Leader of Early Ocean Salmon Research. Author of over 20 peer-reviewed papers and 30 agency reports on various aspects of the biology and culture of Pacific salmon. Research on Pacific salmon has included determining early marine growth, distribution, and migration; in nearshore habitat utilization; predator/prey relationships; by-catch mortality; the effects of hydrocarbon contamination on juvenile salmon in the marine environment; the association of early marine conditions with year-class success of salmon; salmon aquaculture and genetics; and status of stocks. Principle Investigator *Exxon Valdez* NRDA Fish/Shellfish 4, NMFS Component, 1989 through project completion in 1993.

GM-14 Physiologist - Stanley D. Rice. Received BA (1966) and MA (1968) in Biology from Chico State University, and PhD (1971) in Comparative Physiology from Kent State University. Employed at Auke Bay Fisheries Laboratory since 1971 as a research physiologist, task leader and Habitat Program Manager since 1986. Rice has researched oil effects problems since 1971, and has published over 70 papers, including over 50 on oil effects. Studies have ranged from field to lab tests, behavioral to physiological to biochemical studies, from salmonids to invertebrates to larvae to meiofauna. Rice has conducted and managed externally-funded projects since 1974, including the Auke Bay Laboratory *Exxon Valdez* damage assessment studies since 1989. Activities since the oil spill have included leadership and management of up to 10 damage assessment projects, fieldwork in PWS, direct research effort in some studies, establishment of state of the art chemistry labs and analyses in response to the spill, quality assurance procedures in biological-chemical-statistical analyses, establishment of hydrocarbon database management, servicing principal investigators and program managers in NOAA and other agencies with reviews and interpretations, provided direct input into agency decisions, interacted with other agencies in various ways (logistics coordination, critique experimental designs, interpret observations, etc.).

GS-11 Fisheries Biologist (Research) - Ron A. Heintz. Education: BS Ecology, University of Illinois (1979); MS Fisheries Science, University of Alaska (1986). He has worked for the National Marine Fisheries Service, Auke Bay Laboratory since 1985 concentrating his efforts on salmon enhancement research and salmon genetics. He is the principal investigator and co-investigator on several salmon genetics projects.

GS-12 Fisheries Biologist (Research) - John F. Thedinga. BS Fisheries and Wildlife Management, University of North Dakota (1975); MS Fisheries Science, University of Alaska (1986). He has been employed by the National Marine Fisheries Service, Auke Bay Laboratory since 1978 specializing in research on the effects of logging on salmon and freshwater habitat. He has been principal investigator and co-investigator on several projects and has published over 25 scientific papers.

Performance will be monitored by ongoing evaluation of time-specific milestones identified in the project schedule. Annual reports will document the accomplishment of project milestones. In FY-97, a GM-14 physiologist (Rice) will oversee and provide quality control for the whole project. A GM-13 biologist (Wertheimer) will be the project leader. A GS-12 and GS-11 biologist (Thedinga, Heintz) will collaborate on experimental design, implementation, data management, analysis, and write-up. A GS-9 and GS-7 biologist (Bradshaw, Maselko) will assist in setting up the experiments, collecting data, analyzing data, and reporting results. This project is undertaken as part of the research activities of the Auke Bay Laboratory (ABL) and will be supported by the laboratory infrastructure. The ABL will provide backups if any personnel changes occur. Bruce Wright, Trustee Council staff, will be responsible for coordination of this and other NOAA projects with the Trustee Council.

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Table 2. Proposed and actual number of groups and pink salmon fry marked at Little Port Walter for Project 076. Ad = adipose fin; CWT = coded-wire tag; RP = right pelvic fin; LP = left pelvic fin.

Treatment	Mark Type	Number Time Strata Marked		Number Fry Marked	
		Proposed	Released	Proposed	Released
Exposure High Dose	Ad-CWT	7	7	70,000	70,314
Exposure Low Dose	Ad-CWT	7	7	70,000	69,441
Exposure Control	Ad-CWT	7	7	70,000	65,409
Exposure Control	Ad-RP	1	1	70,000	56,435
Sashin Creek Wild	Ad-CWT	6	6	60,000	62,053
Sashin Creek Wild	Ad-LP	1	1	60,000	58,469
Lovers Cove Wild	Ad-CWT	6	7	60,000	76,834
F-1 High Dose	Ad-CWT	1	1	10,000	8,862
F-1 Control	Ad-CWT	1	1	10,000	10,932
TOTAL				480,000	478,749

Table 2. Weir and peak aerial survey counts for pink salmon streams within approximately 30 km of Little Port Walter. The column for 1997 surveys indicates whether escapement will be both estimated and sampled for tagged pink salmon returning in 1997. The adjusted peak count is the 10-yr mean peak count for unweired streams expanded by 2.5.

Stream Number	Stream Name	1997 Surveys	10-yr Mean Peak Count	Adjusted Peak Count
	AKI Weir[1]	Yes	85,712	85,712
109-10-006	Sashin Creek[2]	Yes	29,064	72,660
109-10-007	Borodino Creek	Yes	NA	NA
109-10-009	Lovers Cove Creek	Yes	26,973	67,432
109-10-023	Deep Cove NW Head	Yes	10,336	25,840
109-10-028	Parry Creek	Yes	11,220	28,050
109-52-050	Pillar Bay SW Side	No	1,304	3,260
109-62-003	Piledriver Cove Cr.	Yes	8,118	20,295
109-62-005	Happy Cove Creek	No	300	750
109-62-028	William Creek	Yes	5,446	13,615
109-62-029	Wolf Creek	Yes	7,973	19,932
109-62-030	Thetis Bay SW Head	No	1,693	4,323
109-62-031	Thetis Bay Salt Chuck	No	1,439	3,598
109-62-034	South Explorer Basin	No	125	318
109-62-036	Neal Creek	No	2,546	6,365
109-62-038	Gedney Harbor	No	2,350	5,875
109-63-001	God's Pocket West	No	779	1,948
109-63-002	God's Pocket North	No	553	1,383
109-63-003	Malmesbury W of Joyce	No	1,500	3,750
109-63-004	Malmesbury NW Joyce	No	633	1,582
109-63-005	Joyce Creek	Yes	7,533	18,832
109-63-007	Malmesbury N Arm E	No	603	1,508

Table 2. (continued)

109-63-009	Malmesbury N Arm S	No	17	42
109-63-012	Malmesbury Lake Creek	No	1,689	4,222
109-63-015	Malmesbury S Arm S	No	638	1,595
109-63-017	Malmesbury S Arm S	No	629	1,573
109-63-020	Tavin Creek	No	417	1,042
	Total for Area[3]		180,524	322,842
	Total, Surveyed Streams[3]		163,311	279,708
	% Total Surveyed 1997[3]		90.5%	86.6%

[1] AKI = Armstrong Keta Incorporated. Numbers are weir counts of fish entering hatchery adult capture and holding traps.

[2] Numbers are from aerial survey counts. Weir count at Sashin Creek in 1995 was 117,000.

[3] Excludes Sashin Creek

Table 3. Stream number, name, and average peak aerial survey count for streams located in bays 35-50 km from Sashin Creek.

Stream Number	Name	Average Peak Count
109-20-006	Gut Bay	2,260
109-52-007	Rowan Cr., Rowan Bay	20,196
109-52-055	Kwatahein Cr., Bay of Pillars	7,769
109-62-013	Alecks Creek - Tebenkof	30,938
109-20-016	Red Bluff Bay	104,400
113-12-001	Branch Bay	*
113-11-009	Puffin Bay	*
109-61-011	Table Bay	325

* These streams are not regularly surveyed by ADF&G, no estimates of escapement exist.

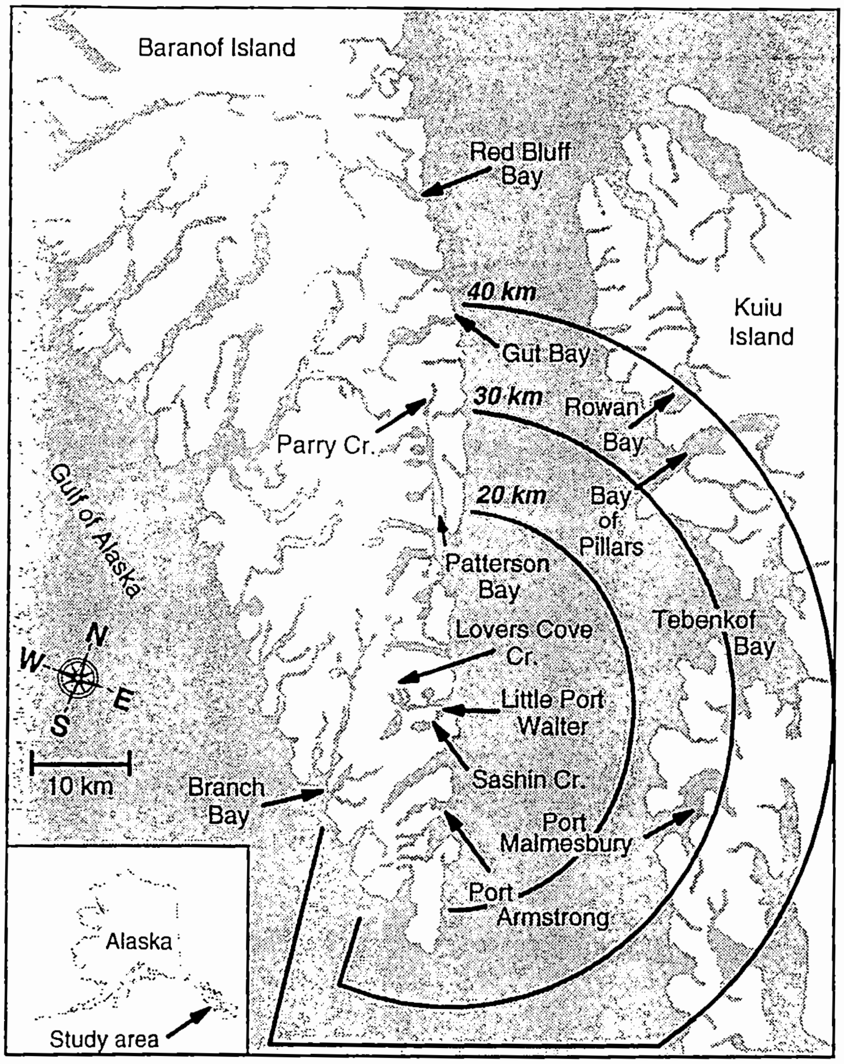

Figure 1. Map of Little Port Walter and vicinity.

Appendix 1

Comparison of Schaefer and Petersen Estimators for Estimating Pink Salmon (Oncorhynchus gorbuscha) Escapements.

Introduction:

Project 97097 proposed using a carcass mark-recapture sampling design to estimate escapements of pink salmon to unweired streams. This approach incorporated a carcass mark-recapture design and the Jolly-Seber estimate was used as the population estimator. However, surveys in the Auke Bay area in 1996 indicated that carcass marking seriously underestimated escapement due to frequent flushing out of the stream system. To compensate for the dynamic nature of the streams, a live fish tagging - carcass recapture sampling design is proposed. The Jolly-Seber estimate could no longer be used since it assumes marking during the sampling period. In the revised design the sampling takes place after the tagged fish die.

Pink salmon escapements may be regarded as a closed population since all fish can be examined as they enter the stream system and sampling is done throughout the spawning area. The Jolly-Seber estimate assumes an open, constantly changing population (Seber 1982). This would be true if the creek was sampled during a time period that did not cover the extent of the run, or the extent of the spawning grounds. However, when marking and sampling take place over the time span of the run and throughout the spawning area, all fish would have effectively passed through the marking area and ended up as carcasses in the sampling area. Therefore over the course of the sampling all fish have the potential of being examined. There is a fixed number of spawners escaping into the stream system, and once the run is complete this number will not change.

Since pink salmon escapement can be regarded as closed, the Petersen estimate is the most attractive of the mark-recapture estimators. There are two closed population estimators that are appropriate for this design, the Schaefer and Petersen. The Schaefer stratifies the population spatially or as in this case temporally and estimates the number of fish in the stream at the time of each marking event. The total escapement is then the sum of the individual estimates. The Petersen uses only the final total number of fish tagged, proportion recovered, and carcasses sampled for the escapement estimate (Seber 1982).

This model demonstrates the effect of the number of fish tagged and the proportion of tags recovered on the population estimate. Additionally a comparison and contrast between the Schaefer and Petersen estimates is made in order to demonstrate their applicability.

Methods:

The pink salmon escapement model of the average expected stream life cycle was based on observations made over numerous years at Sashin Creek, Auke Creek, and Prince William Sound (Olsen and McNeil 1967; Vallion et al. 1981; Sharr et al 1993). The total escapement period was set to 45 days with 80% of fish dying eight days after entering the stream (see figure 1).

The population is divided into two distributions, both composed of the same individuals, but temporally spaced: the marking distribution and the capture distribution. The marking distribution is composed of live fish arriving at the creek mouth, and the capture distribution is composed of the fish that died after ntering the stream. Ideally the two distributions are equal, but if marking causes live fish to exit the tream after tagging, or when marks are lost, the sampling distribution becomes a subset of the marking distribution. This results in overestimation of the population size. Other than examining adjacent streams for tagged fish, we cannot control for straying induced by tagging. However, we can control for tag loss by double tagging live fish. We can calculate a tag loss correction factor using the proportion of carcasses found with one tag missing (Seber 1982).

The simulated population estimate was derived by marking live fish over five events and measuring the proportion of marked carcasses in the recovery distribution over seven recovery events. Marking and sampling are done every four days. However, sampling does not take place until after the second marking event when tagged fish first start dying off, thereby entering the sampling distribution. The last marking event takes place on the 28th day of the run, whereas sampling occurs until the 44th day.

While the Schaefer (N_s) estimates the number of fish at each marking event (then summed to obtain the total population), the Petersen (N_p) estimates the whole population at once (Seber 1982).
Thus:

$$\hat{N}_s = \sum_{i=1}^{t} \sum_{j=1}^{u} \frac{n_j m_i c_{ij}}{c_{\cdot i}\ c_{\cdot j}} \qquad \hat{N}_s = \frac{\sum_{i=1}^{t} m_i \sum_{j=1}^{u} n_j}{\sum_{i=1}^{t} \sum_{j=1}^{u} c_{ij}} \qquad {}_s = \frac{\hat{N}^2\ (\hat{N} - \sum_{i=1}^{t} \sum_{j=1}^{u} c_{ij})\ (\hat{N} - \sum_{i=1}^{t} m_j}{\sum_{i=1}^{t} m_i \sum_{i=1}^{t} \sum_{j=1}^{u} c_{ij}\ (\hat{N}-1)}$$

where,
m_i = number of fish marked at time I
c_{ij} = number of carcasses recovered at time j that were marked at time I
n_j = total number of carcasses recovered at time j
t = total number of marking events
u = total number of recovery events

Variance could not be computed for the Schaefer model because no variance estimator is available for an unbalanced design (Seber 1982). Therefore only the Petersen variance was calculated to demonstrate how it is affected by the marking effort and the proportion of tags recovered. We used the removal variance estimator since every carcass that was examined will be chopped as to preclude future recovery.

To observe the model's sensitivity to the marking effort and the proportion of tags recovered, three scenarios of 100, 200, and 300 tagged fish per marking event were bootstrapped 1,000 times in a Lotus spreadsheet. Although the number of fish tagged was predetermined for each iteration of the model, the probability of recovering a fish at each of the sampling events was assigned at random. This allowed for unforseen events (i.e. floods) that flushed out most of the carcasses, resulting in unusually low recoveries during certain sampling events. Alternatively high recoveries would occur during other sampling events.

Results:

The Schaefer estimator produced more outliers than the Petersen. Errors in the estimation were especially large when a whole strata of tagged fish was never recovered (Figures 2, 3). When a whole strata of tagged fish was lost, the escapement was calculated based on the remaining marking events because the population estimate based on the fish marked at time *I* had to be assumed to be zero. When $c_{\cdot i} = 0$ the population was underestimated. The Petersen estimator, however, was unaffected by whole strata loss, as the total proportions of marked to unmarked carcasses remained unchanged.

The accuracy of the estimate was directly proportional to the marking effort and the proportion of marked carcasses recovered (Figure 2). The variance of the Petersen estimator was affected by the number of fish marked at a marking event (M_i) and the proportion of fish recovered. The variance increased three fold when the number of fish tagged decreased from M_i=300 to M_i=100 marks per marking event at all tag recovery proportions. However the variance only increased 1.5 times when M_i was decreased from 300 to 200. The proportion of tagged fish recovered had an even greater effect on the variance. The variance decreased from 4,300,000 at 15% recovery to 170,000 at 75% recovery at M_i=300, and displayed an exponential trend (Figure 2).

Discussion:

The Petersen population estimate appears to be more precise than the Schaefer estimate (Figures 2, 3), even though in the modeled population, the strata were based on recovery periods, with each strata having different capture probabilities. This is surprising because the Schaefer estimator is recommended when stratification of the population is suspected. The sampling design optimized for the Schaefer design requires the additional cost of utilizing separate tag codes for each of the marking events. This makes for more limited choice of tags and requires additional time to record and decode the tags.

Unless the Schaefer design has an equal number of tagging and recovery events, there is no available variance estimator. It is possible to force a balanced design in order to obtain a variance estimate, by pooling adjacent strata with similar recovery probabilities (Seber 1982). We did not pool the strata to calculate the variance, therefore it is unclear as to whether the variance would be smaller for the Schaefer than for the Petersen design. However, the variance estimators obtained through the bootstrapping of the model resulted in lower estimates for the Petersen than the Schaefer model (Figure 2).

Sampling effort must be divided between marking and recovery efforts. At the beginning of the run, all of the effort will be put into marking fish due to the time lag before entering the spawning grounds. Recovery effort should not start until after marked fish start dying. In the middle of the run, when the escapement rate is highest, the sampling effort should be equally spread between marking and recovery.

Great care should be taken to ensure that marked and unmarked carcasses have the same capture probabilities. Therefore the samplers should be very careful not to search out the tagged carcasses. The use of cryptic tags, which will require the samplers to closely examine each carcass in order to observe a tag, will greatly reduce sampling bias. However, whenever a fish attracts a sampler's attention because of a tag, the area around that recovery should be intensely surveyed. If the tag recoveries were made as the result of the sampler noticing the tag, however, some form of an adaptive sampling scheme would have to be utilized.

There are advantages to group-specific or individual-specific tagging, even though the Petersen provides a more accurate estimate without requiring such detailed tagging. In addition to providing data for a population estimate, individual-specific tagging can also be used to describe the escapement distribution through time, and, if recovery location is recorded, the spatial distribution of spawning through time.

Appendix References

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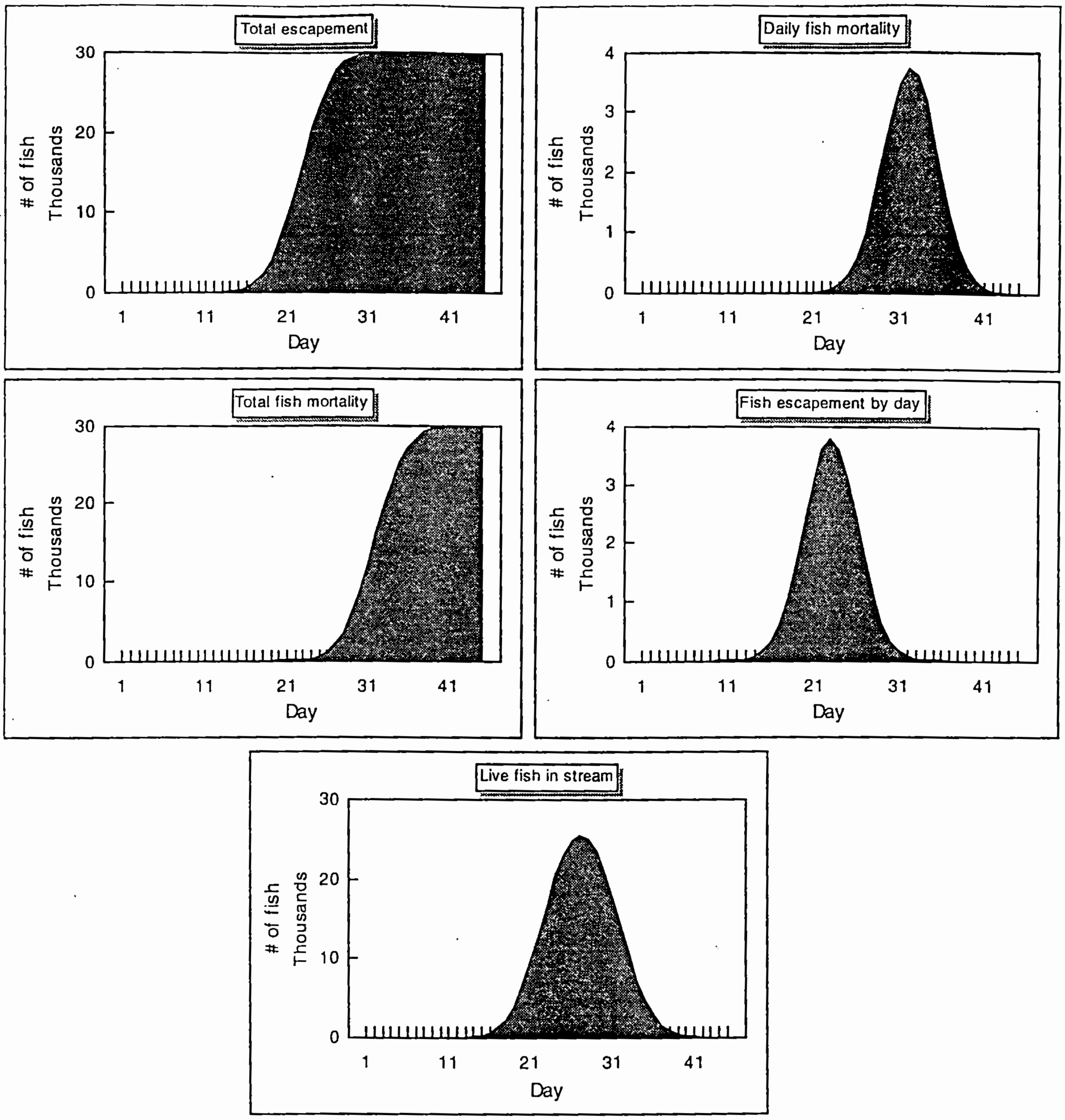

Figure 1. The hypothetical pink salmon escapement. The sampling design was applied to this modeled population. Fish available for marking (marking distribution) are represented by "Live fish in stream" graph. Tag recovery sampling is done from the "Total fish mortality" distribution.

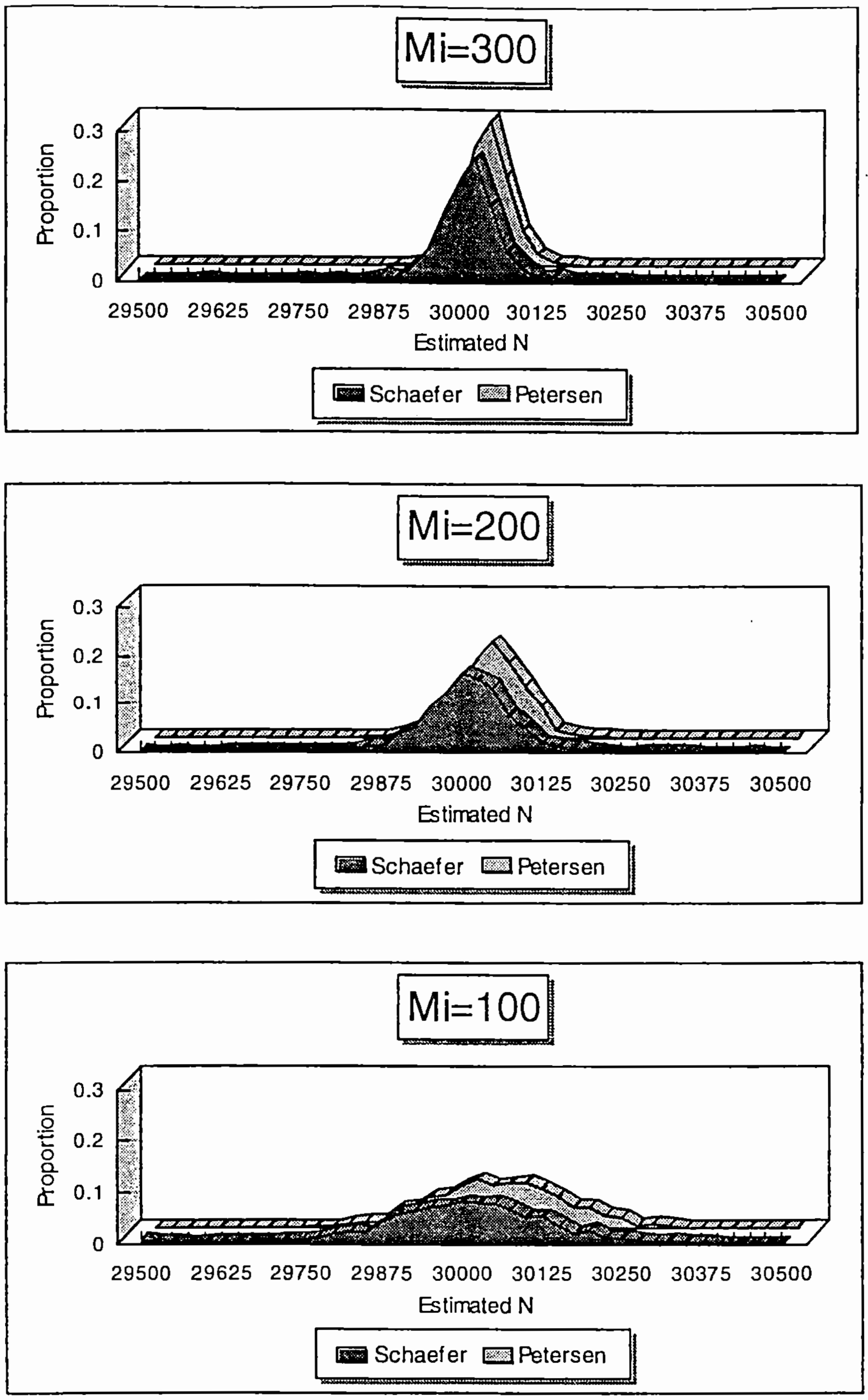

Figure 3. Probability distributions of the estimated population sizes for the Petersen and Schaefer estimators based on 1,000 iterations. Mi is the number of live fish tagged at each of the five marking events.

1998 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1997 - September 30, 1998

Budget Category:	Authorized FFY 1997	Proposed FFY 1998						
Personnel	$264.7	$166.1						
Travel	$29.9	$21.7						
Contractual	$170.2	$29.0						
Commodities	$53.6	$28.5						
Equipment	$8.4	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$526.8	$245.3	Estimated	Estimated	Estimated	Estimated	Estimated	
General Administration	$51.6	$26.9	FFY 1999	FFY 2000	FFY 2001	FFY 2002	FFY 2003	
Project Total	$578.4	$272.2	$0.0	$0.0	$0.0	$0.0	$0.0	
Full-time Equivalents (FTE)	4.0	3.1						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$307.5	$133.8	$50.0					

Comments:
This project includes elements of 191B.

Actual authorization for FY97 was $618.7, and the estimated projection for FY98 was $234.6K. This budget requests that the FY97 budget be reduced in contractual obligations by $37.6K and the FY98 budget be increased by the same amount to accommodate $32.8K for temporary personnel for the fall surveys in October of 1998. This action is requested due to changes in contracting and hiring procedures at the Alaska Science Center, and the overlap of the field operations between the two fiscal years (I. e., August-October operations).

NOAA Contribution:
Habitat Investigation Program Manager, S. Rice,1 mo = $10.9K
Principal Investigator, A. Wertheimer, 9 mo = $66.2K
Co-PI: Fishery Research Biologist, R. Heintz, 6mo = $34.1K
Little Port Walter Station Manager, F. Thrower, 1 mo = $7.0K
Additional operating costs of Little Port Walter Field Station = $15.6K

For a total NOAA Contribution of $133.8 K

1998

Prepared: 4/14/97

Project Number: 98076
Project Title: Oil Effects on Pink Salmon Straying
Agency: National Oceanic & Atmospheric Administration

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1997
J Thedinga	Co-PI: Fishery Research Biologist	12/3	10.0	5.5	1.3	56.3
R Heintz	Co-PI: Fishery Research Biologist	11/5	4.0	5.1	1.2	21.6
R Bradshaw	Fishery Research Biologist	9/5	6.0	4.2	1.2	26.4
J Maselko	Fishery Research Biologist	9/3	8.0	3.5	1.0	29.0
	Fisheries Technicians (11)	7/1	8.7	2.5	11.0	32.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		36.7	20.8	15.7	
					Personnel Total	$166.1

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
					0.0
Anchorage, January Workshop/coordination mtgs., 2	0.5	2	8	0.2	2.6
Miscellaneous					0.8
					0.0
Unidentified scientific meeting: present paper, 3					4.5
					0.0
Little Port Walter Field Station--4 staff, multiple trips					0.0
Beaver Charter	1.0	7			7.0
Cessna Charter	0.6	8			4.8
Miscellaneous					2.0
					0.0
					0.0
				Travel Total	$21.7

1998

Prepared: 4/14/97

Project Number: 98076
Project Title: Oil Effects on Pink Salmon Straying
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FFY 1997
NOAA Contract labor (incubation, egg/fry survival determination)	
3 x $20.00/h x 300 h ea	18.0
1x $18.00/h x 300 h ea	5.4
Contract X-ray Services for CWT pink salmon heads	5.6
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$29.0

Commodities Costs:	Proposed
Description	FFY 1997
Incubation Supplies (valves, trays, custom fabrication materials)	10.0
Groceries	6.0
Fuel	8.0
Film, report production costs	4.5
Commodities Total	$28.5

1998

Prepared: 4/14/97

Project Number: 98076
Project Title: Oil Effects on Pink Salmon Straying
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency
Outboard motors	1	NOAA
Video Camera	1	NOAA
Incubation Trays	180	NOAA
Computers/NEC Monitors	2	NOAA
Palette Recorder	1	NOAA
Egg Sorter/Counter	1	NOAA

1998

Prepared: 4/14/97

Project Number: 98076
Project Title: Oil Effects on Pink Salmon Straying
Agency: National Oceanic & Atmospheric Administration

FORM 3B
Equipment
DETAIL

Habitat Protection and Acquisition Support

Project Number:	98126
Restoration Category:	Habitat Protection
Proposer:	AK Dept. of Natural Resources
Lead Trustee Agency:	ADNR, USFS
Cooperating Agencies:	ADF&G, USFS, DOI
Duration:	FFY 1998 - TBD
Cost FY 98:	$ 938.7
Cost FY 99:	$ To be determined
Cost FY 00:	$ To be determined
Cost FY 01:	$ To be determined
Geographic Area:	Prince William Sound, Kenai Peninsula, Alaska Peninsula Kodiak Archipelago
Injured Resource/Service:	Multiple Resources

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EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

Project 98126 provides negotiation support to the Trustee Council in order to reach closure on habitat protection priorities. This support includes those services such as title reports, appraisals, on site inspections, hazardous materials surveys, surveys, timber cruises and reviews, and other services necessary for the successful completion of habitat protection negotiations.

INTRODUCTION

This project is designed to support habitat protection activities of the Trustee Council and is a continuation of the Comprehensive Habitat Protection Process. These activities include evaluations by the Habitat Work Group, appraisals, title searches, hazardous materials surveys and other efforts necessary for the Trustee Council to achieve habitat protection objectives. In 1993, the Restoration Team, Habitat Protection Work Group conducted a survey and assessment of selected large parcels of private land (>1000 acres) within the oil spill zone. The lands were mapped, scored and ranked to determine the restoration value of these areas to injured resources and services and the benefits that could be achieved through habitat protection. Successful negotiations were conducted with owners of lands within Kachemak Bay State Park and on northern Afognak Island resulting in the purchase of the park inholdings and in the establishment of the Afognak Island State Park. In addition, negotiations were recently completed with Akhiok Kaguyak and Old Harbor Native Corporation for the purchase of habitat protection rights on lands located within the Kodiak National Wildlife Refuge, with Eyak Corporation for timber rights in the Orca Narrows viewshed and with the Kodiak Island Borough for lands on Shuyak Island. Negotiations are nearing completion with Chenega Corporation for habitat protection rights in western Prince William Sound.

In 1995, Volume III of the Comprehensive Habitat Protection Process, *Small Parcel Process, Evaluation and Ranking* was completed. Responses to the solicitation for nominations of small parcels were processed and evaluated. A second round of small parcel nominations were received and evaluated. The Trustee Council is currently moving forward with acquisition of a suite of small parcel nominations that best meet the restoration goals and objectives identified by the Trustee Council.

Negotiations continue with several large parcel landowners as well as with numerous small parcel landowners. Reaching closure on these agreements requires substantial technical support. It is expected that Trustee Council efforts in this area while reaching closure on many fronts will continue in the near term.

NEED FOR THE PROJECT

The objective of habitat protection is to identify and protect essential wildlife and fisheries habitats and associated services and to prevent further environmental damage to resources injured by the *Exxon Valdez* oil spill. Nineteen resources and services injured by the spill are linked to protection of upland and nearshore habitats (See Section D). Protection of lands containing these habitats prevents additional injury to resources and services and natural support systems while recovery is taking place. Active negotiations with landowners for packages of ranked parcels are currently taking place and anticipated to continue into the Fall. Evaluations, starting with field surveys, of large and small parcels submitted this Spring will also continue into the Fall. This project provides support for HWG to provide technical support to the negotiators and the Executive Director and to conduct these additional evaluations.

COMMUNITY INVOLVEMENT

The public has reviewed and commented favorably on all habitat protection efforts and has been highly supportive of habitat protection as a major restoration strategy into the future. All reports published as part of the Comprehensive Habitat Protection Process have been reviewed by the public. Input from natural resource and services specialists in the public sector was collected in a workshop conducted by The Nature Conservancy.

Members of local communities have previously had the opportunity to review habitat protection evaluation and ranking results and Trustee Council priorities. The Trustee Council continues to be receptive and responsive to public comment pertinent to habitat protection priorities and acquisitions. This project is the completion of the habitat protection effort and no further community involvement is expected at this time. The Trustee Council is always willing to entertain comment from interested individuals.

PROJECT DESIGN

A. Objectives

Habitat protection and acquisition is designed to protect lands linked to resources and services that were injured by the Exxon Valdez oil spill. Protection of these lands prevents additional injury to living resources and habitats, services and natural support systems while recovery is taking place. Habitat protection addresses cases where existing regulations affecting private land use are inadequate to protect essential habitats of recovering resources and services. In situations where natural recovery is slow to occur or where direct restoration is neither technically feasible or cost effective, other measures need to be considered to mitigate injury. These may include replacement of injured resources and services with those that are equivalent {Replacement or acquisition of the equivalent means compensation for an injured, lost or destroyed resource by substituting another resource that provides the same or substantially similar services as the injured resource (56 Federal Register 8899 [March 1, 1991]).

The affected injured resources and associated services are listed below. Habitat protection objectives and benefits for each of these resources and services would differ depending on the particular parcel and the options acquired, however, general objectives and benefits are outlined below.

Pink salmon, sockeye salmon, cutthroat trout, Dolly varden, herring: ensure maintenance of adequate water quality, riparian habitat and intertidal habitat for spawning and rearing.

Bald eagle: ensure maintenance of adequate nesting habitat and reduce disturbance in feeding and roosting areas.

Black oystercatcher: reduce disturbance to feeding and nesting sites.

Common murre: reduce disturbance in nearshore feeding areas and near nesting colonies.

Harbor seal and sea otters: reduce disturbance at haul-out sites, pupping sites, and in nearshore feeding areas.

Harlequin duck: ensure maintenance of adequate riparian habitat for nesting and brood rearing, and reduce disturbance to nearshore feeding, molting, and brood-rearing habitats.

Intertidal/subtidal biota: maintain water quality along shoreline and reduce disturbance in nearshore areas.

Marbled murrelet: ensure maintenance of adequate nesting habitat and reduce disturbance to nearshore feeding and broodrearing habitats.

River otter: ensure maintenance of adequate riparian and shoreline habitats for feeding and denning.

Recreation: Maintain or enhance public access for recreational opportunities, reduce disturbances that would create visual impacts.

Wilderness: Maintain wilderness qualities, reduce impacts to wilderness qualities.

Cultural resources: Maintain or reduce disturbance to cultural resource sites.

Subsistence: Ensure subsistence opportunities in known harvest areas.

B. Methods:

The *Habitat Protection and Acquisition Process* is the method for acquiring lands or partial interests in lands that contain habitats linked to resources and/or services injured by the oil spill. Protection tools that will be considered for use by the Trustee Council include: fee acquisition, conservation easements, acquisition of partial interests, cooperative management agreements, and others. Following purchase, acquired parcels will be managed by the appropriate resource agency in a manner that is consistent with the restoration of the affected resources and/or services. The Trustee Council will decide which agency will manage the land or may create a new management authority.

Funds from this project will be used to acquire full title or partial interests in lands, subject to approval by the Trustee Council, that contain habitats/sites linked to resources and services that were injured by the Exxon Valdez oil spill. Acquisition of lands or interests in lands will be accomplished according to accepted realty principles and practices. All acquisitions will require title evidence, appraisals of fair market value, litigation reports, hazardous substances surveys, legal review of title, and negotiations. Some acquisitions may require land surveys and additional ecological surveys.

C. Contracts and Other Agency Assistance

Various components of this project will be contracted out to the private sector. Contracting is managed by the agency responsible for acquisition of habitat protection rights and future management. Various agencies handle various realty requirements differently depending upon agency requirements and in house expertise.

SCHEDULE

This project is a continuation of 93064, 94126, 95126, 96126, and 97126, and does not lend itself to a specific timetable. Activities associated with this project are subject to influence from landowners, negotiators and various contractors.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

All habitat protection efforts including this project are dependent upon the results of on-going research and monitoring projects. For example, the Large Parcel Element used information from the anadromous fish stream catalog, colonial seabird catalog, bald eagle nesting maps, and data from Trustee Council funded studies on black oystercatchers, marbled murrelets and pigeon guillemots.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

There is no substantive change anticipated for FY 97. It is anticipated that the approach to habitat protection acquisitions pursused by the Trustee Council will remain essentailly the same. Negotiations are ongoing with both large and small parcel landowners.

ENVIRONMENTAL COMPLIANCE

Previous acquisitions have received a categorical exclusions. The appropriate federal agencies, US Dept. of the Interior or US Forest Service will comply with NEPA where appropriate.

PERSONNEL

Project Leaders

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1996 EXXON VALDEZ TRUST)UNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1997	Proposed FFY 1998	PROPOSED FFY 1998 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	NPS	FWS
				$16.7	$314.6	$276.6	$24.7	$276.6
Personnel	$488.6	$430.5						
Travel	$75.2	$47.7						
Contractual	$592.7	$362.4						
Commodities	$8.5	$8.2						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$1,165.0	$848.8	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	
General Administration	$110.7	$89.9						
Project Total	$1,275.7	$938.7	$570.0	$365.0	$165.0	$0.0	$0.0	$0.0
Full-time Equivalents (FTE)	10.0	6.9						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

NOTE: This project is a continuation of Project 97126.

This budget is based upon the current status of ongoing negotiations as of April 15, 1997. It is expected that negotiations will continue throughout the summer causing further revisions of this budget as the status of these negotiations change. This budget is based upon the assumption that negotiations with Afognak Joint Venture, Chugach Alaska Corporation, Eyak, Koniag, Port Graham, Tatitlek, and several small parcels will require additional work.

Note: If survey, posting and boundary marking are required for acquired lands additional funding will be requested.

Note: Mineral appraisals will be needed for all subsurface.

1998

Prepared:

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Lead Agency: AK Dept. of Natural Resources

FORM 2A
PROJECT
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1997	Proposed FFY 1998						
Personnel	$35.4	$42.6						
Travel	$4.5	$4.5						
Contractual	$331.6	$243.6						
Commodities	$0.5	$0.5						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$372.0	$291.2	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated	Estimated	
General Administration	$24.4	$23.4						
Project Total	$396.4	$314.6	$200.0	$100.0	$75.0			
Full-time Equivalents (FTE)	2.0	0.5						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

1998

Prepared:

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Natural Resources

FORM 3A
AGENCY
PROJECT
DETAIL

1996 EXXON VALDEZ TRUST ЭUNCIL PROJECT BUDGET
October 1, 1996 - ꟾeptember 30, 1997

Personnel Costs:			GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1998
	TBD	Natural Resource Manager II	20	3.0	7,200	0	21.6
	TBD	Natural Resource Manager II	20	3.0	7,000	0	21.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		6.0	14,200	0	
Those costs associated with program management should be indicated by placement of an *.						Personnel Total	$42.6

Travel Costs:		Ticket	Round	Total	Daily	Proposed
PM	Description	Price	Trips	Days	Per Diem	FFY 1998
						0.0
	Travel to Prince William Sound and Gulf of Alaska for purposes of					0.0
	survey, title verification, and recordation, appraisal review and site	300	5	10	150	3.0
	inspections.					0.0
						0.0
	Travel to Juneau for Trustee Council briefings, presentations.	444	2	4	150	1.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					Travel Total	$4.5

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Natural Resources

FORM 3B
Personnel
& Travel
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Contractual Costs: Description	Proposed FFY 1998
Printing and Map Production, maps and data analysis for negotiators, appraisers, land status verification	20.0
Aircraft charters to uplands to further refine parcel boundaries (24 hours @ $400.00/hour)	9.6
Services necessary for the Trustee Council to reach closure on purchase agreement for parcels under negotiation. This may include, title reports, litigation reports, appraisal reviews, timber reviews, hazardous materials assessments.	146.0
Advertising	1.0
Document production and printing costs.	2.0
Small Parcel Title Insurance	10.0
Small Parcel Appraisals	20.0
Closing and recordation of final title documents, surveys, purchase agreements. This will involve travel to local recording districts.	20.0
Hazardous Materials Review - AJV, Small Parcels	15.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$243.6

Commodities Costs: Description	Proposed FFY 1998
Office and field supplies (toner cartridges, data cassettes, waterproof notebooks)	0.5
Commodities Total	$0.5

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Natural Resources

FORM 3B
Contractual &
Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Natural Resources

FORM 3B
Equipment
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1997	Proposed FFY 1998						
Personnel	$13.0	$13.0						
Travel	$3.5	$1.2						
Contractual	$1.0	$0.3						
Commodities	$0.5	$0.2						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$18.0	$14.7	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated	Estimated	
General Administration	$2.0	$2.0						
Project Total	$20.0	$16.7	$20.0	$15.0	$15.0			
Full-time Equivalents (FTE)	0.2	0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1996

Prepared:

Project Number: 97126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Fish & Game

FORM 3A
AGENCY
PROJECT
DETAIL

1996 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Personnel Costs:			GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1998
	TBD	Habitat Biologist III	18	2.0	6,500		13.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		2.0	6,500	0	
Those costs associated with program management should be indicated by placement of an *.						Personnel Total	$13.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
PM	Description	Price	Trips	Days	Per Diem	FFY 1998
						0.0
	Travel to Kenai to evaluate or facilitate small parcel acquisitions	100	4	4	200	1.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					Travel Total	$1.2

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Fish & Game

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs: Description	Proposed FFY 1998
Document reproduction.	0.3
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.3

Commodities Costs: Description	Proposed FFY 1998
Office supplies, paper, toner cartridges.	0.2
Commodities Total	$0.2

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Fish & Game

FORM 3B
Contractual &
Commodities
DETAIL

1996 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: AK Dept. of Fish & Game

FORM 3B
Equipment
DETAIL

4/15/97

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1997	Proposed FFY 1998					
Personnel	$11.8	$11.8					
Travel	$2.6	$2.6					
Contractual	$0.0	$8.0					
Commodities	$0.0	$0.0					
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS				
Subtotal	$14.4	$22.4	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated	Estimated
General Administration	$1.8	$2.3					
Project Total	$16.2	$24.7					
Full-time Equivalents (FTE)	0.2	0.2					
	Dollar amounts are shown in thousands of dollars.						
Other Resources							

Comments:

1998

Prepared:

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, National Park Service

FORM 3A
AGENCY
PROJECT
DETAIL

1996 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET

October 1, 1996 - ..ptember 30, 1997

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1998
PM	Name	Position Description					
							0.0
	Charles Gilbert	Realty Officer	13	1.0	5,900		5.9
	Stuart Snyder	Appraiser	13	1.0	5,900		5.9
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		2.0	11,800	0	
Those costs associated with program management should be indicated by placement of an *.						Personnel Total	$11.8

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1998
PM	Description					
						0.0
	Travel to Seward to conduct site visits, meet with negotiators.	100	4	4	150	1.0
	Travel to Port Graham to conduct site visits and	250	4	4	150	1.6
	meet with negotiators.					0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					Travel Total	$2.6

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, National Park Service

FORM 3B
Personnel
& Travel
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Contractual Costs: Description	Proposed FFY 1998
Title Insurance and Closing Costs	8.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$8.0

Commodities Costs: Description	Proposed FFY 1998
Commodities Total	$0.0

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, National Park Service

FORM 3B
Contractual &
Commodities
DETAIL

1996 EXXON VALDEZ TRUST OUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, National Park Service

FORM 3B
Equipment
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1997	Proposed FFY 1998						
Personnel	$255.2	$183.0						
Travel	$42.2	$14.4						
Contractual	$86.1	$47.0						
Commodities	$1.5	$1.5						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$385.0	$245.9	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated	Estimated	
General Administration	$44.3	$30.7						
Project Total	$429.3	$276.6	$150.0	$150.0				
Full-time Equivalents (FTE)	5.6	3.6						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1998	Project Number: 98126 Project Title: Habitat Protection & Acquisition Support Agency: Dept. of Interior, Fish & Wildlife Service	FORM 3A AGENCY PROJECT DETAIL

Prepared:

1996 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Personnel Costs:			GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1998
							0.0
	C. Rasmussen	Review Appraiser	13/7	4.0	5,364		21.5
	S. Schuck	Realty Specialist	12/8	12.0	5,909		70.9
	N. Parker	Realty Specialist	9/1	6.0	3,699		22.2
	S. Alexander	Realty Assistant	6/1	12.0	2,721		32.7
	K. Milton	Carto Tech	8/1	6.0	3,290		19.7
	G. Meuhlenhardt	Biologist	11/4	3.0	5,321		16.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		43.0	26,304	0	
Those costs associated with program management should be indicated by placement of an *.						Personnel Total	$183.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
PM	Description	Price	Trips	Days	Per Diem	FFY 1998
						0.0
	Travel to Kodiak	0.36	12	24	0.15	7.9
		0.2			0.14	0.0
						0.0
	Kodiak - Charter air service to specific tracts	1.5	4			6.0
						0.0
	Kenai - KNA and Salamatof	0.15	3			0.5
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					Travel Total	$14.4

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, Fish & Wildlife Service

FORM 3B
Personnel
& Travel
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Contractual Costs: Description	Proposed FFY 1998
Title Insurance and related fees.	27.0
Survey of approximately 12 10 acre sites	10.0
Appraisal	10.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$47.0

Commodities Costs: Description	Proposed FFY 1998
Office Supplies	1.5
Commodities Total	$1.5

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Interior, Fish & Wildlife Service

FORM 3B
Contractual &
Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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

1998	Project Number: 98126 Project Title: Habitat Protection & Acquisition Support Agency: Dept. of Interior, Fish & Wildlife Service	FORM 3B Equipment DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1997	Proposed FFY 1998						
Personnel	$173.2	$180.1						
Travel	$22.4	$25.0						
Contractual	$174.0	$63.5						
Commodities	$6.0	$6.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$375.6	$274.6	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated	Estimated	
General Administration	$38.2	$31.5						
Project Total	$413.8	$306.1	$200.0	$100.0	$75.0			
Full-time Equivalents (FTE)	2.0	2.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: This project is a continuation of project 97126.
This is an estimated budget prepared for the April 15 submittal. The budget is based upon negotiations continuing with Eyak Corp. and Chugach Alaska Corp. and one small parcel. This budget will be refined before the August Trustee Council meeting, based upon progress in Habitat Protection activities.

NOTE: If posting and marking are required for acquired Chenega and Tatitlek lands additional funding will be requested.

Note: Mineral appraisals will be needed for all subsurface. Costs will be determined by the August TC meeting.

1998

Prepared:

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Agriculture, Forest Service

FORM 3A
AGENCY
PROJECT
DETAIL

4/15/97

1996 EXXON VALDEZ TRUSTE OUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Personnel Costs:			GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1998
	D. Gibbons	Negotiator	14.0	3.0	8700.0		26.1
	J. Wolfe	Negotiator	15.0	1.0	9100.0		9.1
	R. Goosens	Appraiser	13.0	1.0	6300.0		6.3
	L. Keeler	Lands Specialist	12.0	5.0	5800.0		29.0
	K. Holbrook	Reality/Land parcel specialist	12.0	6.0	5800.0		34.8
	Vacant	Realty specialist	12.0	3.0	5800.0		17.4
	D. Gibbons	Natural Resource Manager	14.0	3.0	8700.0		26.1
	J. Swanson	Lands Examiner	9.0	2.0	4500.0		9.0
	R. Schrank	Cadastral Engineer	12.0	1	5800		5.8
	Vacant	Biologist	11	2.0	5200.0		10.4
	C. Woods	Lands Recorder	6	1.0	3500.0		3.5
	Vacant	Hydrologist	11	0.5	5,200		2.6
		Subtotal		28.5	74,400	0	
Those costs associated with program management should be indicated by placement of an *.						**Personnel Total**	$180.1

Travel Costs:		Ticket	Round	Total	Daily	Proposed
PM	Description	Price	Trips	Days	Per Diem	FFY 1998
						0.0
	RT Juneau to Anchorage to meet with review appraisers, contract appraisers and negotiators.	444.00	15	42	224.00	16.1
	RT Juneau to Washington DC	2500.00	2	6	224.00	6.3
	RT Anchorage to Cordova	200.00	3	9	224.00	2.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Those costs associated with program management should be indicated by placement of an *.					**Travel Total**	$25.0

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Agriculture, Forest Service

FORM 3B
Personnel
& Travel
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Contractual Costs: Description	Proposed FFY 1998
Title documents, title reports, purchase agreements, hazmat surveys.	10.0
Air Charters (30 hours @ $400/hour)	12.0
Title Insurance and closing costs for Eyak, Chugach Alaska Corp. and small parcels..	15.0
Appraisals (timber, land, minerals)	10.0
Mineral Surveys	15.0
Boat costs and fuel (10 days @ $150/day)	1.5
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$63.5

Commodities Costs: Description	Proposed FFY 1998
Office Supplies including paper, toner cartridges, software upgrades, binders, etc.	2.0
Duplication	2.0
Maps	2.0
Commodities Total	$6.0

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Agriculture, Forest Service

FORM 3B
Contractual &
Commodities
DETAIL

4/15/97

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1998

Project Number: 98126
Project Title: Habitat Protection & Acquisition Support
Agency: Dept. of Agriculture, Forest Service

FORM 3B
Equipment
DETAIL

Project Title: Tatitlek Coho Salmon Release

Project Number:	98127
Restoration Category:	General Restoration
Proposer:	Tatitlek IRA Council
Lead Trustee Agency:	ADF&G
Cooperating Agencies:	Tatitlek IRA Council
Alaska SeaLife Center	
Duration:	4th year, 5 year project
Cost FY 98:	$12,100
Cost FY 99:	$12,100
Geographic Area:	Boulder Bay, Prince William Sound
Injured Resource/Service:	Salmon/Subsistence

RECEIVED
APR 11 1997
EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

Project will create a coho salmon return to Boulder Bay near Tatitlek village. Enough coho eggs to produce 50,000 smolt will be collected from an ADF&G approved stream, incubated and reared to smolt at the Solomon Gulch Hatchery transported and held for two weeks in net pens in Boulder Bay before release. Release will produce a 2,000 to 3,000 adult return to Boulder Bay for harvest in a subsistence fishery.

A. INTRODUCTION

Subsistence fisheries available to residents of Tatitlek village were severely disrupted by the *Exxon Valdez* oil spill. This project is intended to enhance subsistence resources near Tatitlek by creating a 2,000 to 3,000 coho salmon return to Boulder Bay which is immediately adjacent to Tatitlek village. This resource is intended to partially replace for the near term other subsistence resources, such as harbor seal, that were injured by the spill

This coho salmon return will be created through an annual release of 50,000 coho salmon smolt in Boulder Bay. The smolt are produced at the Solomon Gulch Salmon Hatchery under an agreement between its operator, the Valdez Fisheries Development Corporation and the Tatitlek IRA Council. The coho salmon eggs needed to produce the smolt come from a wild coho run that has been approved by ADF&G for the egg take. The eggs are taken to the Solomon Gulch hatchery for incubation and rearing to the smolt stage. The sea ready smolt are then transported by boat to Boulder Bay and are imprinted to the bay by placing them in net pens for about a two week period before being released into the wild.

This project was approved by the EVOS Trustee Council in FY 95. Funds were appropriated to underwrite the environmental assessment, a draft of which has been produced. Funds received in FY 96 and beyond will be used to produce the coho salmon returns to Boulder Bay.

NEED FOR THE PROJECT

A. Statement of Problem

Subsistence harvests by Tatitlek village residents have declined considerably since the oil spill. Most marine resources that were utilized for subsistence by Tatitlek villagers have not substantially improved since the spill. Subsistence harvests are still a lot less then they were prior to the spill.

B. Rationale/Link to Restoration

This project would enhance the recovery of the local salmon resource that is utilized for subsistence and provide a means for lessening the impacts of continued harvests on other subsistence harvests injured by the spill such as harbor seals.

C. Location

This project will be undertakes at the Solomon Gulch Hatchery and in Boulder Bay near Tatitlek. The benefits will be realized by those participating in the subsistence fishery created by this project. These will mainly be residents from Tatitlek.

COMMUNITY INVOLVEMENT

This project was initiated at the request of the Tatitlek Bay IRA Council. The council negotiated the agreement with the Valdez Fisheries Development Corporation to produce the smolt for the project. Members of the village set up the net pen site each year in Boulder Bay and hold and feed the smolt each year prior to release. The villagers participate in the subsistence fishery on the returning adults.

PROJECT DESIGN

A. Objectives

1. Continue agreement with the Valdez Fisheries Development Corporation to produce 50,000 coho salmon smolt for release in Boulder Bay.

2. Imprint smolt to Boulder Bay by holding and feeding them in net pens in the bay for two weeks prior to release into the wild.

3. Harvest for subsistence 2,000 to 3,000 coho salmon annually upon their return to the imprint site.

B. Methods

The purpose of this project is to create a run of coho salmon in Boulder Bay near Tatitlek for subsistence use. The project would be undertaken annually and could be classified as "put and take" since it is unlikely that the coho returns produced by this project would establish a wild run. There are four basic steps to the project; egg take, incubation and rearing to the smolt stage, imprinting and release of smolt and the subsistence harvest.

The Solomon Gulch hatchery is responsible for the egg take and smolt production, Tatitlek village is responsible for imprinting and releasing the smolt into the wild. The subsistence fishery is open to all, but mostly consists of Tatitlek village residents.

The eggs are taken from a coho run approved by ADF&G for use in this project. Enough eggs are taken to produce 50,000 smolt. They are taken to the Solomon Gulch hatchery where standard fish culture practices are utilized to incubate the eggs and rear the resultant fry to the smolt stage. The smolt are then transported by boat to Boulder Bay where they are placed in net pens and held (and fed) for a two week period during which time they imprint to Boulder Bay. The smolt are then released into the wild and proceed to their ocean rearing grounds returning back to Boulder Bay approximately 12 months later as adults. Around 2,000 to 3,000 adult coho salmon return to Boulder Bay from the smolt release. As many of these fish as possible (usually 75% to 85%) are harvested in a subsistence fishery that has been set up specifically for this purpose. The unharvested fish die without spawning.

C. Cooperating Agencies, Contracts and Other Agency Assistance

The Tatitlek IRA Council is contracted by ADF&G to oversee this project. The council in turn contracts with the Valdez Fisheries Development Corporation to take the eggs and produce the smolt.

SCHEDULE

A. Measurable Project Tasks for FY 98

August, 1997	Egg take
May 20 to 25, 1998	Smolt transported to Boulder Bay and placed in net pens.
June 3 to 8, 1998	Smolt released into Boulder Bay
August, 1998	Egg take

B. Project Milestones and Endpoints

Objective 1.	Initial agreement in place. Will be reviewed and renewed by April 15 each year.
Objective 2.	Completed by June 15 each year.
Objective 3.	Completed by July 15 annually.

C. Completion Date

This project will continue until the subsistence resources injured by the spill have fully recovered.

PUBLICATIONS AND REPORTS

Annual reports	Describe project activities for each fiscal year. Due April 15 following the fiscal year being reported on.
Final report	Synopsis of each year's activities and analysis of project as a whole. Due April 1 following the year in which the final adult return occurs.

PROFESSIONAL CONFERENCES

No travel to professional conferences is planned under this project.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

There appear to be no opportunities to coordinate or integrate this project with other restoration efforts.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

There are no project design or schedule changes in this proposal from the DPD approved by the Trustee Council for FY 97.

PROPOSED PRINCIPAL INVESTIGATOR

Gary Kompkoff, President
Tatitlek IRA Council
Box 171
Tatitlek, AK 99677
Phone (907) 325-2311
Fax (907) 325-2298

FY 98 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Budget Category:	Authorized FFY 1997	Proposed FFY 1998					
Personnel	$0.0	$0.0					
Travel	$0.0	$0.0					
Contractual	$11.3	$11.3					
Commodities	$0.0	$0.0					
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS				
Subtotal	$11.3	$11.3	Estimated FFY 1999	Estimated FY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004
General Administration	$0.8	$0.8					
Project Total	$12.1	$12.1	$12.1	$0.0	$30.9	$0.0	$0.0	$0.0
Full-time Equivalents (FTE)		0.0					
	Dollar amounts are shown in thousands of dollars.						
Other Resources							

Comments:

FY 98

Prepared : 4/8/97

1 of 8

Project Number: 97127
Project Title: Tatitlek Coho Release
Agency: AK Dept. of Fish & Game

FORM 3A
AGENCY
PROJECT
DETAIL

Printed: 4/10/97

FY 98 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Personnel Costs:			GS/Range/	Months	Monthly		Proposed
PM	Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1998
*							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		0.0	0	0	
Those costs associated with program management should be indicated by placement of an *.						**Personnel Total**	$0.0

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

FY 98

Project Number: 98127
Project Title: Tatitlek Coho Release
Agency: AK Dept. of Fish & Game

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FFY 1998
Contract with non-trustee agency	11.3
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$11.3

Commodities Costs:	Proposed
Description	FFY 1996
Commodities Total	$0.0

FY 98

Project Number: 98127
Project Title: Tatitlek Coho Release
Agency: AK Dept. of Fish & Game

FORM 3B
Contractual &
Commodities
DETAIL

FY 98 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FFY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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	Inventory
Description	of Units	Agency

FY 98

4 of 8

Project Number: 98127
Project Title: Tatitlek Coho Release
Agency: AK Dept. of Fish & Game

FORM 3B
Equipment
DETAIL

Printed: 4/10/97

FY 98 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Budget Category:	Authorized FFY 1997	Proposed FFY 1998					
Personnel	$2.6	$2.6					
Travel	$0.0	$0.0					
Contractual	$6.1	$6.1					
Commodities	$1.6	$1.6					
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS				
Subtotal	$10.3	$10.3	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004
Indirect	$1.0	$1.0						
Project Total	$11.3	$11.3	$11.3	$0.0	$0.0	$0.0	$0.0	$0.0
Full-time Equivalents (FTE)		0.1						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY 98

Prepared: 4/7/97

Project Number: 98127
Project Title: Tatitlek Coho Release
Name: Tatitlek IRA Council

FORM 4A
Non-Trustee
DETAIL

Printed: 4/10/97

FY 98 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Personnel Costs:						
Name	Position Description		Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1998
	Net Pen Worker		0.5	$2,500		1.3
	Net Pen Worker		0.5	$2,500		1.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	5,000	0	
					Personnel Total	$2.6

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

FY 98

Project Number: 98127
Project Title: Tatitlek Coho Release
Name: Tatitlek IRA Council

FORM 4B
Personnel
& Travel
DETAIL

Printed 6/97

FY 98 EXXON VALDEZ TRUSTE)UNCIL PROJECT BUDGET
October 1, 1997 - September 30, 1998

Contractual Costs:	Proposed
Description	FFY 1998
Transport 20,000 coho smolt to Boulder Bay	5.5
village skiff rental	0.6
Contractual Total	$6.1

Commodities Costs:	Proposed
Description	FFY 1998
Fish Food	1.2
Skiff fuel/oil	0.2
Misc. supplies	0.2
Commodities Total	$1.6

FY 98

Project Number: 98127
Project Title: Tatitlek Coho Release
Name: Tatitlek IRA Council

FORM 4B
Contractual &
Commodities
DETAIL

FY 98 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1997 - September 30 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1998
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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

FY 98

Project Number: 98127
Project Title: Tatitlek Coho Release
Name: Tatitlek IRA Council

FORM 4B
Equipment
DETAIL

Printed ..../97