19.08.05 (3 of 5)

approved TC 8-9-99

A Genetic Study to Aid in Restoration of Murres, Guillemots and Murrelets to the Gulf of Alaska.

Project Number:	00-169
Restoration Category:	Research
Proposer:	Queen's University (V.L. Friesen) & DOI (J.F. Piatt)
Lead Trustee Agency:	DOI
Cooperating Agencies:	U.S. Geological Survey
Alaska SeaLife Center:	no
Duration:	4th year, 4-year project
Cost FY00:	$19.2
Geographic Area:	Gulf of Alaska and neighboring areas
Injured Resource:	common murre, pigeon guillemot, marbled murrelet, Kittlitz's murrelet

ABSTRACT

Populations of common murres, pigeon guillemots, and marbled and Kittlitz's murrelets suffered high mortalities following the *Exxon Valdez* Oil Spill. We propose to finish our molecular analyses to measure genetic differentiation and gene flow among colonies of these species. This project will aid restoration by 1) determining the geographic limits of populations affected by the Spill, 2) identifying sources and sinks, and 3) identifying appropriate reference or 'control' sites for monitoring. As incidental results, it will also reveal cryptic species and subspecies, indicate the importance of inbreeding and small effective population sizes in restricting recovery, and suggest suitable source colonies for translocations.

INTRODUCTION

In the present proposal, we propose to complete our genetic research to aid restoration of common murres (*Uria aalge*), pigeon guillemots (*Cepphus grylle*), marbled murrelets (*Brachyramphus marmoratus*) and Kittlitz's murrelets (*B. brevirostris)* to the Gulf of Alaska. Specifically, in FY00 we proposed to use data collected in previous years on DNA sequence variation in mitochondrial DNA (mtDNA), microsatellites and nuclear introns to estimate gene flow and genetic differentiation among colonies of each species from the Spill area and outside sites. We have just completed the second year of this project: preliminary analyses indicate that gene flow occurs among colonies of common murres, that common and thick-billed murres (*U. lomvia*) hybridize extensively in the Gulf of Alaska, and that the present approach should provide reliable colony-specific markers for identifying the origins of birds killed by the Spill.

Marbled and Kittlitz's Murrelets.-Our previous studies of geographic variation in allozymes and cytochrome *b* sequences of murrelets indicated that the Asian and North American subspecies of marbled murrelets represent cryptic species that have been genetically isolated for 5-6 million years and that must be managed independently (Friesen et al. 1996a). Preliminary results from this study also suggested that North American populations of marbled murrelets may be genetically differentiated, and that Kittlitz's murrelets from Kachemak Bay and Attu Island are highly divergent and may represent cryptic subspecies or even species. However, both sample sizes and variabilities of these relatively slowly evolving genes were insufficient for assessing fine-scale differentiation. In FY97 we refined protocols for assaying variation in nine introns and three microsatellite loci in marbled murrelets, and screened samples from within the Spill area and neighboring sites. Results suggest that murrelets from the collection sites in the Aleutians differ genetically both from each other and from those in mainland North America (Congdon et al. submitted). In FY98, murrelets were screened for variation at one additional intron, but because of turnover in personnel, little other progress was made. In FY99 we are refining protocols for assaying sequence variation in the mitochondrial control region (mCR) and expanding our analyses to include murrelets from more distant sites, as well as birds from additional sites within the Spill area. Analyses of marbled and Kittlitz's murrelets should be essentially complete by the end of FY99; analyses of Kittlitz's murrelets are especially critical given the possibility of cryptic species.

Common Murres.-In FY97, we refined protocols for analyses of mCRs, microsatellites and introns in common murres, and screened samples for variation in the mCR and cytochrome *b*. In FY98 assayed samples for variation at five microsatellite loci and three introns. Preliminary analyses indicate that gene flow among colonies of common murres may be high (Patirana et al. in prep.), and that ~5% of murres from the Gulf of Alaska are hybrids or back-crosses between common and thick-billed murres. Simulations based on variation in three microsatellite loci among common murres from British Columbia, Washington, Oregon and California indicate that birds can be assigned to colonies with high confidence based on provide colony-specific markers that can be used to identify the origins of birds killed by the Spill. In FY99 we plan to complete our collections and analyses of DNA samples from common murres.

Pigeon Guillemots.-Previously, we surveyed variation in the mCR among populations of guillemots (*Cepphus* spp.) from throughout the Northern Hemisphere and found colony-specific sequence differences (Kidd and Friesen 1998). In FY97 we refined protocols for analysis of microsatellites and introns in guillemots, and in FY98 we continued tissue collections and assayed DNA samples for variation at one microsatellite locus and five introns. We plan to complete our collections and analyses of DNA samples from pigeon guillemots in FY99.

Because data collection is still in progress for all species, no restoration recommendations can be made at this point.

NEED FOR THE PROJECT

A. Statement of Problem

Alcids are highly vulnerable to marine oil pollution due both to the large amount of time they spend resting on the ocean surface, and to their dependence on marine fish and invertebrates for food. Many species of alcids suffered heavy mortality associated with the *Exxon Valdez* Spill; for example, the estimated mortality for common murres was in the hundreds of thousands. Although guillemots and murrelets were declining prior to the Spill, the accident probably increased their rate of decline. Common murres now appear to be recovering from the Spill, but pigeon guillemots and marbled murrelets apparently are not; the state of recovery of Kittlitz's murrelets is unknown. The reasons for the failure of these species to recover (as well as for the prespill declines) are unclear, but may be due to availability and quality of prey (currently being investigated through the APEX Predator Experiment and Nearshore Vertebrate Predator Project), and/or genetic problems such as genetic isolation of colonies or inbreeding. We are using state-of-the-art genetic techniques to aid in the restoration of these species.

B. Rationale/Link to Restoration

Although the application of molecular methods to fisheries and wildlife management is common (e.g. Ryman and Utter 1987, Hansen and Loeschcke 1994, Allendorf and Waples 1996, Graves 1996), few if any studies have used genetic methods explicitly to aid in seabird conservation (Friesen 1997). Theoretically, measurement of genetic divergence and gene flow among populations of murres, murrelets and guillemots will aid restoration in the following three main ways:

Definition of the geographic limits of the affected populations.-Many seabirds killed by the Spill were migrating; thus, the 'affected' zone, or the populations that were affected by the Spill and require restoration effort, may be geographically different from the Spill zone. Genetic data should enable identification of breeding populations and thus the geographic limits of the populations of birds killed by the Spill. Furthermore, if colonies are essentially panmictic and/or constitute metapopulations, they should recover without assistance within a few generations. However, if colonies constitute numerous localized populations, they may not naturally recolonize sites affected by the Spill, and may require human assistance for recovery.

Identification of sources and sinks.-According to metapopulation theory, 'source' populations are populations that occur in optimal habitat and can act as net exporters of recruits for populations elsewhere; 'sink' populations occur in suboptimal habitat and require immigration to maintain numbers (Pulliam 1996). Genetic data can provide measurements of gene flow into and out of colonies, and thus can enable identification of sources and sinks. For example, protein data suggest that rock shags (*Stictocarbo magellanicus*) on the Falkland Islands may have served as the main source of breeders for other colonies in southern South America (Siegel-Causey 1997). If colonies affected by the Spill represent sources, then their restoration will be critical. If a colony represents a sink, its restoration may be a waste of resources and may actually prevent recovery of the total population.

Environmental monitoring.-Demographic parameters may be very different for genetically divergent populations, even if they occur in ecologically similar or geographically proximate areas. For example, common murres breeding in Washington have different breeding chronologies from those at neighboring colonies in British Columbia, and may be genetically different (K. Warheit et al. unpubl. data). Genetic data may enable identification of appropriate reference or control sites from which to obtain baseline data for monitoring, restoration and modelling, e.g. to determine if a seabird colony has recovered normal functioning.

Three other types of information that are useful for conservation and restoration are produced incidentally by genetic studies.

Population uniqueness and cryptic species.-A colony's uniqueness (e.g. its endemicity or genetic distinctiveness) may be used to priorize restoration efforts. Most importantly, genetic data enable the identification of 'cryptic' species - populations that are similar in appearance but that represent separate, non-interbreeding species (e.g. long-billed [*Brachyramphus perdix*] and marbled murrelets; Friesen et al. 1996a).

Small effective population size and inbreeding.-The longterm effective size of a population is the size of an idealized population that would have the same amount of genetic variation as the population being considered; the longterm effective size of a population may be one or two orders of magnitude lower than the census size due to such factors as unequal breeding success and population bottlenecks (Futuyma 1998). For example, the North Atlantic population of thick-billed murres consists of approximately 2.5 million breeding pairs (Nettleship and Evans 1985), but appears to have a long-term effective size of only ~15,000 females (Friesen et al. 1996b). Theoretically, as a population's effective size decreases, individual fitness declines due to increased inbreeding (Allendorf and Leary 1986, Gilpen and Soulé 1986). Furthermore, several researchers have argued that if effective population size declines below a certain critical level, the population may enter an extinction vortex in which inbreeding, deleterious alleles and stochastic effects combine synergistically to accelerate extinction (Gilpin and Soulé 1986). Application of a new body of theory known as Coalescence Theory to genetic information may be used to estimate longterm effective population size and to place confidence limits on these estimates (Beerli 1999 and references therein). Thus the extent to which small effective population sizes and inbreeding are preventing or slowing population recovery may be inferred.

Translocations.-If breeding success within a colony is low due to inbreeding depression, or if recruitment is low, transplantation of small numbers of individuals from other sites may be desirable. Ideally, sources of animals for such introductions should be neighboring colonies within the same population or a closely related population. Genetic data are important for determining which colonies are genetically appropriate sources to prevent both inbreeding (Allendorf and Leary 1986) and outbreeding depression (Templeton 1986).

C. Location

This project requires collection of blood, feather and/or tissue samples from birds breeding thoughout the Pacific Basin, mostly in Alaska (Table 1). As much as possible, blood and blood feathers ('pin' or growing feathers) are being obtained from chicks or adults during banding through contributions from researchers working at specific sites. Birds being collected for ongoing diet studies in Alaska (J.F.P.) also are being used as a source of tissue. Sampling is being continued in FY99 to fill the 'holes' in Table 1; no further collections will be made in FY00.

Laboratory analyses are being undertaken in V.L.F.'s molecular laboratory at Queen's University. This laboratory is fully equipped for the assays described in the present proposal, and analyses of DNA variation in seabirds are routine; few other laboratories have the capability for assaying variation in mCRs, microsatellites *and* introns in seabirds. This laboratory receives additional technical and logistical support from the Queen's University Molecular Ecology Lab (run by Dr. Peter Boag), and the Queen's University Core Facility.

COMMUNITY INVOLVEMENT

The bulk of work involved in the proposed project must be conducted by highly trained personnel in a specially equipped research laboratory. We will attempt to obtain tissue samples from seabirds harvested for subsistence purposes when possible. Sample collections may require chartering local vessels and paying for assistance from local experts, hunters or vessel operators (see **Methods**). Information about the age of colonies, which is needed for interpretation of genetic results, will be sought from traditional knowledge. Project results will be communicated to local residents through popular reports in the Trustee Council newsletter when available.

PROJECT DESIGN

A. Objectives

The primary purpose of this project is to conduct a genetic analyses to aid in the restoration of common murres, pigeon guillemots, and marbled and Kittlitz's murrelets to areas affect by the Spill. We have three main objectives for each species:

1) To determine the geographic extent of the populations affected by the Spill.

2) To identify source and sink colonies.

3) To identify appropriate reference or 'control' sites for monitoring.

As incidental results, we should also be able

4) To identify cryptic species or subspecies.

5) To measure coefficients of inbreeding and effective population sizes.

6) To identify appropriate source populations for translocations, if necessary.

B. Methods

We are comparing DNA sequence variation in two mitochondrial genes, 6-8 microsatellite loci and 8-10 nuclear introns among approximately 30 birds from each of 12-15 colonies each for common murres, marbled murrelets and pigeon guillemots, and as many individuals as possible for Kittlitz's murrelets (Table 1). For each species, we are testing the null hypothesis that colonies are panmictic (i.e. genetic structure is essentially absent) against the alternative hypothesis that significant genetic differences exist among birds from different colonies.

Sampling.-To obtain reliable estimates of genetic differentiation and gene flow within and between the Spill area and neighboring areas, as well as to define the geographic limits of the populations affected by the Spill, we are sampling 4-6 colonies of each species from the Spill area, as well as 4-6 colonies each west and east of the Spill area. A minimum of 30 samples are required from each site for each species for reliable estimation of genetic variation within and among sites (Richardson et al. 1986, Weir 1996). Many of the necessary baseline samples were obtained opportunistically during previous research projects through the assistance of Vernon Byrd and Dave Roseneau (Alaska Maritime National Wildlife Refuge), Jay Pitocchelli, Tom van Pelt and Lindsey Hayes (U.S. Geological Survey, Anchorage), Alex Pritchard (University of Alaska), Jan Hodder (Oregon Institute of Marine Biology) and Kathy Martin (Canadian Wildlife Service). Other samples were available from tissue collections at the University of Alaska Museum and the Burke Museum (University of Washington), or were collected for dietary analyses in previous years by J.F.P. and his coworkers. Most samples are already in hand; the remainder are being obtained during FY99. Samples from birds killed by the Spill also are being obtained from the Burke Museum and will be screened for marker loci to determine their colony of origin.

Loci.-Much of southern Alaska was ice-covered during the Pleistocene glaciations, so most seabird colonies from the Spill area were probably only populated within the last ~10,000 years. Measurement of gene flow and genetic divergence among colonies of these birds therefore requires analysis of loci with high mutation rates. MtDNA has proven useful for studies of such species since it has a relatively high mutation rate and is more sensitive to population bottlenecks and restricted gene flow than are nuclear loci (Wilson et al. 1985, Avise 1994, Avise and Hamrick 1996, Mindell 1997). The mCR is especially useful for analyzing recent evolutionary events since it has a mutation rate 5-10x higher than the mean for mtDNA (Brown et al. 1986, Avise 1994, Avise and Hamrick 1996, Baker and Marshall 1997). Analysis of the mitochondrial cytochrome *b* gene also is useful for estimating population genetic structure and longterm effective population sizes in alcids since its mutation rate has been calibrated for this family (Friesen et al., unpubl.). However, mtDNA represents a single supergene whose pattern of inheritance is not typical of the rest of the genome (Wilson et al. 1985); results of analyses of mtDNA therefore need to be confirmed with analyses of nuclear loci. Microsatellite loci have mutation rates higher than those of mtDNA so are being used increasingly for evolutionary studies (Avise 1994, Dowling et al. 1996, McDonald and Potts 1997). However, depending on the age and size of populations, microsatellite loci may contain high levels of homoplasies (back-, parallel and convergent mutations), which may result in inaccurate estimates of genetic differentiation and gene flow. Nuclear introns have variabilities equivalent to those of mtDNA (Congdon et al. submitted), so also are useful for studying recent evolutionary events (Friesen et al. 1996; Holder et al., in press; Congdon et al. submitted). Because microsatellites and introns are nuclear loci, they are less sensitive to population bottlenecks and restricted gene flow than are mitochondrial genes; Moore (1995) estimated that, due to the larger effective population size of nuclear genes, 8-16 nuclear loci are required to obtain information equivalent to that of one mitochondrial gene. Previous researchers (e.g. Richardson et al. 1986, Weir 1996) have also suggested that information from at least five to six nuclear loci are required to obtain reliable estimates (i.e. to derive robust error estimates) of genetic structure and gene flow. Thus we are analyzing the mCR and cytochrome *b* gene, as well as 8-16 nuclear loci, with the specific number of each class of marker depending on observed levels of variability.

Laboratory Assays.-Variation in number of repeating units in microsatellite loci is being assayed using standard protocols (Dowling et al. 1996). To reduce time and cost associated with assaying sequence variation in mitochondrial genes and introns, a two-step procedure is being used. Samples first are screened for mutations using analysis of single-stranded conformational polymorphisms (SSCPs; Friesen et al. 1996a, 1997). The exact nature of mutations then is determined by direct sequence analysis of at least one individual with each genotype detected from SSCPs. Previous experience indicates that this combination of techniques provides an efficient and sensitive method for comparing sequence variation among populations (Friesen et al. 1996a, 1997, Congdon et al. submitted). We estimate that these analyses will be completed by the end of FY99.

Statistical Analyses.-Data are being analyzed using standard methods developed for analysis of data from protein electrophoresis and sequencing (e.g. Swofford & Selander 1981; Swofford 1993), as well as a few new techniques that capitalize on the power of combining genotypic and sequence data (e.g. Michalakis and Excoffier 1996, Beerli 1999):

1) To determine the geographic limits of populations affected by the Spill, the extent of genetic differentiation of colonies will be calculated using Wright's *F* statistics and its analogues (e.g. ϕ_{st}) and tested for significance using randomization procedures (e.g. Excoffier et al. 1992).

2) To identify source and sink colonies, the direction and magnitude of gene flow (including confidence limits) among colonies is being estimated using coalescence theory (Slatkin and Maddison 1989, Beerli 1999).

3) Appropriate reference or 'control' sites for monitoring, will be apparent from the results of objective (1); colony-specific markers (in the form of allele frequency differences at multiple loci) for impact assessment will be determined using SPAM (ADFG 1999) and Assign (M. Damus, unpubl. program)

4) Cryptic species will be inferred from (i) fixed allele differences, which indicate prolonged genetic isolation of populations, (ii) paraphyletic relationships among populations from different species, and/or (iii) high sequence divergences between the mitochondrial genomes of individuals from different populations.

5) Coefficients of inbreeding will be estimated from nuclear data using Wright's F statistics, and longterm effective population sizes (including confidence limits) will be estimated from mitochondrial sequence data using the method of Beerli (1999), which is based on Coalescence Theory.

6) Appropriate source populations for translocations will be apparent from the results of objective (1).

Alternative Methodologies.-Although gene flow and population genetic structure can be approximated from demographics (e.g. Rockwell and Barrowclough 1987), generation of these data involves longterm banding studies and is extremely labour-intensive, especially for species such as marbled and Kittlitz's murrelets with secretive nesting habits. Furthermore, estimates of genetic divergence from demographic data tend to miss occasional mass migrations, which may be important sources of gene flow in seabirds (e.g. Nettleship and Evans 1985). Traditional molecular methods such as protein electrophoresis also are not usually suitable for measuring genetic subdivision in populations either in birds or in species that breed at high latitudes due to low levels of variability (Evans 1987). Although DNA fingerprinting can reveal high levels of variability, it is expensive, laborious and time-consuming, and exhibits levels of homoplasy (genetic 'noise') too high for comparisons of populations. Finally, analysis of randomly amplified polymorphic DNA (RAPDs) requires high quality DNA, which is not available for many of our samples (e.g. murrelet stomachs preserved in ethanol from Washington); furthermore, many traditional methods of assessing genetic structure and gene flow cannot be applied to RAPD data either because of null alleles or because the exact nature of variation is not known. The approach outlined in the present proposal combines the strengths of classical protein electrophoresis with direct sequence analysis, and provides a powerful method for studies evolutionary genetics and conservation (e.g. Friesen et al. 1997, Congdon et al. submitted).

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Collections of blood and tissue were coordinated with other agencies (museums, wildlife agencies, etc.) by V.L.F. and J.F.P. Collections of seabirds for diet studies and genetic samples were coordinated with the USFWS, Alaska Maritime National Wildlife Refuge. No additional contracts or cooperating agencies are required to complete this project.

SCHEDULE

A. Measurable Project Tasks for FY00

Jan. 1 '00 - Feb. 29 '00:	Technician collates data for common murres, double-checks genotype scores and sequences, and analyzes data using Winamova, Migrate, Spam, etc.
Jan. '00:	PIs attend Annual Restoration Workshop
Mar. 1 '00 - Apr. 30 '00:	Technician collates data for murrelets, double-checks genotype scores and sequences, and analyzes data using Winamova, Migrate, Spam, etc.
May 1 '00 - Jun. 30 '00:	Technician collates data for guillemots, double-checks genotype scores and sequences, and analyzes data using Winamova, Migrate, Spam, etc.

May 1 '00 - Jun. 30 '00:	V.L.F. prepares manuscript based on results for common murres
Jul. '00:	V.L.F. and/or J.F.P. present interim results at conferences
Jul. 1 '00 - Aug. 31 '00: murrelets	V.L.F. prepares manuscript based on results for marbled
Sep. 1 '00 - Oct. 31 '00:	V.L.F. prepares manuscript based on results for guillemots
Nov. 1 '00 - Dec. 31 '00:	V.L.F. prepares manuscript based on results for Kittlitz's murrelets, as well as final report
Apr. 15 '01:	V.L.F. submits final report

B. Project Milestones and Endpoints

Jan. '97:	PIs attend Annual Restoration Workshop
Mar. 31 '97:	Technicians complete development of microsatellite protocols for guillemots, and refine protocols for analysis of introns and control regions for each species as necessary
Aug. 31 '97:	Field collections for FY97 completed
Dec. 31 '97:	Technicians complete screening of samples available up to and including FY97 for variation in the mitochondrial control region, eight microsatellite loci and ten introns
Jan. '98:	PIs attend Annual Restoration Workshop
Apr. 15 '98:	V.L.F. completes annual report for FY97
Aug. 31 '98:	Field collections for FY98 completed
Dec. 31 '98:	Technicians complete screening of samples collected in FY98
Mar. '99:	PIs attend Annual Restoration Workshop
Apr. 15 '99:	V.L.F. completes annual report for FY98
Aug. 31 '99:	Field collections for FY99 completed
Dec. 31 '99:	Technicians complete screening of samples collected in FY99
Jan. '00:	PIs attend Annual Restoration Workshop
Apr. 15 '00:	V.L.F. completes annual report for FY99
Jun. 30 '00:	V.L.F. and technicians complete data analysis (including all analyses outlined in **Objectives**) and manuscripts
Jul. '00:	V.L.F. reports results of studies at conferences
Apr. 15 '01:	V.L.F. submits final report

C. Completion Date

Data collection and analysis will be completed for all species by the end of 1999; final reports and manuscripts summarizing results of the completed projects for each species will be prepared during FY00.

PUBLICATIONS AND REPORTS

Four major publications will be prepared for publication following completion of the project in FY00; each will report estimates of genetic variability, genetic structure and gene flow for one target species. These papers will form the basis for the final report, and will be submitted to international peer-reviewed journals such as *Evolution*, *Molecular Ecology*, or *Auk*, as well as to managers involved with restoration.

PROFESSIONAL CONFERENCES

Final results of the project will be presented as contributed papers by the principal investigators at the annual meetings of the Society for Conservation Biology, the Society for the Study of Evolution and/or the American Ornithological Union in 2000 (locations and dates to be announced).

NORMAL AGENCY MANAGEMENT

Not applicable.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Collection of samples are being coordinated with ongoing studies of seabird feeding ecology in Alaska conducted by the Alaska Biological Science Center, USGS (J.F.P.) and the U.S. Fish and Wildlife Service (Alaska Maritime National Wildlife Refuge). Tissues and skeletons obtained from seabirds are being archived at the American Museum of Natural History (New York), and tissues also are being collected for use in ongoing studies of seabird trophic relationships using stable isotope ratios (K. Hobson, Canadian Wildlife Service, Saskatoon). Samples from carcasses salvaged from the Spill are being obtained from the Burke Museum. This project is made possible by previous contracts awarded to V.L.F. and Dr. Tim Birt by the Environmental Innovations Program of Public Works and Government Services Canada and the Lindbergh Foundation, which enabled the development of primers and protocols for 30 nuclear introns. The present project also is made possible through the donation of tissue samples from murres, murrelets and guillemots by field researchers in Canada and the United States (see **Methods - *Population surveys***); these samples are worth an estimated $12,500.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The slight increase in the budget over the costs projected in FY99 results from a cost for general administration and miscellaneous charges (Xeroxing, telephone calls, printer cartridges) overlooked in the budgets in previous years. Two technicians listed in the previous proposal were replaced (see Personnel). Otherwise, the present proposal does not differ from that approved in FY99.

PROPOSED PRINCIPAL INVESTIGATORS

PLEASE NOTE CHANGE IN FAX AND PHONE NUMBERS FOR V.L.F.

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Table 1. Sites, numbers of samples available, and numbers of samples needed for genetic analyses of murres, murrelets and guillemots.

Site	Avail-able	Needed
COMMON MURRE		
California (Farallon Islands)	30	0
Washington (Clallam)	30	0
N. Vancouver Island	40	0
Southeastern Alaska	0	30
Prince William Sound (Cordova)	23	7
Middleton Island	0	30
Central Cook Inlet (Kachemak Bay, Chisik I.)	48	0
Lower Cook Inlet (Barren Is.)	27	3
Central Alaska Peninsula (Semidi Is.)	24	6
Western Alaska Peninsula (Midun , Koniuji Is.)	18	12
Eastern Aleutians (Aiktak I.)	28	2
Western Aleutians (Attu, Agattu & Buldir Is.)	27	3
Bering Sea (Pribilof, St. Matthew, St. Lawrence Is.)	30	0
Chukchi Sea (Capes Lisburne & Thompson)	33	0
Sea of Okhotsk (Talan I., Magadanskaya)	30	0
Japan (Teuri I.)	0	30
MARBLED MURRELET		
California	40	0
Oregon	12	18
Washington	18	12
British Columbia (Queen Charlotte Is.)	30	0
Southeastern Alaska (Lemesurier I.)	20	10
Prince William Sound (Unakwik Fjord)	20	10
Cook Inlet (Kachemak Bay)	24	6
Kodiak Island	26	4
Mitrofania Bay	26	4
Shumagin Islands (Koniuji Is., Belkofski B., Yakutat P.)	22	8
Eastern Aleutians (Dutch Harbor)	12	18
Central Aleutians (Adak I.)	10	20
Western Aleutians (Attu I.)	18	12

Table 1, cont'd.

Site	Available	Needed
KITTLITZ'S MURRELET		
Prince William Sound	4	*
Kachemak Bay	18	*
Adak Island	6	*
Western Aleutians (Attu I.)	5	*
Bering Strait	*	*
PIGEON GUILLEMOT		
California (Farallon Is.)	20	10
Oregon	25	5
British Columbia (Queen Charlotte Is.)	30	0
Southeast Alaska (Glacier Bay)	0	30
Prince William Sound (Jackpot & Naked Is.)	30	0
Cook Inlet (Kachemak Bay)	9	21
Kodiak Island	0	30
Alaska Peninsula (Semidi, Shumagin, Tanakiak Is.)	17	13
Western Aleutians (Attu, Agattu Is.)	0	30
Kuril Is.	0	30
Bering Sea (Pribilof, St. Lawrence Is.)	0	30
Chukchi Sea (Capes Thompson and Lisburne)	0	30

*Samples will be obtained from Kittlitz's murrelets opportunistically.

NOTE: Every effort is made to obtain samples non-destructively to minimize the need for collections, e.g. as feathers or blood samples collected during banding, or from museum specimens.

2000 EXXON VALDEZ TRUSTEE C(IL PROJECT BUDGET

October 1, 1999 - September 30, 2000

approved TC 8-9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$0.0						
Travel		$0.0						
Contractual		$17.9						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$17.9			Estimated FY 2001	Estimated FY 2002		
General Administration		$1.3						
Project Total	$0.0	$19.2			$0.0	$0.0		
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

The slight increase in the budget over the costs projected in FY99 results from a cost for general administration, page charges and miscellaneous charges (Xeroxing, telephone calls, printer cartridges) overlooked in the budgets in previous years. Otherwise, the present proposal does not differ from that approved in FY99.

FY00

Prepared: 12 April 1999

Project Number: 00-169
Project Title: A genetic study to aid in the restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: DOI

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs: Name	Position Description	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	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 2000
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

FY00

Prepared:12 April 1999

Project Number: 00-169
Project Title: A genetic study to aid in the restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: DOI

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs: Description	Proposed FY 2000
4A Linkage	17.9
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$17.9

Commodities Costs: Description	Proposed FY 2000
Commodities Total	$0.0

FY00

Prepared:12 April 1999

Project Number: 00-169
Project Title: A genetic study to aid in the restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: DOI

FORM 3B
Contractual &
Commodities
DETAIL

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

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

FY00

Prepared:12 April 1999

Project Number: 00-169
Project Title: A genetic study to aid in the restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: DOI

FORM 3B
Equipment
DETAIL

2000 EXXON VALDEZ TRUSTEE CO[illegible]L PROJECT BUDGET
October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$13.8						
Travel		$1.5						
Contractual		$0.0						
Commodities		$1.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$16.3			Estimated FY 2001	Estimated FY 2002		
Indirect		$1.6						
Project Total	$0.0	$17.9						
Full-time Equivalents (FTE)		0.5						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: Indirect charges involve 10% overhead on all costs for Queen's University

FY00

Prepared:12 April 1999

Project Number: 00-169
Project Title: A genetic study to aid in the restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: DOI

FORM 4A
Non-Trustee
SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:				Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
	Name	Position Description					
	Dr. Tim Birt	Research Associate		6.0	2.3		13.8
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		6.0	2.3	0.0	
						Personnel Total	$13.8

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
	Description					
	Travel to EVOS 2000 workshop for VLF	1.0	1	5	0.1	1.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.5

FY00

Prepared:

Project Number: 00-169
Project Title: A genetic study to aid in the restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: DOI

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs: Description	Proposed FY 2000
Contractual Total	$0.0

Commodities Costs: Description	Proposed FY 2000
Page Charges	0.5
Miscellaneous (xeroxing, phone calls, toner, etc.)	0.5
Commodities Total	$1.0

FY00

Prepared:12 April 1999

Project Number: 00-169
Project Title: A genetic study to aid in the restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: DOI

FORM 4B
Contractual &
Commodities
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	

FY00

Prepared:12 April 1999

Project Number: 00-169
Project Title: A genetic study to aid in the restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: DOI

FORM 4B
Equipment
DETAIL

Kenai Habitat Restoration and Recreation Enhancement

Project Number:	00180-CLO
Restoration Category:	General Restoration
Proposer:	M. Rutherford/ADNR
Lead Trustee Agency:	ADNR
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	5th yr. 5 yr. project
Cost FY 00:	$10.7
Cost FY 01:	$0.0
Cost FY 02:	$0.0
Geographic Area:	Kenai Peninsula
Injured Resource/Service:	Pink salmon, sockeye salmon, Dolly Varden, commercial fishing, subsistence, recreation, tourism

ABSTRACT

This project will fund final report writing for Project /180. Adverse impacts to the banks of the Kenai River total approximately 19 miles of the river's 166-mile shoreline. Included in this total are 5.4 river miles of degraded shoreline on public land. Riparian habitats have been impacted by trampling, vegetation loss and structural development. This riparian zone provides important habitat for pink salmon, sockeye salmon and Dolly Varden, species injured by the oil spill. The project's objectives were 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 included revegetation, streambank restoration, elevated boardwalks, floating docks, access stairs, fencing, signs, and educational interpretive displays.

INTRODUCTION

This project is a continuation of the Kenai River Habitat Restoration and Recreation Enhancement Project that began in 1996. The objectives of this project are to:

1. Restore and protect fish habitat on the Kenai River,

2. Improve existing recreational access to the Kenai River watershed in a manner that restores and protects riparian fish and wildlife habitat,

3. Provide information to the public that promotes their understanding of the river's ecology and proper use of its resources.

Public lands on the Kenai Peninsula, including those acquired with Exxon Valdez oil spill joint settlement funds, contain important habitat for several species injured by the spill and provide recreation services for tens of thousands of Alaska residents and tourists. Kenai River fish support a large commercial fishery, a commercial sport fishing industry, a subsistence fishery, and a recreational sport fishery. In the aggregate, revenues generated by sportfishing, commercial fishing and river-based tourism represent a significant and growing proportion of the local economy.

The riparian zone, the transitional area that lies between the river's channel and the uplands, provides important fish and wildlife habitat and plays a major role in the hydrology of the watershed by helping to control floods and erosion. This vegetated area functions as a buffer and filter system between upland development and the river, thereby maintaining water quality by absorbing nutrients, accumulating and stabilizing sediments, and removing heavy metals and pollutants that are a result of urban development and which enter the river from surface runoff. It is also the area where a significant portion of the Kenai River's sportfishing and other recreational activities are concentrated.

Degradation of the river's streambanks, riparian vegetation and fish habitat has the potential of jeopardizing its long term productivity and degrading the quality of the recreational experience. This project proposes revegetation, streambank restoration, and public access improvements that will promote pink and sockeye salmon and Dolly Varden habitat protection and restoration, as well as enhancement of recreational services in the Kenai River watershed. The project also proposes to design and construct educational and interpretive displays that will inform the public of the proper manner in which to access and use the river's resources.

Restoration and enhancement proposals on public lands extending from the outlet of Kenai Lake to the mouth of the Kenai River (Figure 1), were nominated by public landowners and evaluated by an Interdisciplinary Team (IDT) of biologists and resource managers using specific threshold and evaluation criteria (Table 1). The IDT designed the qualifying criteria used to evaluate and rank the proposals by considering a variety of factors, including the degree of damage at a site and the effects that each proposal will have on fish habitat, recreation, and the surrounding environment.

All proposals had to meet threshold criteria before the evaluation criteria were applied. The scores are a method of ranking those proposals that best achieve the overall project's goals for habitat restoration, compatible recreation enhancement, and educational value. In an attempt to identify the most cost-effective proposals and obtain maximum benefits from available funds, it was decided to compare the relative restoration benefits of the proposals in terms of costs. To facilitate that determination, the results of the evaluation process, i.e. the scores, were plotted against the estimated costs.

Conceptual restoration and enhancement plans were presented to the IDT for evaluation. Final engineered plans were provided to ADFG/ADNR prior to construction. Choice of building materials and construction methods are the responsibility of the landowner (but subject to IDT review) and must employ restoration techniques permittable by regulatory agencies (ADFG, ADNR, and the Army Corps of Engineers).

The project was proposed to last for three years, beginning in 1996. Projects approved for funding in 1997 will be completed in 1998. Monitoring of funded proposals will be carried out by ADFG/ADNR to ensure the proposals are constructed and function as designed. Monitoring will also be used to gather information regarding effectiveness of restoration techniques.

Twelve nominations (sites) were chosen for restoration/enhancement. Construction status of these sites is as follows:

- Kenai Dunes (Completed)
- Rotary Park (Completed)
- Endicott Sonar Site (Completed)
- Ciechanski (Completed)
- Big Eddy (Completed)
- Funny River (Completed)
- Bing's Landing (Completed)
- Kobylarz (Completed)
- Cone (Completed)
- Centennial Park (Completed)
- Slikok Creek [Phase I (In Progress); Phase II (In Progress)]

- Russian River [Phase I (Complete); Phase II (Complete);
  Phase III (In Progress)]

Signs and interpretive displays were erected at each project site. They include:

- 24 signs that identify the funding source for each project.
- Ten displays dealing with protection of the river's resources.
- Six displays depicting aquatic insects as in important element of the river ecosystem as it relates to salmon fry.
- Four displays depicting interesting facts about salmon fry.

Table 1

Threshold Criteria

1. The project will protect, restore or enhance the historic functional attributes of a site and the surrounding area.
2. The project is located on public land.
3. The managing agency agrees to endorse the project.
4. The managing agency agrees to future maintenance and management of the project in a manner that facilitates and is consistent with the restoration or enhancement endpoint (#1).
5. All elements of the project can be permitted.
6. The project is not a mitigation requirement.

Nomination must be in compliance with all Threshold Criteria.

Evaluation Criteria

1. Potential Habitat Value
   What is the potential habitat value of the project? [Score_ = (20/10/5) x 3.5]

2. Potential Recreation Value
   What is the potential recreation value of the project? [Score = (20/10/5) x 2.5]

3. Disturbance Level
   What is the level of disturbance (human impact) in relation to habitat/recreation values? [Score = (20/10/5) x 2.0]

4. Rate
   To what extent will the project decrease the amount of time needed for riparian habitat to recover? [Score = (20/10/5) x 1.0]

5. Collateral Impacts
   What is the potential for adverse impacts to natural or cultural resources or to the nearby human community resulting from this project?
   [Inverse relationship: Score = (5/10/20) x 3.0]

6. Design/Effectiveness
   How would you rate the project's design to its expected effectiveness?
   [Score = (20/10/5) x 2.0]

7. Vulnerability
   Is the protected, restored or enhanced site vulnerable to natural or human-induced degradation. [Inverse relationship: Score = (5/10/20) x 2.0]

NEED FOR THE PROJECT

A. Statement of Problem

Use of the Kenai River watershed is degrading fish habitat along the riparian zone of the mainstem and, to a lesser degree, the tributaries of the river. Streambanks that provide essential fish habitat are being trampled and denuded of vegetation leading to increasing rates of erosion and sedimentation. Both commercial and residential developments are altering shorelines, changing patterns of runoff and creating the potential for the discharge of non-point source pollutants into the river. Federal and state resource agencies have limited ability to manage these problems that have the potential of threatening the productivity and world class recreational value of this river system.

Commercial fishing, subsistence, recreation and tourism (including sport fishing) are services that were reduced or lost because of the spill. Within the Kenai River watershed, the resources that support these services that were injured by the Exxon Valdez oil spill include pink and sockeye salmon and Dolly Varden. Chinook and coho salmon also contribute significantly to these services. The Exxon Valdez Oil Spill Restoration Plan states that the Kenai River sockeye salmon population is not recovering and that: With regard to sockeye salmon, the objective of habitat protection is to ensure maintenance of adequate water quality, riparian habitat, and intertidal habitat.

The restoration strategy articulated in the restoration plan for recreation and tourism focuses on the: Preservation and improvement of the recreational and tourism values of the spill area. The Plan goes on to discuss strategies for promoting recovery of commercial fishing, recreation and tourism by:...increasing the availability, reliability, or quality of the resource on which the service depends.

What is needed within the Kenai River watershed is an integrated approach that protects resource habitats, restores degraded streambanks and riparian vegetation, maintains productivity and promotes appropriate, sustained human use of the river.

B. Rationale

The work proposed by this project is a continuation of the on-going effort needed to protect and restore fishery resources. Continuing loss of habitat will exacerbate the injury caused by the spill to both resources and services and lead to diminished productivity. This, in turn, diminishes the value of the commercial, subsistence and sport fisheries and the quality of recreation on the river with significant, adverse implications for the local economy.

The present condition of North America's native fish fauna is attributable, in part, to the degradation of aquatic ecosystems and habitat (FEMAT Report, 1993). Loss and degradation of freshwater habitats are the most frequent factors responsible for the decline of anadromous salmonid stocks (Nehlsen, et. al. 1991). Along with habitat modification or loss, changes in water quality and quantity are often cited as causative factors for degradation of aquatic systems and declines in anadromous fish populations.

The Kenai River Cumulative Impacts Assessment of Development Impacts on Fish Habitat (Liepitz, 1994) was designed to identify and evaluate the cumulative impacts of development actions including public and private land use impacts on Kenai River fish habitat. The study documented that : 11.1 percent to 12.4 percent (18.4 to 20.6 miles) of the river's 134 miles of upland and 32 miles of island shoreline and nearshore habitats have been impacted by bank trampling, vegetation denuding, and structural development along the river's banks. Degraded public land along the Kenai River includes 5.4 miles of trampled riparian habitat and 3.5 miles of developed shoreline.

Based on a review of historic recreation use patterns and habitat impacts in the Slikok Creek and Russian River areas, the project will protect, restore, stabilize, or rehabilitate streambanks where resource damage is occurring; enhance or close existing access points and movement corridors; or re-direct users to other areas of the river on a temporary or long term basis. These actions will be based on the need to facilitate human use of the river in a way that protects fish habitat and minimizes degradation of other sensitive and/or pristine habitats.

This project is designed to promote streambank stability, increase vegetative cover, and mitigate accelerated erosion and sedimentation for the benefit of pink salmon, sockeye salmon, Dolly Varden and other fish species that migrate and rear along the river's banks. Techniques used to achieve these goals will include the use of elevated, grated boardwalks, river access stairs, fishing platforms, and other riparian habitat improvement and protection techniques. These techniques will, at the same time, restore and enhance sportfishing. One example is elevated, grated boardwalks, constructed to protect revegetating streambanks, that will provide river access to anglers with a minimum of impact to the recovering habitat. Post-construction monitoring will examine the effects of the method and the amount of recreational use that occurs in the area.

The education component of the project will produce user information and interpretive displays at strategically located access points along the Russian River and at Slikok Creek. These displays will provide users with information on the natural history of the river's fish, their habitats, ecology of the river system and the best methods that they can use to maximize their recreational experience with a minimum of impact to the watershed and its resources. Signs placed adjacent to work sites will describe the on-going restoration effort and direct the public away from recovering vegetation.

C. Location

All work on the final report preparation will be conducted in Anchorage, Alaska with site visits to projects along the Kenai River.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

This project was fully integrated with on-going agency recreation management, permitting and regional planning activities affecting the Kenai River watershed. This includes coordination with the Kenai Peninsula Borough, City of Kenai, Kenai City Council, City of Soldotna, Soldotna City Council, Kenai Peninsula Borough Assembly, and local interest groups.

PROJECT DESIGN

A. Objectives

1. Complete the final report for the project

B. Methods

C. Cooperating Agencies, Contracts and Other Agency Assistance

ADNR will coordinate and draft the final report for this project.

SCHEDULE

A. Measurable Project Tasks for FY 99

April 15, 2000: Final Report Due

B. Project Milestones and Endpoints

April 15, 2000: Final Report Due.

NORMAL AGENCY MANAGEMENT

The impacts affecting the Kenai River are occurring at a rate and magnitude far in excess of the management resources that are available to mitigate or restore habitat damage. The proposed project supplements existing efforts to reverse this trend. Moreover, none of the riparian habitat on small parcels that the Trustee Council is acquiring on the Kenai River has been surveyed or evaluated for restoration work. Additional issues relevant to state agency management of the Kenai River are to be found in the following section.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Coordination will occur with agency staffs in DNR, ADF&G and the USFS. Their expertise will be used in defining management objectives, developing criteria, evaluating and ranking potential project sites, conducting archaeological and historical reviews and clearances, performing design to include preparing plans and specifications, bidding construction projects, oversight of project construction, permitting, monitoring public use, and enforcing site restrictions.

Federal funding through the USDA Forest Service has made possible many additional restoration projects in the Russian River area for fish habitat and river bank vegetation. Such projects include closing river banks from foot traffic, constructing access point stairways into river, and revegetating eroded river bank areas. One vital program the Forest Service implemented is Streamwatch, a cadre of volunteers, who are at the Russian River and locations on the Kenai River during fishing season to talk with anglers about their impacts to the river banks. Since its inception in 1994, the Streamwatch Program has doubled in size and has become a resource utilized by other federal, state, and local agencies. Key to the program is the Forest Service leadership, and partnerships with Kenai River Sportfishing Inc. (who provide funding for the program) and Facilities Management Inc. (who provide a free campsite).

The project built upon pilot efforts that implemented or developed for the river. In 1994, boardwalks were installed near the Soldotna airport and on numerous private parcels; exclosures have been used with a high degree of success along portions of the Russian River and in units of the state park system. State permitting procedures have also resulted in numerous bank stabilization projects that maintain or enhance fish habitat by using spruce tree revetments, root wads, live willow cuttings, and other protective measures.

The state and federal governments also committed funds to accomplish several of the objectives identified by this project. Fish and Game Exxon Valdez criminal settlement funds ($3 million) have been dedicated for the construction of habitat protection demonstration projects and land acquisition on the Kenai River. The U.S. Fish and Wildlife Service provided challenge grant funding to assist the ADF&G demonstration projects. The National Marine Fisheries Service provided the ADF&G with an additional one million dollars for streambank improvements under an appropriation requested by Senator Stevens. ADNR restitution funds ($7 million) were used, in part, to construct boardwalks and access platforms that protect streambanks at heavily used state park units at Morgan's Landing, Bing's Landing, and Slikok Creek. Dingle-Johnson funds are being used to provide recreational access, streambank revegetation, and streambank protection structures at The Pillars project site.

The intense public use pressures and development activities on the Kenai River threaten to overwhelm the limited budgets available to resource agencies attempting to manage the river for resource protection and sustained recreational use. That is why supplementary funding is so important. This project, along with those utilizing other available funds, provided a cost-effective method to protect streambanks and minimize further habitat degradation.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

None.

ision 7-8-99
approved TC 8-9-99

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$7.2						
Travel		$0.3						
Contractual		$2.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$9.5			Estimated FY 2001	Estimated FY 2002		
General Administration		$1.2						
Project Total	$0.0	$10.7						
Full-time Equivalents (FTE)		0.1						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
This request is for final report writing for this project.

FY00

Project Number: 00180-CLO
Project Title: Kenai River Restoration & Recreation Enhancement
Agency: ADNR

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared:
6/23/99

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
	Natural Resource Manager		1.0	7.2		7.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.0	7.2	0.0	
					Personnel Total	$7.2

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
					0.0
Travel to Kenai	0.1	1	1	0.2	0.3
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.3

FY00

Project Number: 00180-CLO
Project Title: Kenai River Restoration & Recreation Enhancement
Agency: ADNR

FORM 3B
Personnel
& Travel
DETAIL

Prepared:

6/23/99

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Contractual Costs: Description	Proposed FY 2000
Printing and binding	2.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$2.0

Commodities Costs: Description	Proposed FY 2000
Commodities Total	$0.0

FY00

Project Number: 00180-CLO
Project Title: Kenai River Restoration & Recreation Enhancement
Agency: ADNR

FORM 3B
Contractual &
Commodities
DETAIL

Prepared:

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Project Number: 00180-CLO
Project Title: Kenai River Restoration & Recreation Enhancement
Agency: ADNR

FORM 3B
Equipment
DETAIL

Prepared:

6/23/99

approved TC 8-9-99

Construction of a Linkage Map for the Pink Salmon Genome

Project Number:	00190
Restoration Category:	Research
Proposer:	F. Allendorf/Univ. Montana
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	Yes
New or Continued:	Cont'd
Duration:	5th yr. 7 yr. project
Cost FY 00:	$331.0
Cost FY 01:	$240.8
Cost FY 02:	$240.8
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pink salmon

ABSTRACT

This project will continue experiments at the Alaska SeaLife Center that apply a genetic linkage map, which was constructed during the first four years of the project, to test for organismal effects of regions of the genome on phenotypes that affect traits that are important to recovery of pink salmon (e.g., growth and survival). The map will be used to evaluate the potential impact of hatchery-raised fish on the fitness of wild stocks. Sexually mature adults from the 1998 cohort produced from wild pink salmon collected from Likes Creek will return to the SeaLife Center in August 2000. Genotypes in released fry and returning adults will be compared to test for genetic differences in marine survival and other life history traits (e.g., body size, egg number, and egg size).

approved TC 8-9-99

Construction of a Linkage Map for the Pink Salmon Genome

Project Number:	00190
Restoration Category:	Research
Proposer:	F. Allendorf/Univ. Montana
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	Yes
New or Continued:	Cont'd
Duration:	5th yr. 7 yr. project
Cost FY 00:	$331.0
Cost FY 01:	$240.8
Cost FY 02:	$240.8
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pink salmon

ABSTRACT

This project will continue experiments at the Alaska SeaLife Center that apply a genetic linkage map, which was constructed during the first four years of the project, to test for organismal effects of regions of the genome on phenotypes that affect traits that are important to recovery of pink salmon (e.g., growth and survival). The map will be used to evaluate the potential impact of hatchery-raised fish on the fitness of wild stocks. Sexually mature adults from the 1998 cohort produced from wild pink salmon collected from Likes Creek will return to the SeaLife Center in August 2000. Genotypes in released fry and returning adults will be compared to test for genetic differences in marine survival and other life history traits (e.g., body size, egg number, and egg size).

INTRODUCTION

This is a continuation of our project to construct a genetic linkage map for the pink salmon (*Oncorhynchus gorbuscha*) genome. Such a map was proposed initially to provide the necessary platform to identify genetic damage in pink salmon inhabiting oiled streams following the March 1989 *Exxon Valdez* oil spill (EVOS). We have initiated a series of experiments based at the Alaska SeaLife Center (ASLC) to identify regions of the genome that affect various organismal phenotypes and to test for the effects of natural selection on regions of the genome used in describing genetic population structure. This research will aid recovery efforts with pink salmon, including estimation of straying rates, description of stock structure, and testing if marine survival and other organismal measures of phenotypic variation have a genetic basis.

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

We continue to pursue additional funding for this research through other sources. Eleanor Steinberg, currently a graduate student in the Department of Zoology at the University of Washington, has received funding from the National Science Foundation (NSF) for a Postdoctoral Research Fellowship in Biological Informatics to assist us in the data analysis of the current proposed research (DBI-9974243). In addition, the renewal proposal (DEB-9903910) for NSF grant (Conservation and genetics of Pacific salmonids; DEB-9300135) included an objective to test for the effects of inbreeding on fitness of pink salmon using the returning adults in August 2000.

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

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

This revised Detailed Project Description includes an extension of our experiments to use the map to evaluate the potential impact of hatchery-raised fish on the fitness of wild stocks under the framework of our original Objectives 5 and 6. ADFG will not grant permission for us to bring in gametes from existing hatchery populations to cross with wild fish from Likes Creek. Nevertheless, we have redesigned our experiments and analysis using the approaches of Moran et al. (1997) and Doyle et al. (1995) in Atlantic salmon (*Salmo salar*) and by Unwin (1997) in chinook salmon (*Oncorhynchus tshawytscha*).

NEED FOR THE PROJECT

A. Statement of Problem

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

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

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

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

This approach to describe population structure is based upon the assumption that the molecular markers used are not affected by natural selection. That is, it is assumed that the patterns of divergence in allele frequencies among populations are the result of gene flow and genetic drift. However, even weak natural selection may have a substantial effect on the pattern of genetic divergence among populations (Allendorf 1983). Zhivotovsky et al. (1994) have recently questioned the description of genetic population structure of pink salmon and suggested that natural selection may have an important effect on allozyme frequency divergence in pink salmon.

The molecular markers used may be affected by natural selection even though the markers themselves are not the target of selection. Even loci that are selectively neutral themselves and have no effect on the phenotype are expected to be affected by the action of natural selection at closely linked loci (Slatkin 1995). Apparent heterozygous advantage ("associative overdominance") can result at neutral loci by linkage disequilibrium with nearby loci that are affected by natural selection (Pamilo and Pálsson 1998).

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

B. Rationale

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

The recovery objective for pink salmon is healthy and productive populations that exist at prespill levels or levels in unoiled areas. An indication of recovery is when egg mortality in oiled areas match prespill or levels in unoiled areas. A genetic map would be essential for detecting and understanding causes of reduced egg and embryo survival in oiled areas (Bue et al. 1998). The genetic damage caused by exposure to oil may persist longer in populations of pink salmon than in other vertebrates because of the tetraploid nature of the salmonid genome.

Salmonid fishes went through a tetraploid event some 25 million years ago that duplicated their entire genome (Allendorf and Thorgaard 1984). The extra genes in pink salmon may mask the effects of mutational damage caused by recessive deleterious alleles. The effects of these deleterious mutations may be uncovered in subsequent generations.

C. Location

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

We began in FY 1998 to use the ASLC Research Facilities at Seward for experiments designed to test for natural selection at loci throughout the genome of pink salmon. Sexually mature pink salmon used in the experimental matings were collected from Thumb Cove in Resurrection Bay. The progeny are currently being raised at the ASLC.

COMMUNITY INVOLVEMENT

This is a specialized project that will not benefit directly from the knowledge of local/traditional people. We will hire local residents when possible for assistance (e.g., collecting and maintaining fish). As a professional educator in a university, I am very committed to educational efforts. I am interested in suggestions of other opportunities for informational meetings in the communities of Prince William Sound, including the ASLC in Seward, and articles in the Trustee Council newsletter.

PROJECT DESIGN

A. Objectives

Our initial primary objective was to construct a detailed genetic linkage map for pink salmon by analyzing the genetic transmission of several hundred DNA polymorphisms. Pink salmon have 26 pairs of chromosomes (2N=52; Allendorf and Thorgaard 1984), and, therefore, should have a total of 27 linkage-groups: 25 autosomes, an X-chromosome, and a Y-chromosome. We plan to map enough variable markers so that a new marker can be assigned with high probability to one of the 27 linkage groups. It was impossible to know how many markers this would require because we did not know the total length of the pink salmon linkage map. The linkage map of the zebrafish (*Danio rerio*) has been estimated to be 2900 centimorgans (cM; Johnson et al. 1996) and that of the medaka (*Oryzias latipes*) to be 2480 cM (Wada et al. 1995). There currently are efforts to include zebrafish among genome projects of model species sponsored by the National Institutes of Health under the Human Genome Project (Roush 1997). Such a massive effort in zebrafish would provide extremely helpful information for understanding the genome of salmonid fishes.

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

This project originally had the following overall specific objectives:

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

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

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

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

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

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

We have completed Objective 1; Objective 2 will be completed by the end of FY99. We cannot pursue Objective 3 because Restoration Study /191A did not identify any putative lesions for mapping. At present, we do not intend to pursue Objective 4 because Restoration Study \191A is no longer ongoing. However, this type of experiment to detect oil-induced lesions could be pursued in the future at the ASLC. The primary focus in FY 00 will be Objectives 5 and 6; we propose to use the linkage map to test for the phenotypic effects and adaptive significance of molecular markers throughout the genome of pink salmon.

B. Methods

OBJECTIVES 1 & 2

Our map was constructed using gynogenetic haploid and diploid progeny from an individual female. This is the same procedure that has been used to build the zebrafish linkage map (Postlethwait et al. 1994). Stanley (1983) reported that haploid embryos of Atlantic salmon will develop until just prior to the stage of hatching if development of the eggs is activated by sperm in which the DNA has been inactivated by UV-radiation. We have used this technique routinely with fishes of the genus *Oncorhynchus* (Forbes et al. 1994; Spruell et al. 1999). This allows us to follow the segregation and linkage relationships in haploid progeny from females. The use of haploid progeny avoids possible difficulties of dominance with some types of DNA markers because recessive alleles are not obscured by their dominant alternatives in haploids (Lie et al. 1994). Our map is based on 585 segregating markers in 94 haploid progeny from a single pink salmon female (95-103) that returned to Armin F. Koernig hatchery in Prince William Sound in August 1995). We also have placed a number of so-called "landmark" loci on the map in the last year.

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

Construction of a full linkage map is a large task. We developed as many time and labor saving procedures as possible (Archibald 1994). Our linkage map was constructed by computer assisted analysis (MapMaker, Lander et al. 1987). We have been assisted by Mark Daly of the Whitehead Institute at MIT in using this program. We will compare the recombination rates based upon this map to rates of selected pairs of loci in males. The reduced recombination rates in salmonid males means that it will be easier to assign new markers to a linkage group using male parents. We will test joint segregation of individual markers from different linkage groups identified in females to determine if some of these separate linkage groups in females are linked in males and are therefore syntenic (on the same chromosome).

A useful genetic map contains genetic markers that are abundant, randomly distributed throughout the genome, highly polymorphic, and readily detectable in many laboratories (Jacob et al. 1995). We began using random amplified polymorphic DNA (RAPD) markers because they fit these criteria and they have been used successfully in constructing linkage maps in zebrafish and medaka (Johnson et al. 1996; Wada et al. 1995). We have switched to two other types of genetic markers that are superior to RAPDs in this work.

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

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

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

AFLPs: Amplification fragment length polymorphisms have been used extensively in the construction of genomic maps in plants (Maheswaran et al. 1997; Becker et al. 1995). AFLP analysis consists of three steps (Vos et al. 1995). The first step is the "restriction/ligation" step. Two restriction enzymes are used to cut the genomic DNA into many fragments. Double stranded adapters that are specific to the restriction sites are then ligated onto the fragments. The second step is the "pre-selective amplification". During this step the restriction fragments are amplified using two primers that are specific to the synthetic adapters. Each of these primers includes an additional one base extension into the genomic DNA fragment flanked by the adapters. This step amplifies only DNA fragments with those two bases on either end, reducing the number of DNA fragments available for subsequent amplification. The final step, "selective amplification," uses an aliquot of the pre-selective products as DNA template. Amplification is conducted with primers that are specific to the synthetic adapters with three "selective" bases extending into the genomic DNA fragment. The increasing specificity of the primers used to amplify the fragments results in clean, reproducible banding patterns.

The AFLP technique is especially advantageous for two reasons. First, many bands are produced per reaction and, therefore, more scoreable polymorphic loci are produced per unit effort. Second, the selective amplification step uses a subsample of the PCR products of the preamplification. Up to 133 selective amplifications can be completed from a single pre-amplification that originally used only 0.5 µg of genomic DNA. Much more genomic DNA is needed to produce fewer bands using other methods such as RAPDs. This is an important consideration when dealing with the limited amount of tissue available from haploid embryos.

Gene-Centromere Map:

We have estimated recombination rates between over 300 loci and their centromeres using half-tetrad analysis (Lindner et al. submitted). Half-tetrad analysis can be performed if two of the four products from a single meiosis are recovered. Half-tetrads provide a valuable approach to detect chiasma interference and to estimate gene-centromere recombination rates (Zhao and Speed 1998). We produced meiotic half-tetrads in pink salmon by inhibiting the second meiotic division so that the polar body is retained. This results in gynogenetic diploid individuals that receive two chromosome sets from their female parent and none from their male parent (Thorgaard et al. 1983). This procedure allows analysis of meiosis II (MII) half-tetrads as classified by Zhao and Speed (1998).

During meiosis I, first division segregation, a heterozygous female will produce all homozygous half-tetrads unless a crossover occurs. A crossover will result in an equal proportion of heterozygous and homozygous half-tetrads. During MII, second division segregation, a heterozygous female will also produce homozygous half-tetrads. However a crossover will result in only heterozygous half-tetrads. The proportion of heterozygotes is a measure of the frequency of second division segregation, y. The maximum value for y is 0.66 unless there is chiasma interference which will inhibit subsequent crossovers in the same interval on the chromosome. The presence of strong chiasma interference has been reported in salmonids (Thorgaard et al 1983, Allendorf et al. 1986) and other fish species.

Gene-centromere distances were estimated by the proportion of gynogenetic diploid progeny that were heterozygous (y). Heterozygotes will be produced only if there is a crossover between the centromere and that marker since gynogenetic progeny are the result of second polar body retention (Thorgaard et al. 1983). These recombination rates are a function of the distance the marker is located from the centromere, the gene-centromere distance. Once markers that are tightly linked to centromeres have been identified, additional markers linked to the centromeric markers can be assigned to a specific chromosome (Johnson et al. 1996). This allows us to fill the gaps between linkage groups and thereby reduce the number of linkage groups, as well as confirm linkages identified with the haploids.

Heterozygotes cannot be differentiated from the dominant homozygote at dominant markers. To estimate the proportion of heterozygotes at these markers, we assumed equal numbers of each homozygote class. The frequency of second division segregation (y) can then be estimated by

$$y = \frac{N_t - (2\ N_{aa})}{N_t}$$

where N_t is the total number of progeny screened and N_{aa} is the observed number of recessive homozygotes.

The distribution of proportion of heterozygotes in gynogenetic diploid progeny (y) for all loci (Fig. 1) indicates that the markers we are scoring are distributed along the length of the chromosomes. However, markers types are distributed differently. Figure 1 shows the distribution of y values for PINEs, AFLPs, and microsatellites. AFLP loci are much more centromeric than the other classes of loci ($P<0.001$). The mean y for AFLP loci is 0.40, in comparison to a mean y of 0.69 for both PINEs and microsatellites. The distribution of y at nine allozyme loci is similar to the other non-AFLP markers (0.63; Table 1).

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

[TABLE 1 in WORD file (table-1.doc)]

The clustering of markers can be explained in two fundamentally different ways. First, the gene-centromere distances of markers are genetic distances that may not reflect the physical location of markers. For example, there are regions of the chromosome in which recombination is suppressed. Markers will cluster in these regions based on linkage analysis despite being physically distributed uniformly. In addition, all markers beyond 50cM from the centromere will be assigned a y of 1.0 using half-tetrad analysis if there is complete crossover interference; this will cause a clustering of all distal loci.

Alternatively, markers may be physically arranged along the chromosome in clusters. If so, the physical distance would correspond to the spatial distribution estimated by gene-centromere distances. In this case, clustering of markers would reflect that loci tend to occur in particular chromosomal regions. We can compare the results from various marker types and use the results of mapping in other taxa to begin to differentiate between these two hypotheses.

Suppression of recombination in centromeric regions has been well documented. Roberts (1965) first described this phenomenon in *Drosophila* and estimated a reduction in recombination of up to 40% around the centromere. More recently, Tanksley et al. (1992) observed clustering of markers on a linkage map of tomato and concluded that this was due to a ten-fold reduction in recombination that corresponded to centromeric heterochromatin. This conclusion was supported using additional evidence from physical map of tomato to locate centromeres (Ganal et al. 1989). Based on these results, we might expect an accumulation of markers in centromeric regions.

Our data support the clustering of AFLPs in centromeric regions (Figure 1a). Half-tetrad analysis on several other taxa also show a non-uniform distribution of AFLP-based markers. Qi et al. (1998) assigned 51% of the AFLP markers in barley to centromeric clusters. Similarly, Keim et al. (1997) reported a clustering of AFLP markers in soybean. AFLPs were also found in centromeric clusters in *Arabidopsis thaliana* (Alonso-Blanco et al. 1998).

Young et al. (1998) inferred from their haploid linkage map that AFLPs are also centromeric in rainbow trout. This is based on the presence of a cluster of tightly linked AFLPs at the center of most of their linkage groups. This clustering includes a much higher proportion of AFLPs than we have observed in pink salmon. However, comparisons between the rainbow trout map and the gene-centromere distances estimated in pink salmon must take into consideration the difference in recombination rate between males and females. The rainbow trout map was constructed using androgenetically derived homozygous lines (thus, a male map). Our gene-centromere data from pink salmon estimate recombination in females.

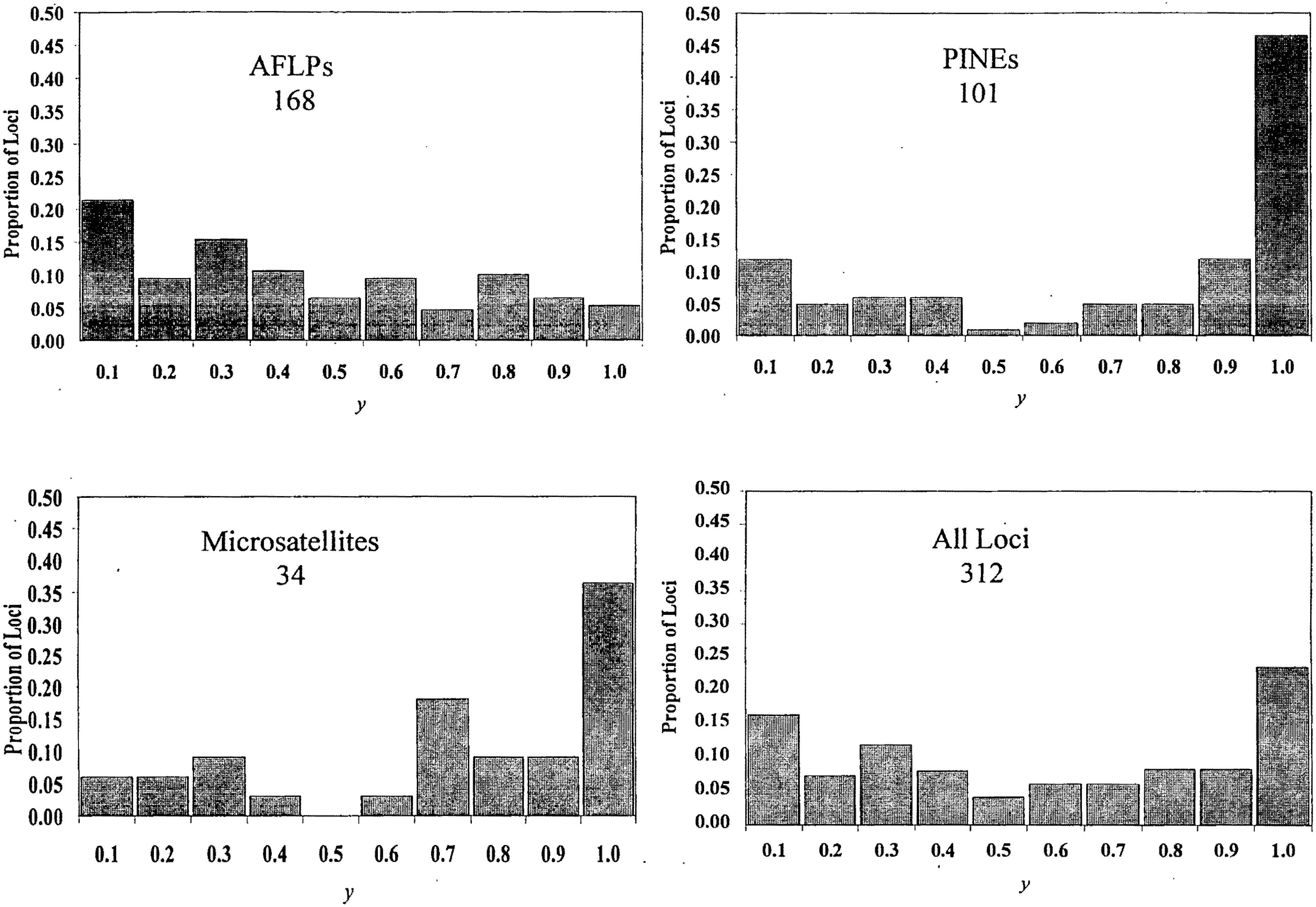


Figure 1. Distribution of distances between loci and their centromeres.

Table 1. Half-tetrad genotypes at nine allozyme loci.

Locus	Family	Maternal Genotype	Progeny *11*	Progeny *12*	Progeny *22*	Proportion heterozygotes (*y*)	Chi-square* (df)
ADA2	A95-103	*100/90*	1	52	1	0.96	0.00
CKC2	A95-103	*105/100*	23	16	18	0.28	0.61
G3PDH1	V96-19	*100/60*	0	79	0	1.00	-----
G3PDH2	V96-19	*100/90*	29	16	29	0.22	0.00
GDA1	A95-103	*108/100*	17	23	19	0.39	0.11
	A95-120	*118/108*	11	26	12	0.53	0.04
	V96-02	*108/100*	6	14	10	0.47	1.00
	Total		34	63	41	0.46	2.15 (4)
PEPB1	V96-13	*138/100*	22	4	16	0.10	0.95
PEPD2	A95-103	*120/100*	3	49	1	0.92	1.00
	A95-114	*120/100*	3	43	2	0.90	0.20
	A95-120	*120/100*	0	31	1	0.97	1.00
	V96-13	*100/80*	3	47	4	0.87	0.14
	V96-19	*100/80*	2	75	3	0.94	0.20
	Total		11	245	11	0.92	3.45 (8)
sAAT3	A95-103	*100/91*	5	47	7	0.80	0.33
	A95-114	*100/91*	8	43	8	0.73	0.00
	V96-13	*100/91*	2	7	3	0.58	0.20
	Total		15	97	18	0.75	2.57 (4)
sAAT4	A95-120	*210/100*	1	46	1	0.96	0.00
	V96-02	*290/210*	0	27	0	1.00	-----
	V96-13	*210/100*	0	49	3	0.94	3.00
	Total		1	122	4	0.96	1.57 (4)

*Chi-square test for equal numbers of homozygotes (1 df). Chi-square (df) in the total row is the contingency chi-square value for differences in y between families.

It has been previously reported that the recombination in males is lower than in females. (May and Johnson 1989). Thus, we expect a tighter clustering of markers around the centromere in males than in females.

It is possible that the distribution of AFLPs reflects a bias in the base composition of certain genomic regions. In both our study and that of Young et al. (1998) the restriction enzymes *Eco*RI and *Mse*I were used to generate the AFLP fragments. The recognition sites for these enzymes (GAATTC and TTAA respectively) are highly biased toward A and T. At least some centromeric regions are also known to be >90% AT (Pluta et al. 1995). This base pair composition bias may result in an accumulation of AFLPs near the centromeres. In addition, Young et al. (1998) used an A as the first selective nucleotide on both primers. We also used an A on the *Mse*I primer, but we used a C on the *Eco*RI primer. Thus, if there is a centromeric bias in AFLPs resulting from regional differences in genomic composition, we would expect the AFLPs examined in rainbow trout to be even more biased toward AT rich sequences.

PINEs provide a good fit to our expectations assuming a random distribution of markers. PINEs markers are clustered in centromeric regions as expected if there is suppressed recombination in this area. PINEs with y values approaching one are also common, perhaps reflecting the maximum distance from the centromere that can be detected using gene-centromere analysis. We might expect PINEs to most closely approximate a random distribution of markers due to the origin of the primers. We have produced PINEs using four different classes of repeats, SINEs (*Hpa*I, *Fok*I, *Sma*I), a LINE (*RSg1*), a transposon (*Tc*1) and a minisatellite (33.6+2). Each of these elements is inserted into the genome by a different mechanism and is influenced by a different suite of evolutionary constraints. The majority of PINE fragments that we have mapped are primed by two different classes of primers.

Greene and Seeb (1997) reported the centromeric distribution of fragments amplified using PINE primers homologous to *Sma*I and *Tc*1. Due to the lack of haploid segregation data from the same female, they were unable to detect markers with large y values because they are not variable in gynogenetic-diploids. Our data do not indicate a tendency for PINEs to be centromeric. However, our results are concordant with Greene and Seeb (1997) if the markers with a y greater than 0.7 are eliminated from our data.

It is important to identify any biases in the distribution of types of markers being used in the construction and consolidation of a linkage map. The AFLP technique provides many polymorphic markers and requires less DNA than the other techniques used, an important consideration for the analysis of haploid embryos (Spruell et al. 1999). The centromeric clustering of AFLPs may limit the utility of these markers for mapping distal regions of chromosomes. This clustering may limit our ability to consolidate maps based exclusively on AFLPs. Centromeric clustering of AFLPs may also reduce the likelihood of identifying QTLs using only this technique. However, there are also benefits of the AFLP distribution. Johnson et al. (1996) describe the use of gene-centromere distances and markers near the centromere to consolidate the zebrafish linkage map. If a similar approach is to be used in salmonids, the availability of centromeric AFLPs should assist in that process. Other types of markers known to be more ubiquitously distributed can then be used to map the remainder of the genome.

The Linkage Map:

We have described the segregation of 585 markers in haploid progeny from female 95-103; we have also mapped 13 allozyme loci in gynogenetic-diploid progeny from this same female. We have assigned 559 of the 598 markers to one of 42 linkage groups covering a distance of 5352 cM (Figure 2; Tables 2 and 3). Only 26 markers remain unlinked. The estimated size of the pink salmon linkage map based on these data is 6872 cM. This includes 5352 cM mapped in Figure 1, an estimated 260 cM to account for the distance from the end markers to their adjacent telomeres, and an estimated 1260 cM in unfilled gaps in the map. The haploid pink salmon genome is approximately 2.72 billion base pairs or 2.72 million kilobase pairs (kbp; Johnson et al. 1987b); thus, we estimate approximately 391 kbp/cM. Our results are consistent with the maps constructed in other fishes (Table 4).

Table 2. Summary of Pink Salmon Linkage Groups

Number of markers in linkage group	Number of linkage groups	Average size (cM)
2-5	12	27.2
6-10	10	50.3
11-15	8	122.5
16-20	4	204.7
21-25	4	213.2
26-30	0	-----
31-35	1	354.1
36-40	0	-----
41-45	2	532.8
>50	1	470.4

Table 3. Summary of Marker Types on the Pink Salmon Map

Marker type	Total loci	Number assigned	Percent assigned
AFLPs	393	372	95
PINEs	162	157	97
Microsatellites	30	30	100
Allozymes	13	13	100
	---	---	---
Total	598	572	96

[FIGURE 2 in WORD files (fig-2a.doc; fig-2b.doc; fig-2c.doc)]

[TABLE 4 in WORD file (table-4.doc)]

Putting "Landmarks" on the Map

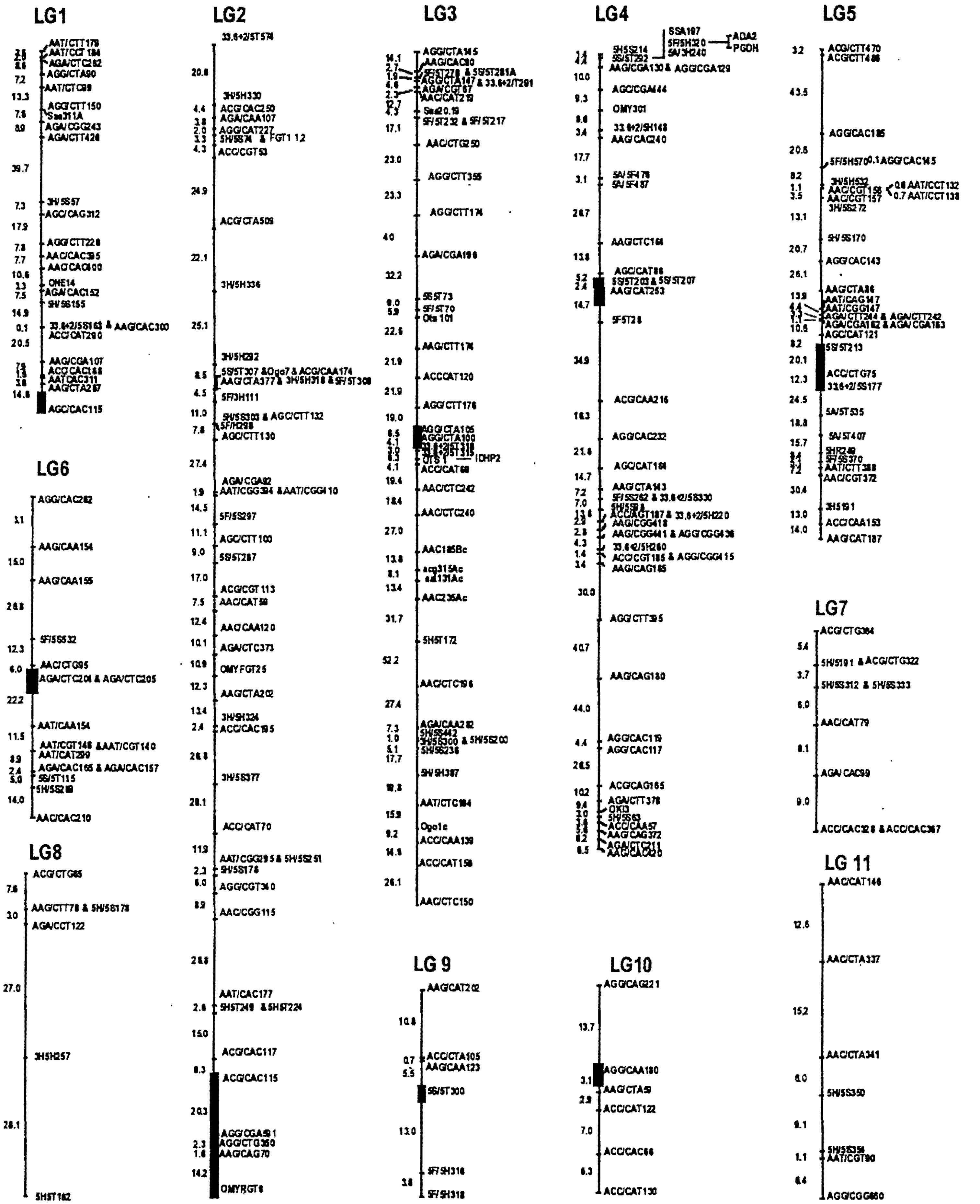
Our primary effort in FY99 has been to consolidate the map and to place other loci on the map so that the map can be used by other genetic investigators working with pink salmon. The primary types of so-called "anchor loci" we have used are allozymes and microsatellites that are currently being used in pink salmon population genetic studies (O'Brien et al. 1993). We will also map other loci that are available and of special interest and usefulness (e.g., growth hormone loci, Forbes et al. 1994, and the major histocompatibility complex, Katagiri et al. 1996; Miller and Withler 1996; Shum et al. 1996). These landmark loci will be used to test for differences in the linkage map between odd- and even-year pink salmon. In addition, we will test for differences in recombination rates, crossover interference, and residual tetrasomic inheritance between males and females (Allendorf and Danzmann 1997).

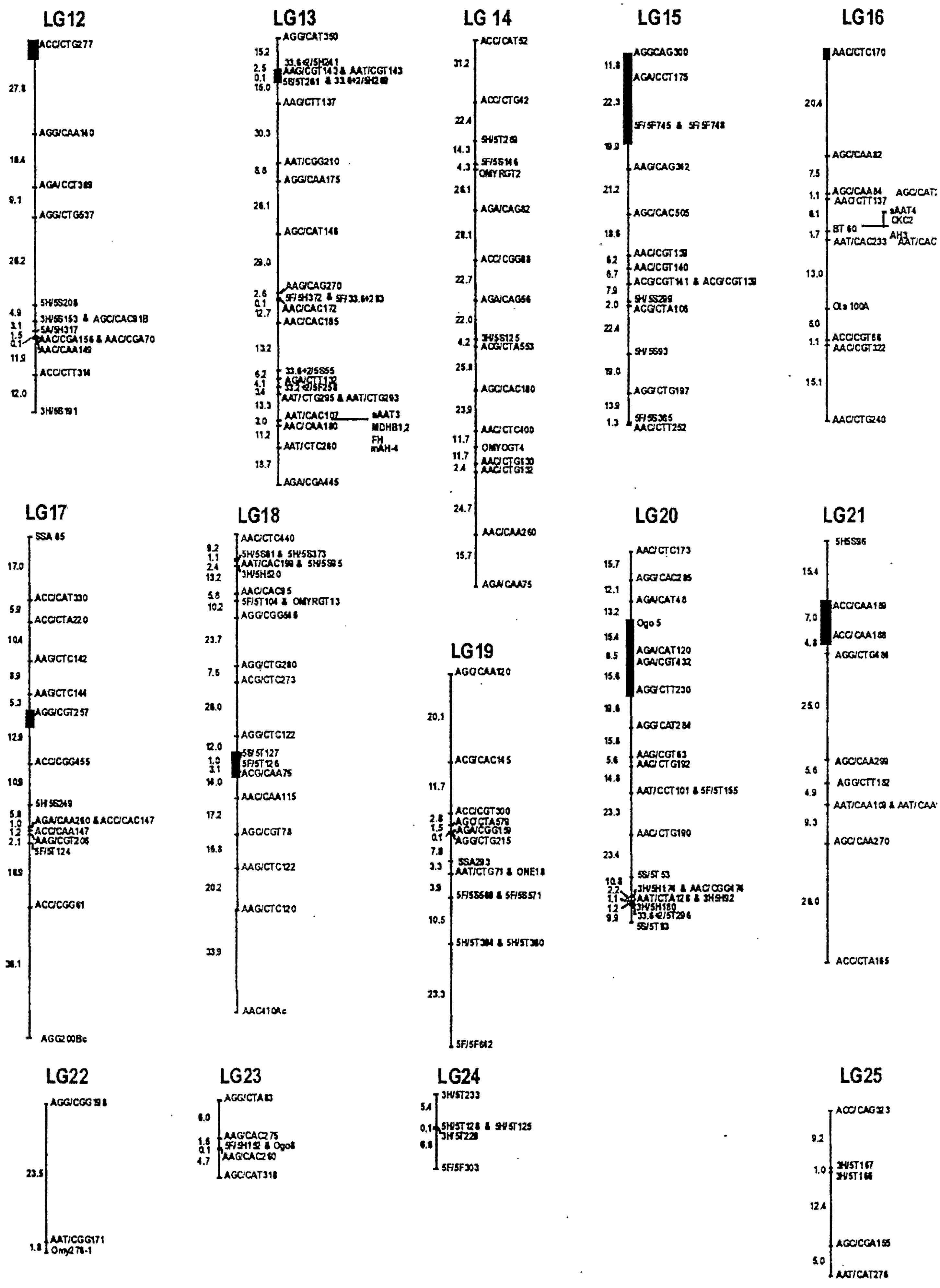
We have placed 30 microsatellite loci on the map in collaboration with Drs. Roy Danzmann, Moira Ferguson, and Takashi Sakamoto at the University of Guelph in Ontario. These microsatellite loci are found in 17 linkage groups.

We have also placed 13 allozyme loci that are polymorphic in Prince William Sound pink salmon (Seeb et al. 1996; Habicht et al. 1998) on the map. We have used gynogenetic-diploids from female 95-103 and several normal diploid families (Table 5) in collaboration with the ADFG Genetics Lab.

We have also initiated collaboration with John Postlethwait at the University of Oregon to develop anchor loci from the zebrafish linkage map that can be placed on the pink salmon linkage map. We have sent pink salmon DNA to Postlethwait's lab at the University of Oregon. They will test 24 zebrafish primers under different PCR conditions with pink salmon DNA. If a reasonable proportion of these primers amplify the correct gene product,

Figure 2. Genetic linkage map of pink salmon based on the inheritance of 598 polymorphic loci. Numbers to the left indicate recombination rates (cM). Locus names are to the right. Centromeres are indicated by black rectangles.





LG12
ACC/CTG277
AGG/CAA140
AGA/CCT369
AGG/CTG537
5H/5S208
3H/5S153 & AGC/CAC91B
5A/5H317
AAC/CGA156 & AAC/CGA70
AAC/CAA149
ACC/CTT314
3H/5S191
LG13
AGG/CAT350
AAG/CTT137
AAT/CGG210
AGG/CAA175
AGC/CAT148
AAG/CAG270
AAC/CAC172
AAC/CAC185
AAT/CTG295 & AAT/CTG293
AAT/CAC107
AAC/CAA180
AAT/CTC280
AGA/CGA445
sAAT3
MDHB1,2
FH
mAH-4
LG 14
ACC/CAT52
ACC/CTG42
5H/5T269
OMYRGT2
AGA/CAG82
ACC/CGG88
AGA/CAG56
AGC/CAC180
AAC/CTC400
OMYOGT4
AAC/CAA260
AGA/CAA75
LG15
AGGCAG300
AGA/CCT175
5F/5F745 & 5F/5F748
AAG/CAG342
AGC/CAC505
AAC/CGT140
AGG/CTG197
AAC/CTT252
LG16
AAC/CTC170
AGC/CAA82
AAG/CTT137
BT 60
AAT/CAC233
ACC/CGT322
AAC/CTG240
LG17
SSA 85
ACC/CAT330
ACC/CTA220
AAG/CTC142
AAG/CTC144
AGG/CGT257
ACC/CGG455
ACC/CAA147
5F/5T124
ACC/CGG61
AGG200Bc
LG18
AAC/CTC440
5F/5T104 & OMYRGT13
AGG/CTG280
ACG/CTC273
AGG/CTC122
5S/5T127
5F/5T126
ACG/CAA75
AAC/CAA115
AGC/CGT78
AAG/CTC122
AAG/CTC120
AAC410Ac
LG19
AGC/CAA120
ACG/CAC145
ACC/CGT300
AGG/CTG215
AAT/CTG71 & ONE18
5H/5T384 & 5H/5T380
5F/5F612
LG20
AAC/CTC173
AGA/CAT48
Ogo 5
AGA/CAT120
AGG/CTT230
AGG/CAT284
AAT/CCT101 & 5F/5T155
AAC/CTG190
LG21
5H5S96
ACC/CAA189
ACC/CAA188
AGC/CAA299
AGC/CAA270
ACC/CTA165
LG22
AAT/CGG171
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AGC/CAT318
LG24
3H/5T233
5F/5F303
LG25
AAT/CAT276

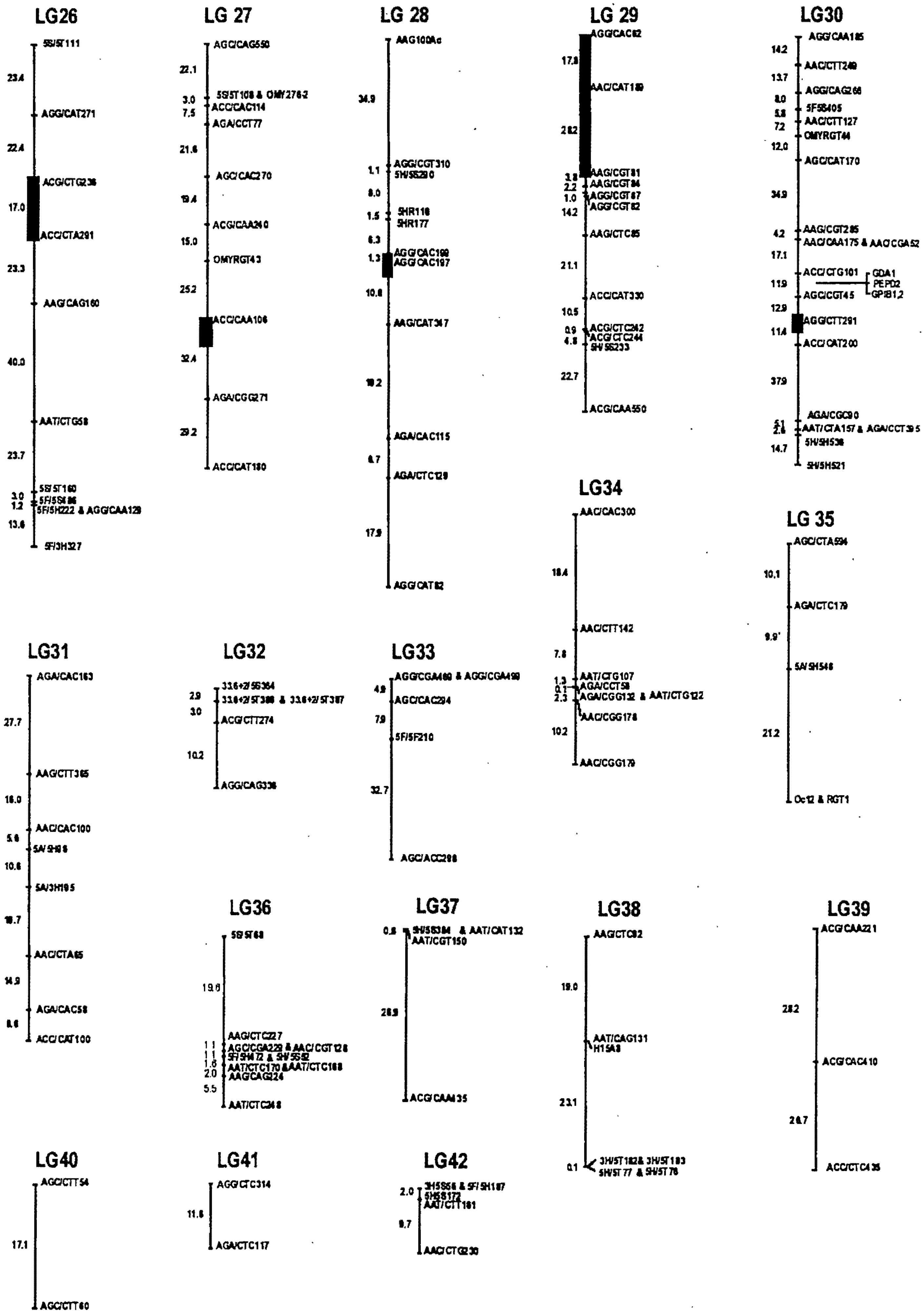

LG26
LG 27
LG 28
LG 29
LG30
LG34
LG 35
LG31
LG32
LG33
LG36
LG37
LG38
LG39
LG40
LG41
LG42

Table 4. Comparison of linkage maps from seven teleost fishes. Total number of markers included on the map are given. Sex refers to which sex the map is based on , F= female and M= male. LOD (log odds) is one of the criteria used for construction of the map using MapMaker linkage analysis program.

	Pink Salmon	Rainbow Trout Young et al. 1998	Zebrafish Johnson et al. 1996	Zebrafish Knapik et al. 1998	Medaka Wada et al. 1995	Tilapia Kocher et al. 1998	Xiphophorus Morizot et al. 1991
Number of Markers	598	476	652	705	170	174	76
Number of Linkage Group	42	42	29	25	28	30	17
Number of Chromosomes	26	30	25	25	24	22	24
Sex	F	M	F	F & M	M	F	M & F
Estimated size (cM)	6872	2627	2720	2350	2480	1000-1200	1400-2600
kbp/cM	391	913	625	708	323	833-1000	300
LOD	3	3	3	3.5	3	3	3

we will screen over 400 primer pairs to identify ones that work on pink salmon. We will then screen the products of these primers to place the ones that are variable on the pink salmon map. The Postlethwait lab plans to place 4,000 genes on the zebrafish linkage map over the next few years. They have agreed to place priority on those gene for which there are also sequences available in GenBank for salmonids (e.g., MHC; Miller & Withler 1996; Shum et al. 1996).

Postlethwait et al. (1998) recently placed 144 known genes on the zebrafish linkage map. They concluded that two polyploidization events occurred in a common ancestor before the divergence of fish and mammals resulting in four paralogous copies of each chromosome segment in each lineage. Postlethwait and his colleagues have subsequently placed another 150 genes on the zebrafish map that further support this conclusion (personal communication). We are not requesting any funds in this proposal to support the work with Postlethwait; we requested funds from the National Science Foundation to support this collaboration.

OBJECTIVES 5 & 6

The completion of a genome map for pink salmon allows us to address important genetic issues related to two other Components of the Pink Salmon Restoration Program. The numerous genetic markers identified in the course of this study will provide greatly increased power and resolution to identify stocks of pink salmon on a very fine scale (Stock Separation and Management). The genetic map also allows us to test for the presence of genes having major effects on phenotypes of importance for the management of pink salmon, and to test for phenotypes associated with specific combinations of multilocus genotypes (Lander and Schork 1994). These genetic markers will be of great value in genetically identifying fish from supplementation programs and detecting their ecological and genetic interactions with wild fish (Supplementation).

This aspect of the research is being performed at the ASLC research facilities. Over 70,000 marked fish will be released in spring of 1999; surviving individuals will be collected when they return to the facility at sexual maturity. A sample of the fish will be collected at release and analyzed so that their genetic characteristics prior to the marine phase of the life cycle can be described. We will test for genetic effects on phenotypes of special importance by comparing the genotypes of the released fish with the genotypes of the returning fish. This will allow us to test for genes with a major effect on marine survival. We will test for loci or regions of the genome that have a large effect on phenotypes of interest, so-called quantitative trait loci (QTL's). For example, Jackson et al. (1998) recently have presented evidence for QTL's that affect upper temperature tolerance in rainbow trout linked to two of 24 polymorphic loci that they examined. Mousseau et al. (1998) have used a similar approach to estimate heritabilities for weight, length, and age at sexual maturation in chinook salmon.

Table 5. Summary of linkages in normal diploid families between allozymes and microsatellites

Loci	Fam	Inform. Parent	N	r	Chi-sq (1 df)
sAAT3 - FH	A14	Fem	86	0.337	9.12
sAAT3 - sMDHB1,2	A14	Fem	89	0.112	53.49
sAAT4 - STR60	A104	Fem	21	0.238	5.76
ADA2 - PGDH	A120	Mal	56	0.125	31.50
ADA2 - SSA197	A103	Fem	42	0.024	38.10
	A120	Mal	18	0.111	10.89
CKC2 - STR60	A103	Fem	46	0.348	4.26
FH - MDHB1,2	A14	Fem	86	0.291	15.07
bGALA - G3PDH1	V2	Mal	75	0.346	7.05
GDA1 - PEPD2	A8	Mal	82	0.012	78.05
	A20	Mal	95	0.105	59.21
	A29	Mal	45	0.000	45.00
G3PDH1 - PEPLT	V5	Mal	75	0.240	20.28
GPIB1,2 - PEPD2	V2	Mal	75	0.013	71.05
sIDHP2 - OTS1	A29	Mal	41	0.366	2.95
	A104	Fem	33	0.303	5.12
PGDH - SSA197	A120	Mal	20	0.050	16.20

Previous work has demonstrated genetic differences between early and late run fish, and that differences in run-timing has a genetic basis (Smoker et al. in press). We will compare the genotypes of fish returning to the facility at different times to test for genes with a major effect on run timing. We will use a suite of genetic markers spread uniformly throughout the genome. Regions of the genome that show major associations with run-timing can then be examined in more detail by comparing additional markers within that region. A similar approach using only 10 protein markers in hatchery rainbow trout revealed several regions of the genome associated with time of spawning (Leary et al. 1989). Sakamoto et al. (manuscript) have reported similar results on the basis of 54 microsatellite loci.

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

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

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

The clearest and perhaps most important effects have been demonstrated on marine survival and growth rates. Pink salmon that are more heterozygous at allozyme loci have greater viability and growth rates than more homozygous individuals (Altukhov et al. 1991; Zhivotovsky et al. 1987; Kartavtsev 1992). Table 6 shows the distribution of individual heterozygosities at four allozyme loci in fry before release into salt water and returning adult spawners in odd-year pink salmon from the Sakhalin Island (Altukhov et al. 1987). We would expect the heterozygosities in fry and adults to be similar if the genotypes at these loci are not associated with survival. The significantly higher heterozygosity in the returning adults (0.619) than in the fry (0.424) indicates that individuals that were more heterozygous at the four loci had greater marine survival.

Altukhov et al. (1991) found a significant positive regression ($r=0.14$; $P<0.01$) between individual heterozygosity at these same four allozyme loci and body length of fry immediately preceding downstream migration from a hatchery on the Sakhalin Island. Kartavtsev (1992) reported a similar relationship in a different experiment with pink salmon from Sakhalin island ($r=0.23$; $P<0.001$). Previous studies with salmonids have found that size has an important effect on survival (Hunt 1969).

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

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

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

We believe that it is unlikely that the enzyme loci themselves are responsible for the observed relationships. Nevertheless, regardless of the underlying mechanisms of these associations, even weak heterozygous advantage (or associative overdominance) would act to maintain similar allele frequencies in different populations in the absence of significant gene flow (Allendorf 1983). This could cause a large overestimation of the actual amount of gene flow among PWS pink salmon populations. For example, just a 10% selective advantage of heterozygotes will cause a 10-fold over estimation of the amount of migration in the case where local populations have an effective size of 100 and an average 0.5 migrants per

Table 6. Distribution of Heterozygosity at Four Allozyme Loci in Pink Salmon from Sakhalin Island

Age-class	Number of het. loci* 0	1	2-4	Average het.
Fry	0.620 (559)	0.336 (302)	0.044 (40)	0.424 (901)
Adults	0.495 (300)	0.391 (237)	0.144 (69)	0.619 (606)

$\chi^2 = 37.3$
d.f. = 2
$P<0.001$

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

generation (Allendorf 1983). Altukhov et al. (1987) have estimated an average selective advantage of approximately 25% at four allozyme loci in pink salmon.

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

Preliminary Results

In August 1998, we collected gametes from 75 female and 75 male pink salmon from the mouth of Likes Creek, Resurrection Bay, Alaska. We also collected liver, eye, heart, and muscle tissue from each individual for subsequent genetic analysis. We then removed the head of each fish and froze them for future otolith removal and meristic counts. We also estimated the number of eggs per female by weight. We used the gametes to produce 75 single-pair families (one female x one male) to be reared at the ASLC.

We measured length of all adult fish from the middle of the eye to the fork of the caudal fin. Five bilaterally paired meristic traits (pectoral fins, pelvic fins, upper and lower gill arches, and mandibular pores) were counted and examined for fluctuating asymmetry (FA) in all 150 adults. We quantified asymmetry as the number of traits that were asymmetric in each individual. We subsequently removed the mandibular pore count data due to scrapes on the lower jaw which made scoring this trait difficult.

We found surprising morphological differences between males and females. Males have significantly greater variance in length then females ($P<0.01$) and they tend to be smaller ($P<0.06$, Figure 3). This result is similar to previous reports (Beacham et al. 1988). We also found much greater fluctuating asymmetry in males than females; the average number of asymmetric characters for females (1.16) is significantly lower then the average for males

(1.54, P<0.02, Figure 4). The variance in the number of asymmetric characters for females ($\sigma^2 = 0.66$) was also significantly lower than the variance for males ($\sigma^2 = 1.04$, P<0.001; Figure 4). In addition, there was a significant correlation between multiple locus heterozygosity at allozyme loci and reduced FA in males, but not in females (Figure 5).

The greater variance in length of males has been explained by different male breeding strategies (Beacham and Murray (1988). However, the differences in morphological variability as measured by FA are much more difficult to explain. Our previous results with rainbow trout (Leary et al. 1992) indicated that these meristic traits become "fixed" at a relatively early age (before six months) so that we would not expect them to be affected by differences in sexual maturity in males and females. An alternative explanation for the differences between males and females is selective survival. That is, differential marine survival occurs in females so that more symmetric fish are more likely to reach reproductive maturity. We have modified our experiments to test this hypothesis and other possible explanations for the differences in morphological variability between males and females.

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

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

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

Experimental Design

In August 1998, 150 (75 male and 75 female) mature pink salmon were collected from Likes Creek, Resurrection Bay, and transported to the ASLC for controlled matings. We made 75 families of full-sibs by crossing one male and one female. Two hundred progeny from each family were collected for inheritance analysis. We then selected 50 of these families on the basis of egg number and survival during incubation for the release experiment. These families were pooled together into a single tank in March shortly after hatching; one of these families was inadvertently not included in the pool. In May 1999, approximately 1,500 progeny from each of these 49 single-pair mating families were released from the ASLC facility. Surviving progeny will return in August 2000. Given an expected return rate of 4%, thousands of individuals will be recovered for genetic and morphological analyses (50-100 fish per family).

We have genotyped the parental fish at 34 polymorphic allozyme loci, 15 microsatellite loci, and two PCR-based loci encoding genes known to have important phenotypic effects (a growth hormone locus *GH-2*, Spruell et al. 1999) and one of the loci in the major histocompatibility complex, *MHC-$\alpha 1$*, Miller and Withler 1997). We are currently using the ProbMax computer program (Danzmann 1997) to assign progeny to families. We generated 100 hypothetical progeny from each of the 49 families and then used them to test our power of placing progeny in families on the basis of 34 allozyme loci and just 10 of the 15 PCR-based loci. Only one out of 4,900 progeny was placed into the wrong family.

Figure 3. Length of pink salmon collected from Likes Creek.

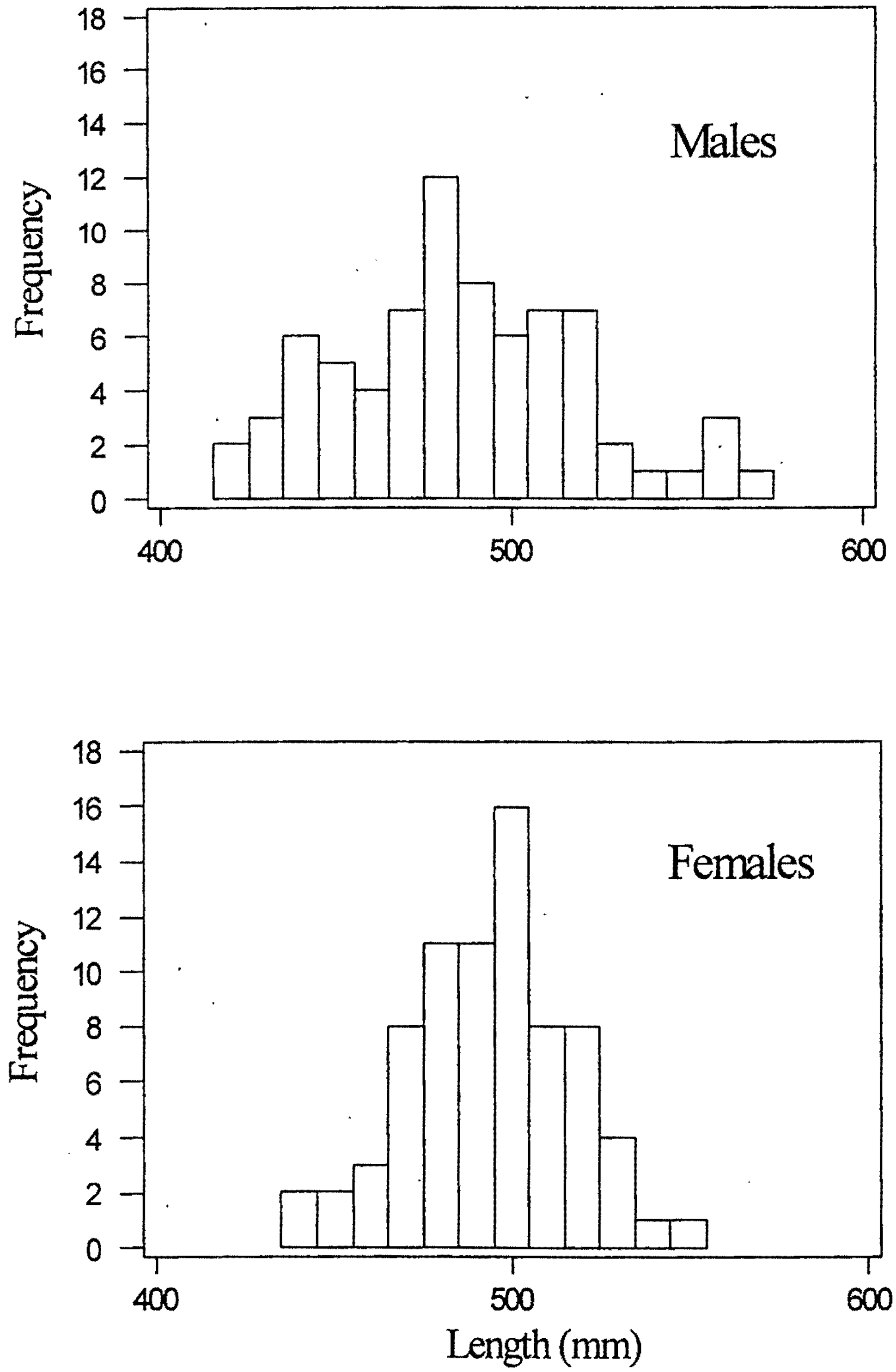


Figure 4. Number of asymmetric characters in pink salmon collected from Likes Creek.

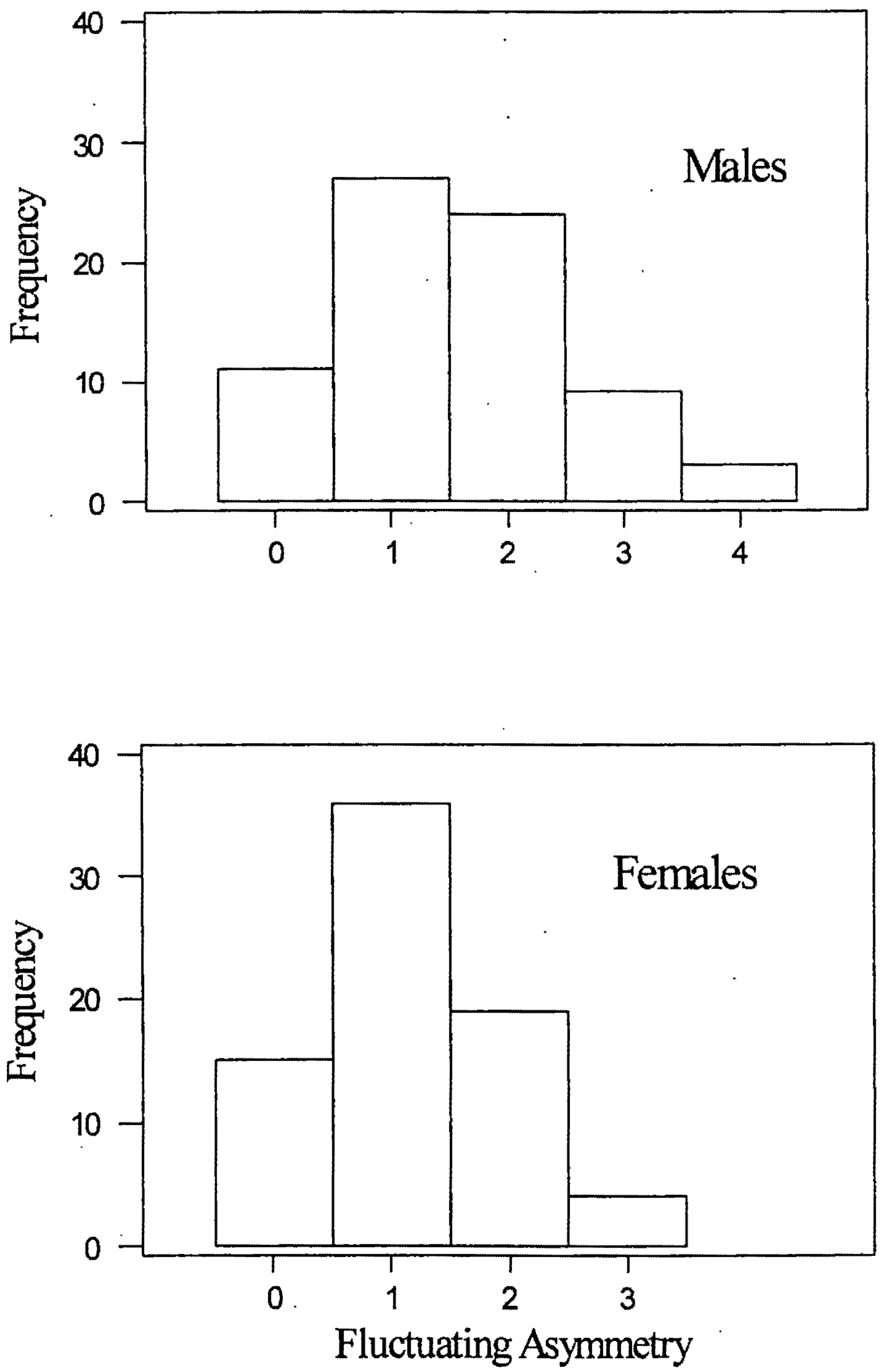
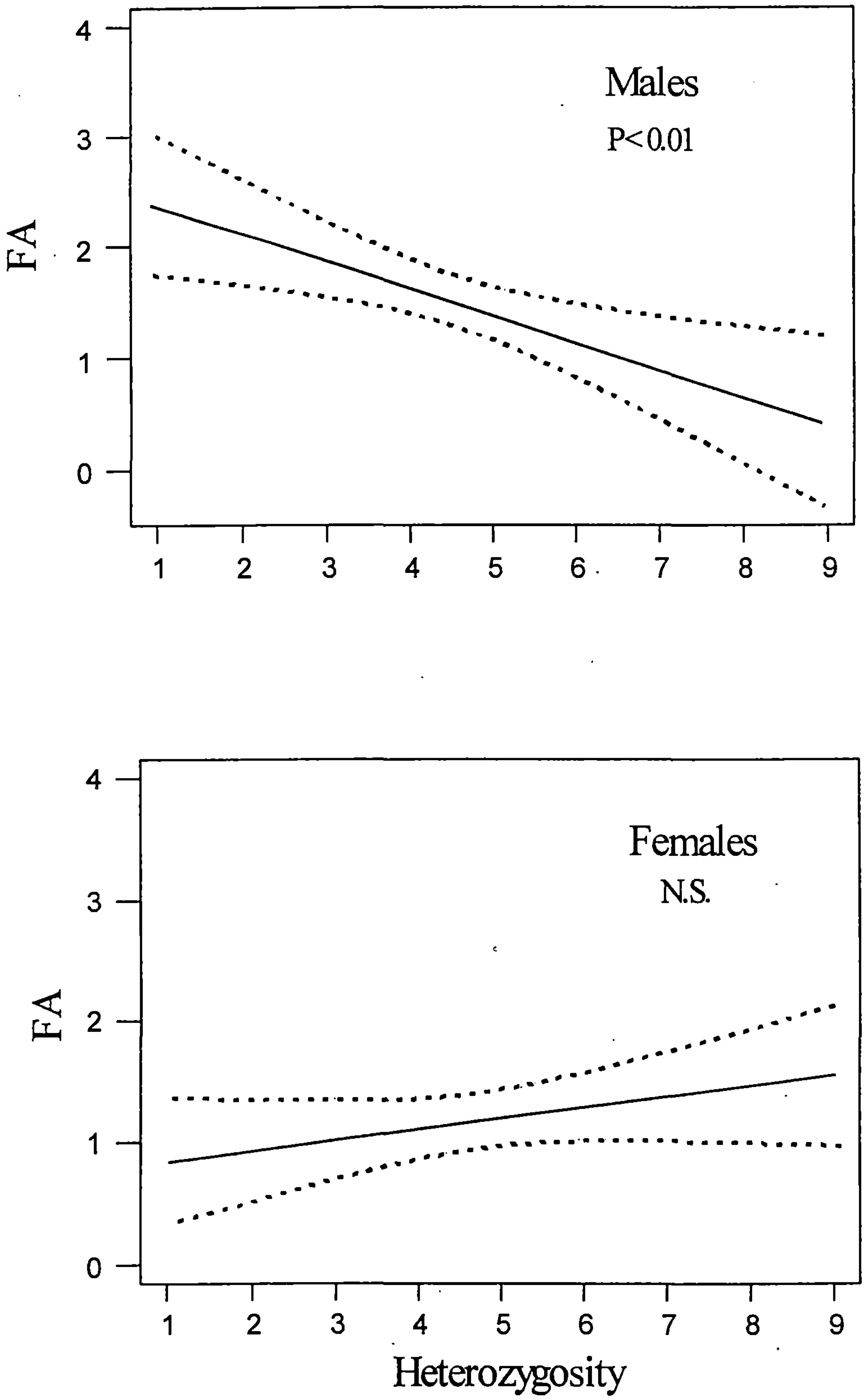


Figure 5. Regression of fluctuating asymmetry (FA) on heterozygosity at allozyme loci in adult pink salmon from Likes Creek. The solid line is the regression and the dotted lines define the 95% confidence band.



We sampled 1,000 progeny when the fry were released to test for a relationship between multiple locus heterozygosity, length, and condition factor both within and between families. We will sex the fish using a sex-linked PCR-marker (Spruell et al. 1999) to test if the morphological differences in length are already present at this early age.

We also are raising approximately 1,000 individuals from the released fish in seawater at the ASLC. We will sample these fish when they are old enough to count the meristic traits used to measure asymmetry. We will determine the sex of the individuals using a male specific growth hormone pseudogene (Spruell et al. 1999). We will compare the meristic counts of these fish raised in the hatchery with the meristic counts of the returning adults to test the hypothesis of Moran et al. (1997) that natural selection against phenotypic asymmetry occurs in the wild, but not in the hatchery environment.

This is an extremely powerful experimental design that will allow us to measure a multitude of parameters for the first time with pink salmon or any salmonid fish. The most powerful aspect of this experiment will be the capability of measuring fitness for individual loci spread throughout the genome. In the case of males, fitness will be estimated by survivorship (viability) from egg to return at sexual maturity. In the case of females, we will use both survivorship and the number of eggs produced so that we can take into account both viability and fecundity. We will also be able to estimate the heritabilities of a variety of traits (e.g., size at sexual maturity) by parent-offspring regression (Mousseau et al. 1998; Leary et al. 1985).

Perhaps the most significant aspect of the proposed research is the power to detect the effects of natural selection on loci spread throughout the genome. Comparison of genotypes in thousands of fry during the freshwater phase of their life cycle and in this same cohort when they return as adults will allow a powerful test for regions of the genome that affect survival. The failure to detect differential survival would provide strong evidence for the assumption of selective neutrality of genetic markers used to describe population structure.

We believe that the most likely result is that there will be some regions of the genome associated with differential survival. This experimental design will allow us to determine what proportion of the genome is affected and how strong the effect is. Also, we will be able to test if this differential survival is associated with regions of the genome marked by allozyme loci.

We plan to repeat this experiment with odd-year pink salmon in August 1999. We will again collect adults from Likes Creek and release their progeny from the ASLC in spring of 2000. This cohort should return in summer of 2001.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The ADFG Genetics Lab is no longer funded to assist us in the work at the ASLC. Therefore, we will either have to contract out the allozyme analysis or hire an additional person to perform this analysis in our lab. Based on preliminary contract costs estimates, it will be less expensive to do the analysis in our lab.

SCHEDULE

A. Measurable Project Tasks for FY 00 (1 Oct 99 - 30 Sep 00)

1 Oct 99 - 30 Apr 00:	Rear experimental progeny from 1999 cohort at ASLC.
1 Oct 99 - 31 Dec 99:	Perform genetic analysis of adults used in experimental matings to produce 1999 cohort.
1 Oct 99 - 31 Dec 99:	Continue genetic analysis of fry from 1998 cohort sampled prior to released in May 99.
1 Jan 00 - 30 Sep 00:	Perform genetic analysis of 1999 cohort produced in experimental matings.
1 Jul 00 - 30 Sep 00:	Begin analysis of returning sexually mature fish from the 1998 cohort.

B. Project Milestones and Endpoints

Objective 1: This objective has been completed.

Objective 2: This objective will be completed by the end of FY 99.

Objective 3: This objective will not be pursued.

Objective 4: This objective will not be pursued.

Objective 5: This objective will not be completed by the end of year 5.

Objective 6: This objective will not be completed by the end of year 5.

C. Completion Date

We initially proposed to continue this work for five years. However, our release experiments were delayed until the ASLC facilities were available. The analysis of these fish will not be able to be completed until after the close of year 5. The 1998 cohort fish released in the spring of 1999 will return at the end of year five. The 1999 cohort fish released in the spring of 2000 will return at the end of year six. We anticipate seeking funds to continue pursuing Objectives 5 and 6 after year 5.

PUBLICATIONS AND REPORTS

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

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

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

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

Lindner, K.R., P. Spruell, C. Habicht, J. E. Seeb, H. Zhao, and F. W. Allendorf. In preparation. A linkage map for pink salmon based on gynogenetic haploids and half-tetrads. To be submitted to Genetics.

PROFESSIONAL CONFERENCES

We anticipate presenting our results at professional and scientific meetings. We do not know at present the specifics of these presentations in FY 00.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

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

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

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The changes in this proposal reflect more rapid than anticipated progress in constructing the map, the discontinuation of Restoration Study \191A, and the decision not to fund our ADFG collaborators on this project. We have had to increase our budget by one full-time person to perform all of the allozyme analysis and for increased travel.

PROPOSED PRINCIPAL INVESTIGATOR

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E-mail: darwin@selway.umt.edu

4-1 File
approved TC 8-9-99

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

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel		$0.0
Travel		$0.0
Contractual		$211.7
Commodities		$0.0
Equipment		$0.0
Subtotal	$0.0	$211.7
General Administration		$14.8
Project Total	$0.0	$226.5
Full-time Equivalents (FTE)		0.0
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

		Estimated FY 2001	Estimated FY 2002		
		$240.8	$240.8		

Dollar amounts are shown in thousands of dollars.

Comments:

Project Total: 226.5
+ 104.5 ASLC bench fees
$331.0

FY00

Prepared:

Project Number: 00190
Project Title: Construction of a Linkage Map for the Pink Salmon Genome
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	$103.8	$123.3						
Travel	$9.6	$12.6						
Contractual	$0.0	$0.0						
Commodities	$28.3	$36.5						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$141.7	$172.4			Estimated FY 2001	Estimated FY 2002		
Indirect	$33.3	$39.3						
Project Total	$175.0	$211.7			$225,000.0	$225,000.0		
Full-time Equivalents (FTE)	2.2	2.7						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

Indirect cost is based on the University of Montana rate of 43.7% of salaries and wages.

Travel costs are included to attend the Trustee Council Annual Restoration Workshop.

Travel costs are included to attend the Technical Review Session.

Travel costs are included to allow attendance at a national meeting to present our results.

Costs have increased to cover additional travel to the ASLC and allozyme analysis due to non-funding of our ADFG collaborators.

Costs are included to cover writing the annual report.

Costs are included to cover manuscript preparation and page charges for articles published in FY 00.

FY00

Prepared: April, 1999

Project Number: 00190
Project Title: Construction of a Linkage Map for the Pink Salmon Genome
Name: University of Montana

FORM 4A
Non-Trustee
SUMMARY

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

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2000
F. Allendorf	Project Director		2.0	10.2		20.4
P. Spruell	Research Scientist		3.0	4.5		13.5
K. Knudsen	Research Specialist		3.0	4.2		12.6
K. Lindner	Research Assistant		12.0	3.2		38.4
Vacant	Research Assistant		12.0	3.2		38.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		32.0	25.3	0.0	
					Personnel Total	$123.3

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
					0.0
Missoula to Anchorage for Trustee Council Annual Workshop	0.7	1	3	0.1	1.0
					0.0
Missoula to Seward to release 1999 cohort of pink salmon	0.8	1	5	0.1	1.3
					0.0
Missoula to Seward to collect returning pink salmon from the 1998 cohort	0.8	3	60	0.1	8.4
					0.0
Travel to a national meeting to present our results	0.7	1	3	0.1	1.0
					0.0
Missoula to Anchorage for Technical Review Session	0.7	1	2	0.1	0.9
					0.0
					0.0
				Travel Total	$12.6

FY00

Project Number: 00190
Project Title: Construction of a Linkage Map for the Pink Salmon Genome
Name: University of Montana

FORM 4B
Personnel
& Travel
DETAIL

Preparec April, 1999

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

Contractual Costs:	Proposed
Description	FY 2000
Contractual Total	$0.0

Commodities Costs:	Proposed
Description	FY 2000
Materials and supplies for DNA and allozyme analysis	22.3
FMBIO fluorescent scanner service and maintenance contract	8.0
Equipment repair and maintenance	5.5
Communications	0.7
Commodities Total	$36.5

FY00

Prepared: April, 1999

Project Number: 00190
Project Title: Construction of a Linkage Map for the Pink Salmon Genome
Name: University of Montana

FORM 4B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	
Hitachi FMBIO 100 Fluorescent Imaging Scanner	1	

FY00

Project Number: 00190
Project Title: Construction of a Linkage Map for the Pink Salmon Genome
Name: University of Montana

FORM 4B
Equipment
DETAIL

Prepared: April, 1999

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$0.0						
Travel		$0.0						
Contractual		$97.7						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$97.7			Estimated FY 2001	Estimated FY 2002		
General Administration		$6.8						
Project Total	$0.0	$104.5						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00	Project Number: 00190 Project Title: Linkage Map for Pink Salmon Genome -- ASLC Bench Fee Component Agency: ADFG	FORM 3A TRUSTEE AGENCY SUMMARY

Prepared:

approved TC 8-9-99

Youth Area Watch

Project Number:	00210
Restoration Category:	General Restoration
Proposer:	R. Sampson/Chugach School District
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	5th yr. 7 yr. project
Cost FY 00:	$122.0
Cost FY 01:	$107.0
Cost FY 02:	$96.3
Geographic Area:	Prince William Sound, lower Cook Inlet
Injured Resource/Service:	All

ABSTRACT

This project links students in the oil spill impacted area with research and monitoring projects funded by the Trustee Council. The project involves students in the restoration process and provides these individuals the skills to participate in restoration now and in the future. Youth conduct research identified and delegated by principal investigators who have indicated interest in working with students. Youth Area Watch fosters long-term commitment to the goals set out in the restoration plan and is a positive community investment in that process. Participating communities in FY 00 will be Tatitlek, Chenega Bay, Cordova, Nanwalek, Port Graham, Seldovia, Seward, Valdez, Whittier and a remote site within the Chugach School District.

INTRODUCTION

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

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

Four core research projects funded by the Trustee Council serve as the central link for all Youth Area Watch activities. Initial cooperating projects include pristane mussel analysis (00195), harbor seal management and biological sampling (00244F), surf scoter life history and ecology (00273) and oceanographic data collection in conjunction with the noted Trustee Council funded projects. These projects continue to work with Youth Area Watch, providing specific research activities for students to conduct and training protocol for those duties. According to protocol, students collect samples and data for the cooperating research and monitoring projects. The samples and data are compiled by a Youth Area Watch project coordinator located in Anchorage and sent on to the principal investigator of the respective projects. Information on the data collected is maintained by the project coordinator for project analysis conducted by the students during group project sessions.

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

Students will post project information on their web site for the public to view. This information will be updated throughout the project year.

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

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

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

B. Rationale/Link to Restoration

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

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

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

C. Location

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

The science teacher (site teacher) within each of the nine communities oversees the day-to-day activities pertaining to the project. Project coordinators travel to the local communities to facilitate in-class integration of project activities and off-shore research in specific locations of importance to the identified research projects. Local projects activities identified by each site occur at or near the community. In the case of the remote site, project coordinators and a principal investigator travel to the location to work one-on-one with the student and provide periodic oversight.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

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

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

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

PROJECT DESIGN

A. Objectives

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

Youth Area Watch objectives include:

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

B. Methods

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

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

The Chugach School District developed an application and screening tool to select students for participation in the project. Up to 28 students will be selected from the communities to be a part of Youth Area Watch. While the distribution may vary according to the interest and ability of students that apply, it is expected that the distribution will be as follows: two student from Chenega Bay, three students from Cordova, two student from Port Graham, two students from Nanwalek, two students from Seldovia, six students from Seward, three students from Tatitlek, four students from Valdez, three student from Whittier and one remote site student.

Prior to the beginning of school in the fall, participating Youth Area Watch teachers at the local sites will come together for an orientation session facilitated by project coordinators. It is anticipated that site teachers will again receive protocol training directly from principal investigators. This training will occur at one community site and the training will be videotaped for future referral.

Youth Area Watch relies on the participation of research projects, sites and program resources to successfully fulfill the project objectives. Throughout the project year, students travel to research vessels, specific project sites near their community and research labs in the process of project activity completion. In the past year, Youth Area Watch was able to coordinate with projects conducting research cruises and work cooperatively on task completion while sharing the costs of vessel hiring. In the FY98, Youth Area Watch coordinators assisted with the coordination of harbor seal protocol training. It is expected that this type of cooperative effort will continue in the present and coming years.

Students will participate in the four core research projects as a group. This will consist of coming together as a group to work on collection protocol, as well as conducting activities for these projects in their community. In addition, students will participate in local projects that pertain to their geographic area. It is during the local project work that students receive a high degree of one-on-one interaction and involvement with principal investigators and their research.

Ongoing Youth Area Watch research and restoration projects include:

1. Pristane/mussel analysis, Project Number 00195. Jeff Short and Pat Harris at the NOAA Auke Bay laboratory study the pristane levels in blue mussels. There are approximately thirty mussel collection sites in Prince William Sound. Students will continue to collect mussels twice a month at sites appropriate for collection according to set protocol. During the fall and winter months, students are responsible for overall mussel bed seasonal watch. Students will tag, identify mussel bed characteristics and predator/prey activities.
2. Harbor seal management and biological sampling, Project Number 00244F. The project is conducted by Monica Reidel of the Alaska Native Harbor Seal Commission, in cooperation with Vicki Vanek from the Department of Fish and Game in Kodiak. After they have participated in traditional ecological knowledge and protocol training, students will pair up with local technicians/hunters and assist with bio-sampling activities. Students collect different parts of the seal, including the skin, blubber, teeth and stomach. Adherence to sampling protocol is ensured by working directly with the local hunters.
3. Surf Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knowledge to Conserve the Resource, Project Number 00273. The principal investigator is Dan Rosenberg. The project studies the population of surf scoters in Prince William Sound and the lower Cook Inlet. This local resource is one of particular importance to subsistence. Youth will assist in capturing and monitoring the scoters to define the breeding, molting and wintering areas.

4. Observational Physical Oceanography in Prince William Sound. While the SEA project for which students collected data is closing out in FY99, the information will be collected in conjunction with the other projects; data will be sent to Pat Harris (/195) and Dan Rosenburg (/273). Project activities will include looking at the physical oceanography of the Sound and efforts will be made to coordinate this data collection with Long-Term Oceanographic Monitoring (/340) where appropriate. Physical oceanography activities will include measuring basic oceanographic features such as temperature, salinity and weather conditions. Research activities include, 1) temperature: reversing thermometer units and a temperature logger will be monitored by students at research sites, 2) salinity: students monitor the water salinity at location where temperature is taken, and 3) weather station: weather station instruments are installed at each site so that students can measure wind speed and direction, air temperature and barometric pressure.

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

This year, local projects include: addressing the outfall from the local cannery in Cordova; identifying traditional subsistence uses in Seldovia; assisting SeaLife Center staff in rearticulating carcasses in Seward; studying at ballast water exchange from tankers in Valdez; and assisting with the kittiwake project (/338) in Whittier.

Coordination between Youth Area Watch and participating research projects remains strong. Where possible, research vessel costs are shared to maximize resources for project activities. In the case of the pristane/mussel project, Youth Area Watch has paid for the biologist's chartered flights to sites for mussel collection to allow students to participate in the process. In other instances, time and resources are contributed by participating projects to Youth Area Watch.

Objectives and Activities

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Activity 3: Students will be informed of the process to apply and participate in Youth Area Watch '00.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Activity 1: Students take daily water temperature and depth reading at their local site. The water is tested for salinity during this measurement as well.

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

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

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

Activity 1: Local hunters facilitate a local orientation to identify community procedures for sample collection participation.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Objective 13: Students at each site collect blue mussels for pristane/mussel analysis.

Activity 1: Students tag and identify mussel bed characteristics during fall and winter months at their local sites.

Activity 2: Students note predator/prey activity at the identified mussel bed sites monthly.

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

Activity 3: Students collect mussels according to principal investigator request during the spring months. Sites are selected by the principal investigator and noted in project reporting.

Activity 4: Student label and cold storage mussels for transport to the Auke Bay laboratory in Juneau.

Activity 5: Students send mussels directly to Auke Bay once an adequate collection has accumulated.

Activity 6: Student count mussels in the beds according to set protocol.

Activity 7: Students compile site data for transmission to the project coordinator.

Activity 8: Students travel to the Auke Bay laboratory to participate in the analysis of data.

Objective 14: Student conduct surf scoter monitoring and collect traditional ecological knowledge for identification of life cycle patterns.

Activity 1: Students capture scoters according to set protocol for bird monitoring.

Activity 2: Students assist the principal investigator in implanting satellite transmitters in scoters as appropriate.

Activity 3: Students monitor the scoters that have been implanted with the transmitter.

Activity 4: Students identify breeding, molting and wintering areas of the scoter within their area.

Activity 5: Students collect traditional ecological knowledge from community members on surf scoter breeding and migratory patterns, hunting and uses. This information is forwarded to the principal investigator, Dan Rosenburg.

Objective 15: Project coordinators facilitate project follow-up training for site teachers in the spring.

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

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

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

C. Cooperating Agencies, Contracts, and Other Agency Assistance

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

The Chugach School District continues to work with the University of Alaska in an effort to provide credit for progressively responsible activities and research conducted by students participating in Youth Area Watch. The district views the University of Alaska system as an integral partner in a continuum of active ecosystem awareness and restoration. Through the Native Marine Sciences Program at the University of Alaska Fairbanks, students will have the opportunity to further their understanding of research and restoration activities, as well as explore personal goals that may lead to a career in this field.

The Chugach School District continues to work with the Chugachmiut and Chugach Regional Resources Commission to coordinate and exchange community information with regard to regional restoration activities. As the coordinating agency for community involvement, Chugach Regional Resources Commission works with the youth through the local facilitators so that students may participate in research and restoration activities.

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

In keeping with its commitment to secure additional support for Youth Area Watch activities, Chugach School District has sought and received two significant grants that offset the cost of the project. A five-year ($498,750) U.S. Department of Labor grant allows the District to couple real life activities with education, focusing on how these experiences will be applied in adulthood; a particular objective of the grant is directed at science opportunities in response to Youth Area Watch. In addition, the District will continue to commit general funds to the project and will seek out alternative funding sources in an effort to transition away from Trustee Council support. The success of the project activities motivates the Chugach School District to commit additional funding through diversified means so that the youth are equipped to continue their restoration and ecological management activities as an integral component of their education. For example, the school district has recently applied for a 21-Century, three-year grant from the Department of Education to support the innovative techniques used to educate students.

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

SCHEDULE

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

July 1 - August 1, 1999:	Confirm research & data collection activities
August 15 - 31, 1999:	Site teacher orientation
September 1 - 18, 1999:	School site orientations
September 15 - 30, 1999:	Students selected for participation
September 24 - October 7, 1999:	Site teacher training on protocol
October 15 - 31, 1999 :	Student orientation and training
November 1 - 7, 1999:	Sites prepare weather stations
November 1 - July 30, 1999:	Students participate in research activities
November 1 - May 31, 1999:	Students maintain web site
March 1, 2000 :	Project Coordinator sends data to PIs
March 1 - 15, 2000:	Site teacher follow-up training
June 1, 2000:	Project Coordinator sends data to PIs
June 1, 2000:	Students complete project reports for FY 99

Ongoing Activities:

February 00 - August 00:	Student bi-monthly collection of mussels
October 99 - September 00:	Student mussel bed monitoring
October 99 - September 00:	Student weather station monitoring (daily)
October 99 - September 00:	Students collect harbor seal samples with local hunters
October 99 - September 00:	Students conduct local project activities
October 99 - September 00:	Students assist in documenting local TEK
October 99 - September 00:	PIs interact and exchange information with students

B. Project Milestones and Endpoints

October 17, 1999:	Students selected for participation
October 30, 1999:	Protocol training complete
November 1, 1999:	Students conduct project activities
March 1, 2000:	Data/samples to PIs
June 1, 2000:	Data/samples to PIs and reports complete
October 17, 2000:	Students selected for participation
October 30, 2000:	Protocol training complete
November 1, 2000:	Students conduct project activities
March 1, 2001:	Data/samples to PIs
June 1, 2001:	Data/samples to PIs and reports complete
October 17, 2001:	Students selected for participation
October 30, 2001:	Protocol training complete
November 1, 2001:	Students conduct project activities
March 1, 2002:	Data/samples to PIs
June 1, 2002:	Data/samples to PIs and reports complete
October 17, 2002:	Students selected for participation
October 30, 2002:	Protocol training complete
November 1, 2002:	Students conduct project activities
March 1, 2003:	Data/samples to PIs
June 1, 2003:	Data/samples to PIs and reports complete

C. Completion Date

Objectives identified in the project design will continue to serve as guidelines for community involvement within the civil settlement throughout the life of the restoration effort. It is expected that the Youth Area Watch project will be completed upon termination of the restoration process.

PUBLICATIONS AND REPORTS

Youth Area Watch was featured in "The Science Teacher," "Living on Earth" and "Alaska Magazine." Copies of these articles have been forwarded to the Restoration Office. In addition, the project has been featured on NPR.

In FY 00, project coordinators would like the assistance of the chief scientist and/or the peer review group to develop an article of importance to scientific juried journals.

PROFESSIONAL CONFERENCES

Throughout the year, Chugach School District administrative staff showcase Youth Area Watch. Most recently, the project was shown to a San Francisco-based foundation and a school district in Connecticut using digital video displays of student work with PI's from research projects. The principal investigator will continue this programmatic modeling in FY 00 as opportunities become available.

NORMAL AGENCY MANAGEMENT

This section is not applicable.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Youth Area Watch relies on the participation of Trustee Council funded projects to maintain coordination with restoration efforts. Through the commitment of principal investigators, youth conduct research activities with and for participating projects. Students work independently, as well as beside researchers during the project year. Costs are shared between projects to allow for increased research vessel time and one-on-one interaction between students and the researchers.

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

A variety of funding sources and project contributions ensure the success of the project. The school district commits over $168,525 in FY 00 to the project. School districts contribute $56,700 in teacher time and $22,050 in facility resources. Communities and school districts contribute $12,600 in lodging. Equipment in-kind contributions total $7,718. Participating principal investigators from research projects contribute $7,140 worth of their time.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

Student orientation for Youth Area Watch will be conducted at the Seward SeaLife Center in FY 00. The hiring of a research vessel is no longer necessary now that this facility is available as a resource. Students witness research in this state-of-the-art facility and make use of the resources for purposes of Youth Area Watch. It is also expected that SeaLife Center staff will orient the students to the research and overall integration of their work into the monitoring of Prince William Sound.

Since the inception of the project, /195, Pristane Monitoring in Mussels has been a core research project for Youth Area Watch. Based on the tremendous success in working with

Pat Harris to collect blue mussels and monitors beds, students began visiting the Auke Bay Laboratory to work along side researchers in the analysis of data. This aspect of the project is integrated into the identified activities. Interaction between research staff and students at the Auke Bay Laboratory in Juneau is expected to continue in subsequent years.

While articles featuring Youth Area Watch were published in FY 99, it is still the hope that a scientific journal will accept an article on the project. The assistance of Trustee Council peer review members and/or the chief scientist is requested to help in achieving this goal. By drawing on the expertise of professionals from the scientific field, it is anticipated that a case can be developed to promote Youth Area Watch approaches of integrating youth in scientific research activities.

Lastly, Lower Cook Inlet communities of Port Graham Nanwalek and Seldovia are fully integrated into the programmatic activities of Youth Area Watch.

PROPOSED PRINCIPAL INVESTIGATOR

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

PRINCIPAL INVESTIGATOR

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

OTHER KEY PERSONNEL

Project Coordinators: Jennifer Childress and Josh Hall. Both Ms. Childress and Mr. Hall are certified secondary teachers with Bachelor of Science degrees in physical science.

As noted previously, the project coordinator position has been split into two, part-time positions to most effectively meet the objectives of the project. Jennifer Childress and Josh Hall will share the following responsibilities:

1. working with principal investigators of research projects to ensure proper protocol.
2. coordinating student selection process.
3. coordinating all orientation and training sessions with site teachers and staff.
4. ensuring that site teachers and students have proper supplies.
5. completing site visits.
6. monitoring project activity of students.
7. providing support to site teachers.
8. coordinating principal investigator-student interaction through research.
9. transmitting data to principal investigators.
10. completing necessary project reports and/or materials for publication.
11. continuing to seek additional funding sources for project activities beyond the life of the Trustee Council.

LITERATURE CITED

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

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

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

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

Approved 8-9-99

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$0.0						
Travel		$0.0						
Contractual		$114.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$114.0			Estimated FY 2001	Estimated FY 2002		
General Administration		$8.0						
Project Total	$0.0	$122.0						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Prepared:

Project Number: 00210
Project Title: Youth Area Watch
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	$54.0	$56.4						
Travel	$34.7	$30.0						
Contractual	$23.0	$5.0						
Commodities	$5.5	$4.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$117.2	$95.4			Estimated FY 2001	Estimated FY 2002		
Indirect	$23.4	$18.6						
Project Total	$140.6	$114.0			$100.0	$90.0		
Full-time Equivalents (FTE)	1.0	1.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$265.5	$264.3			$277.5	$291.3		

Comments:
Personnel - The two, part-time project coordinators share the duties of monitoring and facilitating the project activities at all sites.
Travel - Students travel by both charter (especially when conducting field work, such as mussel collection with the scientist). Student travel to Anchorage for the Science Review is a project contribution. Only transport expenses are requested through the budget. All per diem expenses are contributed to the project.
Contractual - The hiring of boats at a rate of $1,000 per day (5 days) will occur in conjunction with research on surf scoters and kittiwakes.
Commodities - Each major classroom site is allocated $500 for project supplies. Supplies from previous years will be used as well.
Indirect - School district administrative costs are calculated at 20%. This accounts for the direct oversight of fiscal reporting and associated support at the administrative offices in Anchorage. In addition, these costs offset the expenses that sites incure including telephone, fax, postage and other general support.
Other resources - Teacher time ($56,700); participating PIs ($7,140); Youth Area Watch PI ($11,025); Facility space ($22,050); equipment ($7,718); travel, facilities, lodging and additional adminstrative support ($159,705).

FY00

Prepared:

Project Number: 00210
Project Title: Youth Area Watch
Name: Chugach School District

FORM 4A
Non-Trustee
SUMMARY

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

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2000
Project Coordinator	The coordinator facilitates training for both site teachers and participating students; coordinates youth interaction with research PIs; schedules project travel; works with local sites to develop community restoration projects; works with local facilitators and site teachers to ensure the exchange of information; monitors the completion of project activities; solicits additional funding for project enhancement.		12.0	4.7		56.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		12.0	4.7	0.0	
					Personnel Total	$56.4

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Charter and /or commerical trips for students to training/research.	0.5	53			26.5
Project coordinator from Anchorage to Cordova.	0.3	2			0.6
Project coordinator from Anchorage to Nanwalek.	0.2	2			0.4
Project coordinator from Anchorage to Port Graham.	0.2	2			0.4
Project coordinator from Anchorage to Seldovia.	0.2	2			0.4
Project coordinator from Anchorage to Seward.	0.1	3			0.3
Project coordinator from Anchorage to Tatitlek.	1.0	2			2.0
Project coordinator from Anchorage to Valdez.	0.2	2			0.4
Research PI travel to training sites.	0.5	4			2.0
					0.0
					0.0
					0.0
				Travel Total	$33.0

FY00

Project Number: 00210
Project Title: Youth Area Watch
Name: Chugach School District

FORM 4B
Personnel
& Travel
DETAIL

pared:

Contractual Costs:	Proposed
Description	FY 2000
The hiring of boats at a rate of $1,000 per day (5 days) will occur in conjunction with research on surf scoters and kittiwakes.	5.0
Contractual Total	$5.0

Commodities Costs:	Proposed
Description	FY 2000
Supplies for each classroom site are necessary. This will replace consumable commodities used during the project year. Commodities include chemicals, sampling containers (beakers, plastic bags), water resistent note pads and office supplies associated with the project. Each major classroom site (8) will require $500 for supplies, totaling $4,000.	4.0
Commodities Total	$4.0

FY00

Prepared:

Project Number: 00210
Project Title: Youth Area Watch
Name: Chugach School District

FORM 4B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	
Weather stations have been purchased in previous years. They will continue to be used in FY 00.	5	
Computers and peripherals are used at each site to synthesize and post information on the Youth Area Watch web site.	8	
Video equipment is used to document activities for future review and use.	1	
A GPS unit is used during various project activities.	1	

FY00

Project Number: 00210
Project Title: Youth Area Watch
Name: Chugach School District

FORM 4B
Equipment
DETAIL

ared:

approved TC 8-9-99

Project Title: Port Graham Pink Salmon Subsistence Project

Project Number:	00225
Restoration Category:	General Restoration
Proposer:	Port Graham Village Council
Lead Trustee Agency:	ADF&G
Cooperating Agencies:	Port Graham IRA Council
Alaska SeaLife Center	
Duration:	5th year, 5 year project
Cost FY 00	$75.0
Cost FY 01	$0.0
Geographic Area:	Port Graham, lower Cook Inlet
Injured Resource/Service:	Pink Salmon/Subsistence

RECEIVED

EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

This project will help supply pink salmon for subsistence use in the Port Graham area during the broodstock development phase of the Port Graham hatchery. Because local runs of coho and sockeye salmon, the more traditional salmon subsistence resource, are at low levels pink salmon are 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.

Introduction

This project helps underwrite the hatchery production of pink salmon for subsistence use in Port Graham. Normally pink salmon are not heavily utilized for subsistence. However, the local sockeye run has been very depressed and is just now beginning to respond to rehabilitation efforts, and the coho subsistence harvest at about 15% of its historic level. This has resulted in a sharp increase in the number of pink salmon harvested for subsistence in recent years. Unfortunately, the pink run to Port Graham is also suffering. Escapement into the Port Graham River has barely met the minimum goal for six of the last seven years (the 1995 return was somewhat better).

A salmon hatchery is being developed in Port Graham. Its principal mission is to build the pink salmon run back up to levels that will allow commercial exploitation. When this objective is achieved the impact of the subsistence harvest on pinks will be negligible. At this point in time however, the subsistence harvest has a significant impact. The hatchery is in the broodstock development phase. The more eggs that are put in incubation the faster the hatchery will achieve its goals. The low pink returns to the Port Graham River coupled with the subsistence harvest on the hatchery returns is limiting the number of eggs that can be put in the hatchery and extending the time it will take for the hatchery to build the broodstock it needs to become self sufficient.

The EVOS clean-up effort had a negative impact on the Port Graham pink salmon as it did on the local coho and sockeye runs. Boom deployment during the early phases of the clean up trapped a large number of outmigrating pink salmon fry in the boom curtain on the ebbing tides causing high levels of mortality. It is possible that these losses are contributing to the poor even year returns that have been experienced recently.

This project is a small piece of the overall Port Graham pink salmon enhancement program. It comprises about a third of the overall Port Graham pink salmon enhancement budget. Port Graham pink salmon enhancement program complies with all state policies governing salmon enhancement activities including disease, genetics and harvest management. All required reviews and permits have been obtained for the hatchery program including this project. This project is designed to become self-sustaining beyond the development stage, which is currently estimated to occur in 2002.

NEED FOR PROJECT

A. Statement of Problem

The salmon runs to the Port Graham area are at low levels, partly as a result of the *Exxon Valdez* oil spill. As a consequence it has become more difficult for Port Graham villagers to meets their subsistence needs for salmon. Because of their four to five year life cycles, it will take a long time for the sockeye and coho runs to rebuild. A large number of the pink salmon that are being produced by the hatchery now being developed in Port Graham are being taken in the local subsistence fishery. Although the subsistence harvest of hatchery fish is helping to make up for the lack of wild fish, it is making it far more difficult for the hatchery to develop the broodstock it needs to become self-sufficient. Unless the schedule for developing broodstock can be maintained, the hatchery will lose its positive benefit/cost ratio and may have to be closed.

A fire on January 13, 1998 in the building housing the hatchery destroyed the entire main hatchery facility including all the pink and sockeye eggs that were being incubated there. This was a major setback to the pink salmon broodstock development program and the local sockeye salmon rehabilitation effort. A newly started coho supplementation effort that was using an adjacent building to the hatchery for incubation and rearing is being curtailed so that this building can be converted to a pink and sockeye salmon incubation facility. The loss of the coho program and the setback in the pink and sockeye programs will result in less fish returning to the Port Graham and Nanwalek area. This will put additional subsistence harvest pressure on both wild and hatchery salmon that will be returning to the area over the next few years.

It is appropriate that the hatchery contribute pinks to the subsistence fishery. However, extraordinary methods will need to be employed for the hatchery to provide for the subsistence fishery as well as maintain its broodstock development schedule. These will include procedures to enhance the survival of juvenile pinks released from the hatchery, and coordinating with ADF&G to maximize the number of wild adult pink salmon returning to Port Graham that can be collected for broodstock.

B. Rationale/Link to Restoration

The importance of subsistence to the Native villages in the oil spill area has been recognized by the EVOS Trustee Council in its November 1994, *Exxon Valdez Oil Spill Restoration Plan*. This project will help preserve the subsistence lifestyle in Port Graham by providing additional salmon for subsistence needs. Harvest of these hatchery-produced salmon will take pressure off the local wild runs, helping them in their recovery effort. Using an enhanced resource to replace harvest of an injured resource is an accepted strategy under the Restoration Plan.

C. Location

The project will be conducted at Port Graham with the bulk of the benefits accruing to the Port Graham village.

COMMUNITY INVOLVEMENT

The Port Graham Village Council is submitting this proposal. The Port Graham hatchery is owned and operated by Port Graham Hatchery, Inc., an arm of the Port Graham Village Council. The Port Graham Village Council will manage this project under a contract with ADF&G.

PROJECT DESIGN

A. Objectives

Use the Port Graham hatchery to provide pink salmon for local subsistence use while maintaining the hatchery's pink salmon broodstock development schedule.

B. Methods

This will be the fifth year of a proposed five year project. Two basic strategies will continue to be employed to meet the objective. The first will be to supplement the ADF&G monitoring of the Port Graham pink salmon return and the second will be to enhance the juvenile to adult survival of the hatchery produced pink salmon through an extended rearing program. A brief discussion of each approach is given below.

The Port Graham River pink salmon run is the source of the hatchery broodstock. A program has been established to work closely with ADF&G in monitoring the pink salmon return to Port Graham each year in order to get as precise an estimate as possible on the wild and hatchery return. This program supplements the normal management stream and bay surveys of Port Graham that ADF&G conducts. It includes additional stream surveys and closely monitoring the subsistence fishery harvest. This program has established regular lines of communications between Port Graham and ADF&G. By coordinating effort and keeping close track of the pink salmon return, it has been possible to maximize the harvest of pink salmon while ensuring that the Port Graham River pink salmon escapement goal is met. This program will be continued in FY 00.

The second approach will apply techniques to increase the fry to adult (marine) survival of hatchery produced pink salmon. Normal hatchery practice involves holding pink salmon fry in saltwater pens after they emerge from the incubators. These fish are put on feed and held until the first mature zooplankton bloom that usually occurs in the later part of May in the Port Graham area. Normal holding time is 3 to 4 weeks. The marine survival with this technique has been poor, ranging between 1 and 2.5%.

Test lots of pink salmon fry reared at Port Graham to an average weight of 8 grams (the threshold size at which pinks leave the near shore area for the high seas) had survival rates of 7% to 10%. Although this was very encouraging there are major problems with holding pink salmon fry the four months it takes to rear them to 8 grams. First, rearing fish to that size is expensive. Second, there is a high risk that fish held that long may contact disease or otherwise be injured or killed. Of particular concern is the potential for the rearing fish to contact "warm water vibrio", a highly contagious bacterial infection that pink salmon fry are susceptible to if reared in salt water warmer than 10° C. A group of pink salmon fry that were intended to be reared to an average weight of 8 grams under this project in FY 96 had to be released early because of an outbreak of warm water vibrio.

Studies undertaken at other pink salmon hatchery facilities in the state indicate that rearing salmon to a minimum of one gram also greatly enhances marine survival. Nearly eight times as many fry can be reared to 1 gram rather than 8 grams for the same cost. In addition, the reduced holding time required for producing 1 gram fish as opposed to 8 grams reduces the risk of loss from injury or disease. A group of pink salmon fry were successfully reared to the 1 gram size and released as part of this project's FY 96 activities. An estimated 5% of this group survived to return as adults. A similar, perhaps larger, group of 1 gram fry will be produced in FY 00 to see if this marine survival rate can be repeated.

The Port Graham hatchery now has the capability to produce modest amounts of heated water, both fresh and salt. This provides the potential to accelerate development and growth of small groups of fish. In FY 00 a lot of 20,000 to 100,000 pink salmon will be incubated and reared on heated water with the objective of achieving a minimum average weight of 1 gram in time for release into the mature zooplankton bloom in late May. A search of the literature and conversations with other pink salmon hatcheries in Alaska, indicate that a test of this sort has never been conducted. However, it would seem that releasing large size pink salmon fingerling into the mature zooplankton bloom would greatly enhance marine survival.

All fish in both the 1gram fingerling lots reared in ambient temperature water and the 1 gram fingerling lot produced with heated water will be otolith marked with a separate mark for each lot. For comparison purposes a third lot of pink salmon will receive the normal treatment of incubating and rearing in ambient temperature water for release into the zooplankton bloom. This lot will not be marked.

SUPPLEMENTATION CRITERIA. This is a supplementation project. The following is a brief discussion of how the project fits under each of the supplementation criteria presented in the *Invitation to Submit Restoration Projects for Federal Fiscal Year 1996 and Draft Restoration Program: FY 96 and Beyond*, March 1995, pages 34-35.

Benefits of Supplementation. This project will provide additional pink salmon for harvest in the subsistence fishery in the Port Graham area. By shifting some of the subsistence harvest to hatchery salmon this project will help Port Graham wild salmon stocks recover from their present low levels.

Generic Risk. The Port Graham pink salmon hatchery program was reviewed by the ADF&G, CFMD Genetics Section who determined that the program (which includes this project) meets all criteria of the state Genetics Policy for Salmon Enhancement. The program (including this project) has been awarded a state Fish Transport Permit.

Mixed-stock Fishery. The potential for the Port Graham pink salmon hatchery program (including this project) creating or exacerbating a mixed stock fishery program is minimal. The harvest of Port Graham pink salmon are spatially and/or temporally separated from other Kachemak Bay pink salmon stocks as well as other salmon species. There is very little overlap. The same is true with the other salmon species that spawn in the Port Graham area.

Monitoring and Evaluation. A portion of the pink salmon reared to 8 grams will be coded wire tagged. The local fisheries and the hatchery egg take will be monitored for marked fish.

Economic Criteria. This project, especially long term rearing pink salmon fry to increase adult survival, will negatively impact the hatchery benefit/cost ratio. However, not doing this project would either cause a reduction in the overall subsistence harvest in Port Graham as well as put additional pressure on the wild stocks, and/or extend the hatchery broodstock development phase to the point where operating the hatchery stops making economic sense.

Procedural Criteria. All evaluations (Regional Salmon Planning Team, Coastal Project Certification) of the Port Graham hatchery program (including this project) have been conducted and all necessary permits (hatchery permit, fish transport permit, COE, DNR, CZM) have been obtained. This project has not been evaluated under the NEPA process.

C. Cooperating Agencies, Contracts and Other Agency Assistance

The Port Graham IRA Council will operate this project under a contract with ADF&G. The funds for stream survey air charters will be retained by ADF&G to supplement the normal management surveys of Port Graham.

SCHEDULE

A. Measurable Project Tasks for FY 00

October, 1999	Incubators containing the lots intended for extended rearing and heated water rearing are identified and heat-treated to produce a separate otolith mark for each lot.
November, 1999	After eye-up eggs from the lot intended to reach 1 gram by late May are put on a heated water regimen.
May, 2000	Heated water rearing lot intended to produce fingerling with average weight of 1 gram are released into zooplankton bloom.
May, 2000	Fry receiving standard treatment (incubated and reared in ambient temperature water and held for release into zooplankton bloom) are released into zooplankton bloom.
late June, early July	Lots held for extended rearing in ambient temperature water are released after having reached an average weight of 1 gram.
July 7 to August 31	Monitor pink salmon return to Port Graham.
August 10 to August 25	Capture hatchery broodstock.
August 28 to September 10	Egg take.
April 2001	Final report.

B. Project Milestones and Endpoints

The project objective will be successfully met if broodstock development phase is completed on schedule at the end of FY 02.

C. Completion Date

This project will end when the broodstock development phase at the Port Graham hatchery is complete. This is expected to occur by the end of FY 02.

PUBLICATIONS AND REPORTS

Annual reports	Describes project activities for the year, analyzes successes and problems, makes recommendations for improvements due April 15 following fiscal year being reported on.
Final report	Synopsis of each tear's activities with analysis of project as a whole. Due April 15 following final year of project.

PROFESSIONAL CONFERENCES

No travel to professional conferences will be paid for out of this project. However, hatchery staff will be attending the Alaska Hatchery Manager's Workshop and the Native American Fish & Wildlife Society meeting and at which they will give a presentation of the work done under this project.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

If funded, this project will be integrated into the overall pink salmon enhancement program in Port Graham.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

The production of a lot of fingerling with an average weight of 8 grams has been eliminated because of the high potential for this lot to contract warm water vibrio. In its place heated water will be used to produce a lot of fingerling with an average weight of one gram from release during the mature zooplankton bloom in late May. This lot will test the efficacy of this strategy compared with rearing fry in ambient temperature water until they have achieved an average weight of 1 gram before releasing them.

PRINCIPAL INVESTIGATOR

Ephim Anahonak, Jr., Hatchery Manager
Port Graham Hatchery
P. O. Box 5543
Port Graham, AK 99603
phone (907) 284-2233
fax (907) 284-2238

Mr. Anahonak has been hatchery manager of the Port Graham hatchery for the past four years. He has had and will continue to have overall responsibility for the project.

OTHER KEY PERSONNEL

Paul McCollum, hatchery consultant. Mr. McCollum will advise the hatchery staff on the procedures and techniques needed to achieve project objectives.

David Daisy, fish culture consultant. Mr. Daisy will work with the hatchery staff and Mr. McCollum in project design, implementation and reporting.

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

Approved TC 8-9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000	[redacted]					
Personnel	$0.0	$0.0						
Travel	$0.0	$0.0						
Contractual	$70.1	$70.1						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$70.1	$70.1		Estimated FY 2001	Estimated FY 2002	Estimated FY 2003	Estimated FY2004	
General Administration	$4.9	$4.9						
Project Total	$75.0	$75.0		$0.0	$0.0	$0.0	$0.0	
			[redacted]					
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY 00

Prepared: 1 of 8

Project Number: 00225
Project Title: Port Graham Pink Salmon Subsistence Project
Agency: AK Dept. of Fish & Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/15/99

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
	Subtotal		0.0	0.0	0.0	
					Personnel Total	$0.0

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

FY 00

Project Number: 00225
Project Title: Port Graham Pink Salmon Subsistence Project
Agency: AK Dept. of Fish & Game

FORM 3B
Personnel
& Travel
DETAIL

pared:

4/15/99

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

Contractual Costs:	Proposed
Description	FY 2000
4A Linkage: Contract with non-trustee agency	70.1
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$70.1

Commodities Costs:	Proposed
Description	FY 2000
Commodities Total	$0.0

FY 00

Project Number: 00225
Project Title: Port Graham Pink Salmon Subsistence Project
Agency: AK Dept. of Fish & Game

FORM 3B
Contractual &
Commodities
DETAIL

Prepared:

4/15/99

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 1999

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY 00

Project Number: 00225
Project Title: Port Graham Pink Salmon Subsistence Project
Agency: AK Dept. of Fish & Game

FORM 3B
Equipment
DETAIL

ɔared: 4 of 8

4/15/99

1999 EXXON VALDEZ TRU E COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999						
Personnel	$33.0	$33.0						
Travel	$0.0	$0.0						
Contractual	$13.1	$13.1						
Commodities	$14.0	$14.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$60.1	$60.1		Estimated	Estimated	Estimated	Estimated	
Indirect	$10.0	$10.0		FY 2001	FY 2002	FY 2003	FY 2004	
Project Total	$70.1	$70.1		$0.0	$0.0	$0.0	$0.0	
Full-time Equivalents (FTE)		12.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY 00

Project Number: 00225
Project Title: Port Graham Pink Salmon Subsistence Project
Name: Chugach Regional Resources Commission

FORM 4A
Non-Trustee
SUMMARY

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

Personnel Costs:				Months	Monthly		Proposed
	Name	Position Description		Budgeted	Costs	Overtime	FY 2000
[redacted]		Fish Culturist	[redacted]	6.0	$2,750		16.5
		Fish Culturist		6.0	$2,750		16.5
		Subtotal	[redacted]	12.0	5500.0	0.0	[redacted]
						Personnel Total	$33.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2000
[redacted]						
					Travel Total	$0.0

FY 00

Project Number: 00225
Project Title: Port Graham Pink Salmon Subsistence Project
Name: Chugach Regional Resources Commission

FORM 4B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FY 2000
Freight	1.0
Maintenance & Repair	0.8
Seine boats for broodstock collection 8 days @ $500/day	4.0
Air charter for stream surveys - to ADF&G	2.3
Technical consultants	5.0
Contractual Total	$13.1

Commodities Costs:	Proposed
Description	FY 2000
Fish Food	10.1
Skiff fuel/oil	0.3
Plumbing supplies	0.2
Building supplies	0.3
40 x 40 rearing pen nets	3.1
Commodities Total	$14.0

FY 00

Project Number: 00225
Project Title: Port Graham Pink Salmon Subsistence Project
Name: Chugach Regional Resources Commission

FORM 4B
Contractual &
Commodities
DETAIL

P ed:

15/99

approved TC 8-9-99

COMMUNITY-BASED HARBOR SEAL MANAGEMENT AND BIOLOGICAL SAMPLING

Project Number:	00245
Restoration Category:	General Restoration
Proposer:	Alaska Native Harbor Seal Commission
Lead Trustee Agency:	Alaska Department of Fish and Game
Cooperating Agencies:	
Alaska SeaLife Center:	
Duration:	2nd year; four year project
Cost FY 96:	
Cost FY 97:	
Cost FY 98:	
Cost FY 99:	$70,700
Cost FY 00:	$56,500
Cost FY 01:	$40,000
Cost FY 02	$25,000
Geographic Area:	Prince William Sound, Cook Inlet, Kodiak, Alaska Peninsula
Injured Resource/Service:	Harbor seals; subsistence

RECEIVED

EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

This project continues, at a reduced level, work supported through previous harbor seal restoration projects (\244 and 99245). A biological sample collection program, implemented in FY96 and expanded in FY97, in Prince William Sound, lower Cook Inlet, and Kodiak Island will continue. A training initiative will take place in a Chignik area community (Alaska Peninsula). Village-based technicians are selected by the Alaska Native Harbor Seal Commission (ANHSC) and trained by the Alaska Department of Fish and Game to collect samples. The samples are transported to Anchorage or Kodiak for further sampling and distribution to participating scientists for analysis. The ANHSC will produce and distribute a newsletter with summaries of the biological sampling program.

INTRODUCTION

The goal of this project (which continues the work of #\244) is to support collaboration between subsistence hunters of harbor seals, scientists, and resource management agencies to assess the factors which are affecting the recovery of the harbor seal population of the oil spill area and to identify ways to reduce these impacts. In FY 94 (Project 94244) and FY 95 (95244), the Trustee Council provided funding for the Alaska Department of Fish and Game, Division of Subsistence, to compile available data, collect additional information, and to organize workshops and community meetings with scientists and subsistence users. Participants in the workshops concluded that the lack of a formal organization which represents subsistence users of harbor seals is a major impediment to communication between scientists and hunters and to the inclusion of subsistence hunters as full partners in harbor seal research and restoration. To fill this gap, Alaska Native participants in the harbor seal restoration workshop of March 2, 1995 voted to form an Alaska Native Harbor Seal Commission. In FY 96, Project 96244 assisted the ANHSC by providing it with funds to organize two workshops held in conjunction with commission meetings and to produce and distribute two newsletters and other communications. Additional workshops took place under Project 97244, Project 98244, and Project 99245.

A second consensus point reached at the workshops was that subsistence hunters are in an excellent position to assist in scientific studies through providing biological samples from subsistence-taken animals. A goal of Project 96244 was to test the practicality and effectiveness of a community-based harbor seal biological sampling program, designed and administered cooperatively between the University of Alaska, the Alaska Native Harbor Seal Commission, and the Department of Fish and Game. In FY 97, this program was expanded to collect samples from the Kodiak Island area and add Valdez to the sample communities in Prince William Sound. This program continued in FY 98 and FY 99. As of March 1999, samples from 148 animals had been distributed for analysis. Table 1 reports how the samples have been distributed. Table 2 shows the geographic origin of the samples from the oil spill region, as of March 1999.

Finally, this project will support other restoration projects proposed for FY 00 and beyond, such as Harbor Seals: Monitoring and Field Research (\064), , Harbor Seals: Health and Diet (\341), Harbor Seal Metabolism/Stable Isotopes (\371), Harbor Seal Diet: Lipid Metabolism and Health (\441),the Community Involvement and Traditional Knowledge Project (\052), and the Youth Area Watch (\210). The project will also contribute to the Trustee Council's recovery objectives for subsistence by facilitating involvement of subsistence users in the restoration process.

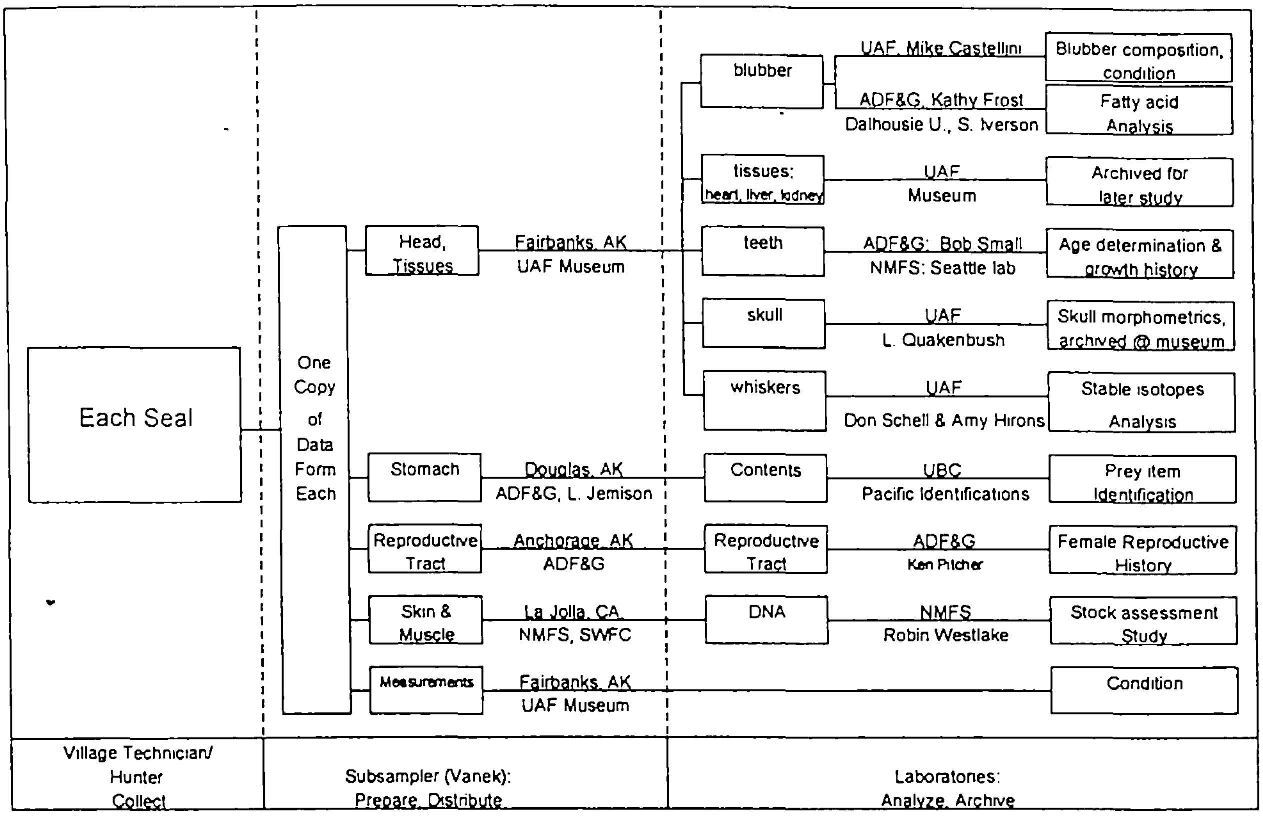
Table 1. Distribution of Subsistence Harbor Seal Samples Collected under EVOS Restoration Projects 244 and 245 (as of 3/18/99)

Tissue	# Samples	Contact	Disposition, status, and analysis
Stomachs	142	L. Jemison, ADF&G	Sent to UBC for prey identification
Teeth	128	R. Small, ADF&G	Extracted at UAF Museum; age & growth history to be determined by NMFS in 1998
Whiskers	148	D. Schell, UAF	Used in stable isotopes analyses (EVOS # 97170)
Brain and collagen[1]	128	A. Hirons, UAF	Used in stable isotopes analyses (EVOS # 97170)
Blubber	129	B. Fadely, et al., UAF & M. Castellini, UAF	Blubber composition studies completed and continuing (EVOS Proj 95117)
		K. Frost, ADF&G	Sent to Dalhousie University for fatty acid analysis (EVOS Proj 95064)
Skin/muscle	148	R. Westlake, NMFS	Sent to NMFS La Jolla for genetic analysis
Reproductive tracts	31	K. Pitcher, ADF&G & H. Harmon, UAF	Stored for future reproductive analysis
Skulls	128	G. Jarrell, UAF	UAF Museum staff is cleaning skulls for archive and morphometric examination
Archived tissue heart liver kidney blubber skeletal muscle	131	A. Runck, UAF	Tissues subsampled and archived in -70C freezer at UAF Museum; available for future contaminant analyses.

[1] Collagen from ligaments or tendons; also using muscle, blubber, skin, heart, liver, and kidney

Table 2. Summary of Harbor Seal Biosamples Collected (3/99)

Community	Number of Seals Sampled	
	Full Set of Samples	Partial Set of Samples
Chenega Bay	4	3
Nuciiq	2	0
Cordova	31	3
Tatitlek	41	29
Valdez	14	0
Seward	0	0
Nanwalek	5	1
Port Graham	0	0
Seldovia	2	3
Afognak Island	1	1
Akhiok	5	0
Old Harbor	1	1
Port Lions	1	0
GRAND TOTAL	107	41



EVOS Project 245: Sample Distribution and Chain of Responsibility (As of 3/99)

NEED FOR THE PROJECT

A. Statement of Problem

The harbor seal populations of Prince William Sound and the northern Gulf of Alaska were in decline before the oil spill for unknown reasons. The spill injured these populations, adding to the decline, and they are not recovering. Harbor seals are a primary subsistence resource in the Alaska Native communities of the oil spill region. Subsistence harvests of harbor seals have declined in many of communities since the spill because of the reduced population size and voluntary efforts on the part of hunters to limit their harvests to aid in recovery. In order to assess these efforts and to identify measures which subsistence users could take to further assist in harbor seal restoration, the Trustee Council funded projects in FY 94 and FY 95 to compile existing data, collect additional information, organize meetings of scientists and subsistence users, and develop recommendations for hunters. Two workshops took place. Among other things, participants at the workshops recognized that without a formal organization representing subsistence hunters of harbor seals, it was unlikely that a consensus on recommendations could be developed or that a dialogue between hunters and scientists could be maintained. Workshop participants stressed that strong involvement of hunters in research activities and management decisions was an essential ingredient in any plan for harbor seal recovery. Several other restoration projects are examining the potential causes of the harbor seal population decline and lack of recovery, including mortality caused by humans. The need exists to continue to follow through on the workshop recommendations to support these harbor seal restoration efforts.

B. Rationale/Link to Restoration

The recovery objective for harbor seals states that recovery will have occurred when harbor seal population trends are stable or increasing. Based on findings from two workshops which involved scientists and subsistence users of harbor seals (conducted under Projects 94244 and 95244), meeting this recovery objective is enhanced by continuing dialogue between scientists and subsistence users, involving subsistence hunters in research efforts, involving traditional knowledge in scientific studies, and collaborating in the development of recommendations for subsistence hunters about how they can assist in harbor seal recovery. This project implements the recommendations of the workshops by continuing a biological sampling program, supporting the activities of the Alaska Native Harbor Seal Commission, and partially funding a workshop in which data and hypotheses are collaboratively reviewed.

The FY 96, FY 97, FY 98, and FY 99 Restoration Work Plans included research projects to monitor seal population trends and conduct research to discover why harbor seals are not recovering. These are likely to continue in FY 00 under project 00245 Assessing parameters that affect marine mammal abundance and health requires access to and examination of animals or tissues. Marine mammals are inherently difficult to study and the collection and examination of tissues is further complicated by legal limitations imposed by federal protective measures and permitting procedures. Sacrificing animals for research purposes is either undesirable or illegal, and beachcast carcasses are often too decomposed to be of value. A potentially invaluable source of fresh specimens exists in Alaska, where coastal Alaska Natives still legally use marine mammals for subsistence or handicraft purposes. This project has developed a successful community-based bio-sampling program. This program has succeeded because:

1. Local people support the program and its goals, are involved in the sample collection, understand the significance of the data being collected, are willing to store and ship samples from villages to a central receiver, and are trained and willing to record data and collect samples as instructed.

2. Samples are easily collected, stored and shipped; they are subsequently sub-sampled by ADF&G staff; are analyzed in due time; and results are returned to villages.

Furthermore, over the last several years, the Trustee Council has attempted to involve spill-area communities more fully in the restoration process. The biosampling effort is a prime example of this involvement and collaboration.

C. Location

The biological sampling portion of the project includes the Prince William Sound communities of Cordova, Chenega Bay, Valdez, and Tatitlek; the lower Cook Inlet communities of Seldovia, Port Graham, and Nanwalek; and two Kodiak Island communities, Akhiok and Old Harbor (Table 2). For FY 00, it is proposed to add a Chignik area community to those with trained biosamplers. This is the only area within the range of harbor seals where no such training has taken place.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Community and subsistence user involvement in the restoration process and in harbor seal recovery is a central purpose of this project. The primary continuing goal is to support the involvement of the Alaska Native Harbor Seal Commission in the biosampling program. As part of the continuing biological sampling effort, the ANHSC will select technicians (most of whom will be subsistence harbor seal hunters) in participating communities. New technicians will be trained by ADF&G staff to collect biological samples. Subsistence hunters will supply the samples and will be trained through the use of an instructional video (produced in FY 96), and through hands-on instruction as needed. Also, participants in the Youth Area Watch Project (\210) will be included in project activities, including community technician training sessions and the workshop. The ANHSC will also produce a newsletter with summaries of the biosampling efforts. Although project funds are no longer available to help support a workshop, it is anticipated that the biosampling program and results will be reviewed at ANHSC meetings.

PROJECT DESIGN

A. Objectives

The primary premise upon which this project is based is that restoration of harbor seal populations is facilitated by involving subsistence users in research and management activities. Key to the success of this effort is support for the activities of the Alaska Native Harbor Seal Commission. Specific objectives include to:

1. Continue a community-based program to collect biological samples and other information from harbor seals in Prince William Sound and the northern Gulf of Alaska involving hunters from Cordova, Tatitlek, Chenega Bay, Valdez, Seldovia, Port Graham, Nanwalek, Akhiok, and Old Harbor. Train bio-samplers in one Chignik area community. Specific sub-objectives include:

   a. Train local technicians and hunters in biological sample collection procedures
   b. Maximize sampling for efficiency and coordination with other harbor seal projects
   c. Evaluate the program's effectiveness and develop a more long-term funding plan.

2. Collect biological samples and other information from harbor seals harvested by subsistence hunters in 10 communities: Tatitlek, Chenega Bay, Valdez, Cordova, Seldovia, Port Graham, and Nanwalek, Akhiok, Old Harbor, and a Chignik area community. Provide these samples to researchers for analysis.

   a. Collect information about the number, sex, approximate age and place and date of harvest for harbor seals taken in each village
   b. Collect biological samples to be analyzed in cooperation with other harbor seal projects, including blubber, whiskers, skin, female reproductive tracts, and stomachs (see Table 1 and Figure 1).
   c. Store samples in a community freezer and periodically ship samples to Anchorage or Kodiak for further processing and distribution for analysis
   d. Develop and maintain a procedure for tracking disposition of samples and results of analyses

3. In collaboration with the Alaska Native Harbor Seal Commission, communicate information about results of harbor seal studies to hunters and scientists on a regular basis through a newsletter and the development of a database.

a. Produce an informational newsletter describing results of harbor seals studies, ongoing harbor seal research, and community involvement
b. Maintain a database of biosamples and results
c. Discuss biosampling program and results at periodic meetings of the ANHSC (these meeting are funded through other programs)

4. Collaboratively produce recommendations for subsistence users of harbor seals which derive from study findings and the discussions at community meetings and workshops

a. These recommendations will be based on traditional knowledge, contemporary observations, and scientific findings
b. Recommendations will be developed at meetings of the ANHSC.

5. Evaluate the program's effectiveness and explore options for a long-term funding plan for the biological sampling program

6. Coordinate with the Youth Area Watch Program (Project /210) to involve participants in that program in biological sampling and workshops and to support a year-long curriculum based on information gathered through the biosampling program.

B. Methods

Objectives 1, 2, & 6: Biological Sampling Program

For Objectives 1 and 2, the Biological Sampling Program, the following procedures will be used:

1. Training. As part of Project 96244 (and revised as part of 97244 and 98244), a marine mammal biologist, Kate Wynne of the University of Alaska, and Vicki Vanek, a veterinarian with the Division of Subsistence (ADF&G) compiled protocols, synthesized these into useable formats, developed data forms, labels, and sampling kits, and incorporated instructions for their use into a training program. In FY 99 under 99245, Vanek assumed full responsibility to apply these materials and revise them as appropriate.

Instruction. Sampling requires instruction or training of community-based sampling technicians, who ideally are also subsistence seal hunters. Any new village-based technicians will attend a full-day sampling training session in Kodiak or Anchorage. Vanek will: provide a detailed explanation of project goals, and significance and use of data to be collected; distribute sampling kits; explain and demonstrate sampling techniques and use of equipment; and distribute written and graphic instructional materials to take to villages. An alternative is for Vanek to travel to the community to train a replacement. Vanek and Riedel will travel to a Chignik area community to introduce the project and train one or more biosamplers.

Other hunters will be informed of program objectives and specified sampling requirements through communication with village technicians and other project personnel and through written, graphic, and video instructional materials.

2. Training materials.

Manual: This was produced in FY 96 (Project 96244). It includes step-by-step diagrams and a visual guide. It is waterproof and is included in the sampling kit. Labor is involved in laying out, laminating, and binding each new manual for newly-trained local assistants.

Examples: If a seal is available, at the training session participants work on an actual animal, filling in data forms and labels. Otherwise, the training relies on slides, the training video, and artificial props.

Video. In FY 96 (Project 96244), a training video was produced by ADF&G, incorporating footage shot at the two training sessions. It has been distributed to the technicians trained at these sessions. The video includes: project rationale and objectives; footage of current research and population declines; significance and use of data to be collected; demonstrations of how to fill in data forms and labels; demonstrations how to use sampling kit and supplies; demonstrations of where and how to remove tissues from animals; and demonstrations of how to sub-sample, bag, and label tissues.

3. Sample collection

Technicians. There is a village-based technician in each participating community, whose responsibilities are to take samples from seals taken by themselves or participating hunters, record data as requested, assure access to freezer and sampling supplies, notify Vanek or Riedel when supplies are low or freezer is nearly full, and load and ship coolers with samples to Anchorage, Cordova, or Kodiak.

Key hunters. Ideally at least two hunters per village provide subsistence taken seals from which the technicians take samples, and record data as requested.

Sample size and distribution: It is difficult to predict the number of samples that may be collected in this program annually or by community, but we have assumed an average of 8 animals per community while designing the sampling strategy and estimating project costs.

Tissues to be collected. A minimal sample can be collected by technicians in each village with relative ease and subsequently sub-sampled in Anchorage or Kodiak to provide the suite of tissue samples required. We have trained technicians and hunters to record information about harvest location and animals' sex, evidence of tags or markers, and standard measures of length and girth and blubber thickness. Technicians are trained to collect the whole head; stomach (after tying off both ends), samples of liver, heart, blubber, and kidney; and female reproductive tract. Although collecting the reproductive tracts and claws is highly desirable, it is realistic to assume they will be collected opportunistically only from those hunters willing to dedicate extra effort required to collect them.

Sampling procedure.

Step 1. In the community: village technician receives sample from the hunter, or works with an animal they have taken themselves. The data form is filled out by hunters in the field and in the community by the technicians, or by youth from the Youth Area Watch project. The data form is placed inside the specimen bag with samples for village-based storage. Technicians have a kit that includes supplies adequate for sampling of 8 animals. Among the items in each kit are 1) ziploc sampling bags for collection of the head, stomach, and tissues, 2) large garbage bags in which to place the sample bags collected from each animal, and 3) data forms and specimen labels. The head, stomach, and tissues will each be individually bagged in a two gallon ziploc bag. All these sample bags are placed in one large garbage bag along with the specimen label from the bottom of the data form. The specimen bag and the data form are placed in a freezer without sub-sampling, the technician contacts Vicki Vanek or Monica Riedel when a full shipment has accumulated, and then sends the samples to Kodiak or Anchorage.

Step 2. Vicki Vanek receives samples in Anchorage and stores them at ADF&G or receives them in Kodiak and stores them at the Fisheries Technology Center. Periodic sub-sampling efforts occur as depicted in Figure. 1. Subsamples from each seal are repackaged into individual bags and labeled, specifying organ and origin; tied securely, refrozen, and shipped to the appropriate laboratory (see Fig. 1).

4. Data collection.

Data are recorded on forms which allow for standardization of data with other harvest-sampling programs. Presently, these forms have been supplied in paper copies only. An objective for Project 99245 is the development of an electronic version of this form, as recommended during the EVOS scientific review committee's review of project \244. Sample label and freezer log forms have been developed to assure adequate sample tracking. Each animal receives a unique number that is tied to the UAF Museum Archive numbering system. The number is assigned before any subsampling occurs so all parts are linked to the appropriate animal and can be easily tracked.

5. Sample analysis.

Figure 1 provides a summary of the research programs involved in the tissue analysis. It is expected that participating scientists will acknowledge in any reports and publications the role of the ANHSC in facilitating the biological sampling program. In Project 99245, an agreement form is being developed which participating researchers will sign to agree to return the results of their analysis for inclusion in databases and to acknowledge the assistance of the ANHSC.

6. Data management and reporting

Biological data collected from this program are managed and maintained in a data base using Microsoft Excel software that is easily translated or integrated with software used by other agencies and organizations. This database is centrally maintained by ADF&G and a summary of the samples collected and analyzed will be included in the project's annual and final reports to the Trustee Council, with copies to pertinent agencies, such as NMFS. Additionally, ADF&G (Vanek) will collate the results of the sample analysis into a readily understandable newsletter, that will be provided to all the project participants.

In Project 99245, steps are being taken to enhance this database, as recommended by the EVOS scientific review committee. These include:

a. Development of an electronic data form (see above). This will facilitate communication of information and incorporation of sample data into databases.
b. Enhance UAF Museum database for back-up tracking, to include information on the biosampled seals, such as the names of researchers who received samples and identification of the sample with this program
c. Development of an electronic form that summarizes all information from samples from a particular animal
d. Development of a biannual biosample status report. Presently (mid-FY99) there is no automatic system in place for researchers to return the results of their analyses or to update other participants on their activities and progress. This will be an electronic form to be submitted every six months by each researcher who receives biosamples from this project.
e. Assisting the Youth Area Watch Program in developing a curriculum that incorporates biosample collection and study results. This will initially include developing a limited set of classroom lessons that illustrate the application of length, weight, sex, location, timing, and stomach content data.

Summary: Proposed responsibilities of each cooperating group for Objectives 1 and 2:

Vicki Vanek of the Alaska Department of Fish and Game, Division of Subsistence will:

1. Compile protocols, develop data forms and sampling kits, and incorporate instructions for their use into a training program (this was completed in Project 96244; appropriate revisions will take place in Project 00245); make appropriate revisions to the instruction manual.
2. Help answer biosamplers' questions
3. Train new community assistants in a Chignik community and any replacements if necessary, in other communities in training workshops.
4. Receive samples from village-based technicians, process samples, and ship samples to participating researchers for analysis
5. Maintain the database of biological data
6. Collate the results of the sample analysis into a readily understandable newsletter.
7. Write a brief summary of the project for inclusion in the interim and final reports for the Trustee Council
8. Participate in the Alaska Native Harbor Seal Commission workshop
9. Provide technical support for Youth Area Watch school curriculum
10. Develop and maintain electronic exchange of information with researchers, including providing data forms to researchers and researchers' subsample status and results (from biannual reports) for annual reports and reports prepared by the ANHSC.

The Alaska Native Harbor Seal Commission will:

1. Identify and subcontract with 10 community technicians
2. Purchase sampling kits and distribute kits and other supplies to village-based technicians
3. Set up air freight accounts for shipping samples

4. Receive samples from Prince William Sound biosamplers, in Cordova and prepare for shipping to Anchorage for subsampling and distribution.
5. Communicate study findings through a newsletter and at its periodic meetings

Objectives 3, 4, and 5: Communications, Recommendations, and Evaluation

Communication of study findings, development of recommendations for hunters, project evaluation, and development of a long-term funding plan, are part of a collaborative effort met in part through a contract with the ANHSC, which will do the following:

1. Communicate with communities involved in the biological sampling project to review data and any recommendations developed by the ANHSC. These communications may be through phone discussions or take place during community visits connected with biosampling training or other ANHSC business
2. Write a newsletter which provides overviews of findings from harbor seal research and ANHSC activities.
3. Participate in the Trustee Council restoration workshop and contribute to Trustee Council's annual and final reports

The Division of Subsistence will provide technical assistance to the Commission as needed. The goals of these objectives are also addressed through the development and maintenance of databases, as discussed above.

Annual and final reports: the Division of Subsistence will prepare annual and final reports for the project overall, with contributions from the collaborating groups.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

A. In prior study years, a contract was developed with the Alaska Native Harbor Seal Commission to undertake portions of the project. This contract will be amended to include the objectives for Project 00245. Tasks for the ANHSC under this contract will include:

1. Purchase sampling kits and distribute kits and other supplies to village-based technicians
2. Set up air freight accounts for shipping samples
3. Identify and subcontract with local community technicians
4. Organize and participate in community meetings in selected communities involved in the biological sampling program
5. Prepare brief (letter format) quarterly reports on its activities as related to this project.
6. Attend the Trustee Council Restoration Workshop and contribute to Trustee Council's annual and final reports

Through subcontracts with the ANHSC, community technicians in 10 communities (Cordova, Tatitlek, Chenega Bay, Valdez, Seldovia, Port Graham, Nanwalek, Akhiok, Old Harbor, and a Chignik community) will do the following:

1. Attend one day training session (if newly hired in FY 00)
2. Collect samples (stomach contents, female reproductive organs, liver, heart, kidney, claws, head)

3. Record data on harvest locations, sex, evidence of tags or markers, length, and girth
4. Label and freeze samples, notify Vicki Vanek or the ANHSC when freezers are full, and load and ship coolers with samples to Kodiak or Anchorage

Contract A: Budget

Personnel	Executive Director for 12.0 months @ 1/3 time	$16,000
Travel	Executive Director travel	2,800
Operational costs: phone & mailing		3,600
Insurance		1,200
Sampling and freezer supplies, freezer electricity, shipping		2,400
Subcontract, village-based technicians		3,800
15% indirect program cost		4,500
Total		$34,300

Note: in kind contributions for the operations of the ANHSC include technical assistance from the Chugach Regional Resources Commission (Anchorage), the Alaska Sea Otter Commission (Fairbanks), and the Indigenous Peoples' Council on Marine Mammals (Anchorage).

Subcontract: Village-based Technicians

Training honorarium: $100/day for two new technicians for one day each:	$200
Compensation for taking biological samples of seals	3,600
Total	3,800

Note: it is anticipated that samples will be taken from an average of 8 seals per community, for a total of 80 seals, and that it will take about 3 hours per seal to take samples, store samples, and ship samples. At a rate of $15/hour, this gives: $15 x 3 hours x 8 seals x 10 communities = $3,600.

SCHEDULE

A. Measurable Project Tasks for FY 00

Start-up to October 15, 1999:	Update contract with the Alaska Native Harbor Seal Commission; hire technicians
October/November:	Hold training sessions for biological sampling for new community technicians
December to September 2000:	Biological sample collection
March/April 2000:	Produce and distribute newsletter (Alaska Native Harbor Seal Commission)
April 15, 2000	Annual report
September 2000:	Evaluate fourth year of program

B. Project Milestones and Endpoints (includes \244)

1. Development of sampling program: October/November 1995
2. Production and distribution of Instructional video: March 1996
3. Workshops to train local hunters and technicians in collection procedures: October/November 1995
4. Workshop in conjunction with meeting of Alaska Native Harbor Seal Commission: March 1996
5. Produce and distribute first proceedings report: April 1996
6. Maximize coordination with other programs: ongoing
7. Ship samples to appropriate laboratories for subsequent analysis: ongoing
8. Advise villages and scientists of analytical results when available: ongoing
9. Conduct interviews with hunters to collect traditional knowledge: ongoing
10. Second workshop in conjunction with Commission meeting: September 1996
11. Produce and distribute second proceedings report: September 1996
12. Train new village technicians and new Youth Area Watch participants: November 1996
13. Hold workshop in conjunction with ANHSC meeting: March 1997
14. Demonstrate updated Traditional Knowledge Database: March 1997
15. Produce and distribute proceeding for 1997 workshop: April 1997
16. Annual report: April 15, 1997
17. Complete map database and report: June 1997
18. Evaluate the program's effectiveness and develop a more long-term funding plan: September 1997 and September 1998
19. Train new Youth Area Watch participants -- October 1997
20. Hold workshop in conjunction with ANHSC meeting: March 1998
21. Produce and distribute proceedings for 1998 workshop: April 1998
22. Develop electronic forms for researcher exchange of information and system to transmit forms, assist UAF Museum to add tracking information to computer programs as a backup to main database; assist in Youth Area Watch curriculum development
23. Final report, \244: September 30, 1998
24. Train new community technicians and new Youth Area Watch participants: October/November 1998
25. Hold workshop in conjunction with ANHSC meeting: March 1999
26. Produce and distribute proceeding for 1999 workshop: April 1999

27. Annual report, 4/15/00
28. Annual report: 4/15/01
29. Annual report: 4/15/02
30. Final report: 9/30/03

C. Completion Date

This project should continue as long as the Marine Mammal Ecosystem Research package is underway. Presently, fieldwork and data analysis for several marine mammal restoration projects are continuing into FY 00, including \064 (Harbor Seals: Monitoring and Field Research), \341 (Harbor Seals: Health and Diet), \371 (Harbor Seal Metabolism/Stable isotopes), and \441 (Harbor Seal Diet: Lipid Metabolism and Health).

PUBLICATIONS AND REPORTS

Annual report	April 15, 2000
Annual report	April 15, 2001
Annual report	April 15, 2002
Final report	September 30, 2003

PROFESSIONAL CONFERENCES

No attendance planned for FY 00.

NORMAL AGENCY MANAGEMENT

The Division of Subsistence of the Alaska Department of Fish and Game has no statutory or regulatory responsibilities for marine mammal management. Without this project, marine mammal biologists who are working on harbor seal recovery will lose a key source of biological information on this species. Trustee Council support of the activities of the Alaska Native Harbor Seal Commission has improved management of the injured harbor seal resource by facilitating communications between scientists and subsistence users and providing traditional knowledge to factor in to harbor seal studies. The ANHSC has received a congressional appropriation through the National Marine Fisheries Service to support certain administrative and operational costs, such as office space and travel to certain meetings and conferences. It is seeking funding from NMFS in accordance with provisions of the Marine Mammal Protection Act to support its long-term activities.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The project provides biological samples from subsistence-taken harbor seals to address potential health and nutritional problems that may be impeding harbor seal recovery, including restoration project numbers \064, \341, \371, and \441. The project provides information to researchers working on harbor seal restoration projects and facilitates their work with Alaska Native hunters.. Participants in the Youth Area Watch project (\210) participate in community technician training sessions and attend workshops.

Several programs exist to sample tissues from harbor seals from the spill area (see Table 2 and Fig. 1). As noted above, every effort is made to coordinate with these programs to minimize the burden and confusion of hunters and communities, maximize logistical efficiency, collect comparable or standardized data whenever possible, and limit the likelihood of duplication of efforts. The National Marine Fisheries Service assists with coordinating the harbor seal sampling and testing programs.

Additional funding for the operations of the Alaska Native Harbor Seal Commission received from the National Marine Fisheries Service and the U.S. Congress, and additional funding is being sought. Such funding supports more extensive activities for the Commission across the entire range of the harbor seal in Alaska. As of April 1997, a congressional appropriation to support basic commission functions (office, accounting, travel to conferences) was being administered through NMFS. The ANHSC received a Title VIII ANILCA grant to assist in the development of co-management plans.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

No additions to project objectives or methods of the detailed project description submitted and approved for Project 99245 are being proposed. Previously, the ANHSC organized a workshop in conjunction with one of its meeting and prepared a proceedings report. This task has been eliminated in FY00 in light of reduced funding. It is anticipated that review of project progress will still take place at ANHSC meetings. In FY00, Vicki Vanek will assume responsibilities as co-principal investigator (along with Monica Riedel), replacing James Fall.

ENVIRONMENTAL COMPLIANCE

This project is, a continuation of Project 99245 which ware classified as categorically excluded under NEPA guidelines. While this project will collect biological samples from subsistence-taken harbor seals, the sampling effort will not result in any additional takings of seals.

PROPOSED PRINCIPAL INVESTIGATORS

Vicki Vanek
Wildlife Biologist
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Monica Riedel
Executive Director, Alaska Native Harbor Seal Commission
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E-mail address: aksealmr@ptialaska.net

PERSONNEL

Monica Riedel, an Alaska Native resident of Cordova, is the executive director of the Alaska Native Harbor Seal Commission. Ms Riedel is responsible for the ANHSC activities under this project, including identifying and subcontracting with local village technicians, developing subcontracts, and developing the newsletter.

Vicki Vanek is a Wildlife Biologist with the Division of Subsistence in Kodiak. She holds a Doctor of Veterinary Medicine degree, and has worked on previous Division projects in collecting marine mammal samples and training hunters as well as on the biological sampling tasks of 96244, 97244, and 98244. Dr. Vanek is responsible for overall project performance for the Division. She will assist hunters and community technicians in biosampling, and will train newly hired technicians. Dr. Vanek will also process biosamples. She will also prepare a newsletter which reports results of the biosampling efforts and will also coordinate preparation of annual and final reports.. Three months of funding is being requested for her work on this project.

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

approved TC 8-9-99

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	$15.3	$12.6						
Travel	$3.6	$3.7						
Contractual	$45.3	$35.1						
Commodities	$1.0	$0.8						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$65.2	$52.2			Estimated FY 2001	Estimated FY 2002		
General Administration	$5.5	$4.3						
Project Total	$70.7	$56.5			$40.0	$25.0		
Full-time Equivalents (FTE)		0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Prepared: 4/15/99

Project Number: 00245
Project Title: Community-based Harbor Seal Management and Biological Sampling
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Vicki Vanek	Wildlife Biologist I	14B	3.0	4.2		12.6
						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	4.2	0.0	
					Personnel Total	$12.6

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Kodiak - Anchorage	0.2	4	12	0.1	2.0
Anchorage - Seldovia - Port Graham - Nanwalek	0.3	1	3	0.1	0.6
Anchorage - Chignik	0.7	1	4	0.1	1.1
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$3.7

FY00

Prepar ' '/15/99

Project Number: 00245
Project Title: Community-Based Harbor Seal Management and Biological Sampling
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FY 2000
4A Linkage	34.3
Air freight for shipping samples from Anchorage and Kodiak to participating sites	0.8
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$35.1

Commodities Costs:	Proposed
Description	FY 2000
Supplies for shipping and for subsampling	0.8
Commodities Total	$0.8

FY00

Prepared: 4/15/99

Project Number: 00245
Project Title: Community-based Harbor Seal Management and Biological Sampling
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual &
Commodities
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

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

FY00

Prepared: 4/15/99

Project Number: 00245
Project Title: Community-based Harbor Seal Management and Biological Sampling
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	$24.0	$16.0						
Travel	$2.2	$2.8						
Contractual	$11.0	$9.9						
Commodities	$1.3	$1.1						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$38.5	$29.8			Estimated FY 2001	Estimated FY 2002		
Indirect	$5.8	$4.5						
Project Total	$44.3	$34.3			$25.0	$15.0		
Full-time Equivalents (FTE)		0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

Indirect = 15% of program costs

FY00

Prepared: April 15, 1999

Project Number: 00245
Project Title: Community-based Harbor Seal Management and Biological Sampling
Name: Alaska Native Harbor Seal Commission

FORM 4A
Non-Trustee
SUMMARY

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

Personnel Costs:				Months	Monthly		Proposed
	Name	Position Description		Budgeted	Costs	Overtime	FY 2000
	Monica Riedel	Executive Director		4.0	4.0		16.0
							0.0
		Note: works 1/3 time year round on this project					0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		4.0	4.0	0.0	
						Personnel Total	$16.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 2000
	Exec. Dir., Cordova to Anchorage for restoration workshop and ANHSC workshop	0.2	2	5	0.1	0.9
						0.0
	Exec. Dir. Cordova to Chignik, biosampling training and meeting	0.9	1	4	0.1	1.3
	Exec. Dir., Cordova to Port Graham, community meeting	0.4	1	2	0.1	0.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$2.8

FY00

Prepared [illegible]/15/99

Project Number: 00245
Project Title: Community-based Harbor Seal Management and Biological Sampling
Name: Alaska Native Harbor Seal Commission

FORM 4B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed
Description	FY 2000
Phone: 12 months @ 200/month	2.4
Postage: 12 months @ 100/month	1.2
Insurance	1.2
Subcontracts with community biosamplers	3.8
Training honorarium: two @ $100/each = $200	
Sample processing: 10 communities, 8 seals/community, $45/seal = 3,600	
Shipping biological samples	0.8
Electricity for village freezers	0.5
Contractual Total	$9.9

Commodities Costs:	Proposed
Description	FY 2000
Purchase replacement materials for sampling kits (knives, gloves, plastic bags) (6 kits)	0.1
Purchase new sampling kits (2 kits @ $120/kit)	0.2
Supplies for shipping samples	0.8
Commodities Total	$1.1

FY00

Prepared: 4/15/99

Project Number: 00245
Project Title: Community-based Harbor Seal Management and Biological Sampling
Name: Alaska Native Harbor Seal Commission

FORM 4B
Contractual & Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	

FY00

Project Number: 00245
Project Title: Community-based Harbor Seal Management and Biological Sampling
Name: Alaska Native Harbor Seal Commission

FORM 4B
Equipment
DETAIL

Prepared: 4/15/99

00247

approved TC 8-9-99

Kametolook River Coho Salmon Subsistence Project

Project Number:	00247
Restoration Category:	General Restoration
Proposer:	Perryville Village Council
Lead Trustee Agency:	ADF&G
Cooperating Agencies:	NONE
Alaska SeaLife Center:	NO
Duration:	4th year, 6-year project
Cost FY 00	$23.2
Cost FY 01	$23.5
Cost FY 02	$30.0
Geographic Area:	Perryville/ Kametolook River/ Alaska Peninsula
Injured Resources/ Service	Subsistence

RECEIVED

EXXON VALDEZ OIL SPILL
TRUSTEE COUNCIL

ABSTRACT

__Abstract:__ Subsistence users from the remote South Alaska Peninsula Native Village of Perryville have noted declines in the coho salmon (*Oncorhynchus kisutch*) run in the nearby Kametolook River since the *Exxon Valdez* oil spill (EVOS). The Trustee Council began funding this project in Federal Fiscal Year 1997 with the intent of restoring the coho salmon run to historic levels. This project is a continuation of an evaluative phase of the project funded through the EVOS criminal settlement (Grant Agreement Number 2168588). Although limnological, juvenile and adult fisheries data were not available or severely limited before the salmon decline, it was determined through the evaluation phase that instream incubation boxes in conjunction with self imposed harvest limits by subsistence users were the preferred alternatives for restoration this salmon run. In 1997, the Alaska Department of Fish and Game, Habitat and Restoration Division, aided the project by providing an Environmental Assessment. In 1997, a Finding of No Significant Impact was signed for NEPA compliance.

Community involvement by the villagers of Perryville is an integral part of restoring the Kametolook River coho as a subsistence resource. Presently, no regulations prohibit fishing in the Kametolook River; however, starting in 1997 the Perryville Village Council voluntarily closed the upper half of the Kametolook River to subsistence salmon fishing in order to not interfere with spawning salmon. In addition, as part of the community involvement portion of the project the Perryville Village Council has hired local assistants who received training to assist ADF&G with fieldwork including: genetic and pathological sampling, incubation box installation, egg takes and incubation techniques, and year around monitoring of the boxes and environment. Also, an aquarium has been set up in the village school where students actively participate in incubating coho salmon from egg to fry stage and releasing the fry into the Kametolook River. In May 1997 and 1998, each year about 125 fry from the school aquarium project were released into the Kametolook River. In the fall of 1998, approximately 300 fertilized eggs were placed in the school aquarium and the fry are expected to be released in the Kametolook River in the spring of 1999.

In 1997, two production type instream incubation boxes were installed in the upper reach of the Kametolook River. These boxes replaced and were in addition to a small test incubation box that has successfully incubated eggs. In 1997, the Kametolook River coho escapement was an estimated 724 salmon, nearly four times the estimated escapement during 1996. The increased escapement is attributed to the self imposed closure of the upper river by the villagers, a commercial fishing closure in marine waters during nearly the entire coho salmon run, and a strong run of coho salmon in general to the Chignik area. In 1997, several attempts to capture ripe coho salmon have generally been unsuccessful; eggs from only seven females (four of which were partially spent) have been deployed in the incubation boxes.

In 1998, in order to increase the egg take, two salmon holding pens were installed near the coho salmon spawning region of the Kametolook and used to make the recovery of ripe salmon more efficient. 16 female and 15 male salmon were captured and placed in the holding pens to ripen. Seven males were used to fertilize 11 ripe females and the fertilized eggs were placed in the two incubation boxes in November, 1998. The coho salmon escapement for 1998 was an estimated 148 salmon. The decreased escapement is attributed to a weak run of coho salmon in general to the Chignik area.

INTRODUCTION

This subsistence project is designed to restore coho salmon subsistence opportunities in the Alaska Peninsula village of Perryville. The project was initiated during community workshops held by the Subsistence Restoration Planning Team. Workshops in Perryville took place in September 1994 and May 1995. The project was subsequently endorsed by the Perryville Village Council. The project was also discussed and endorsed by the Chignik Regional Planning Team in the spring of 1995 and again in December 1996. Alaska Department of Fish and Game, Division of Commercial Fisheries, westward region staff assigned to the Chignik and Alaska Peninsula regions and the Division of Subsistence, have been involved in the planning and development of the project. In addition, an ADF&G biologist in the Norton Sound Region has provided technical expertise regarding the use of both instream incubator boxes and recirculating water incubators, which have been successful in the Norton Sound Region. Alaska Department of Fish and Game, Division of Habitat and Restoration staff have also been involved with the project, especially with the development of an Environmental Assessment.

In 1996, funding for the evaluation phase of the project was provided through a grant to the Native Village of Perryville by the Alaska Department of Community and Regional Affairs, using EVOS criminal settlement funds. During consultation about this grant, the State members of the Trustee Council requested that a proposal to the full Trustee Council be prepared to support the implementation of the project in subsequent years. This was accomplished and the Trustee Council began funding this project in Federal Fiscal Year 1997. The Environmental Assessment was approved and the resulting FONSI for this project was received by the Trustee Council in May, 1997.

It has been determined by the assessment team (PI's, Habitat and Restoration, and Perryville Village Council) that local salmon stock instream incubator boxes are the best method to help restore Kametolook River coho salmon runs. Applications for ADF&G fish transport permits are reviewed annually and a general habitat waterway/waterbody application has been granted for this project. In 1997, an environmental assessment was completed with a Finding of No Significant Impact signed for NEPA compliance. Samples of adult coho salmon will continue to be collected for genetic and pathology data until sufficient numbers are obtained. The assessment team will work with the Principal Geneticist, Principal Pathologist and Area Management Biologist to have the most safe and satisfactory project possible to help restore coho salmon in the Kametolook River to historic levels.

NEED FOR THE PROJECT

A. Statement of Problem

Since Perryville was founded in 1912, the Kametolook River has provided the community with much of its supply of subsistence coho salmon. Since the *Exxon Valdez* oil spill, Perryville residents have noted that there are fewer and fewer coho salmon in the river. It has become such a problem that many families must travel further away from Perryville to find sufficient amounts of salmon. Their use of these other areas has put additional pressure on fish stocks used for subsistence by the neighboring villages of Ivanof Bay, and the three Chignik villages.

Salmon are very important for Native people of Perryville, and are relied on greatly for their subsistence as well as economic livelihoods. Commercial fishing is the mainstay of Perryville's cash economy, where many residents travel to fish camps in Chignik Lagoon and Chignik Bay in the summer months to commercial fish, as well as to put up fresh sockeye salmon for smoking, canning or freezing. Those people who spend summer months in Chignik return to Perryville in the fall to put up coho salmon that are also smoked, as well as dried. Many other Perryville residents, however, do not commercial fish and stay in Perryville year around. Gradually throughout the summer, they travel to the Kametolook River to catch their year's supply of subsistence salmon that are primarily coho, pink, and chum salmon. (Sockeye, estimated at fewer than 100 adults annually, also spawn in the Kametolook River.)

Division of Subsistence personnel first did research in Perryville in 1984. Starting in 1990, the division has documented concerns by local residents that coho salmon availability in the Kametolook River is far below historical levels. Fish and Game biologists working in the Chignik region believe coho salmon stocks in the Kametolook River might be depressed, but have little data regarding historic or present escapement levels for this small, remote river.

B. Rationale/Link to Restoration

Salmon runs to the Kametolook River have been declining in recent years. Members of the village of Perryville requested the EVOS Trustee Council to fund a restoration project and they asked ADF&G to assist with this project. The cause of the decline in salmon numbers is unknown. A restoration project cannot be successful unless the cause of the decline is understood and the project is "fixing" the "right problem". An appropriate salmon restoration project will hopefully increase Kametolook River coho salmon relied on for subsistence by Perryville people back to historic levels. If more fish are available for subsistence, it will not only provide people with more coho salmon, but it will also take pressure off of other subsistence resources that were hurt by the spill, such as other salmon species, clams, seals and sea lions, as well as recent declines of local caribou.

C. Location

The remote Native village of Perryville is located approximately 500 air miles southwest of Anchorage on the Pacific side of the Alaska Peninsula. Veniaminof Volcano overlooks the village that is situated directly along the Pacific Ocean coastline with beaches of volcanic black sand. The Kametolook River is located four miles northeast of Perryville, and is easily accessible from the community via ATV, foot, or boat.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The Trustee Council's goal of achieving additional local public involvement in the restoration process is addressed in that Perryville will be a partner with ADF&G personnel in this project. This project has been discussed and endorsed by the Chignik Regional Planing Team and the Perryville Village Council. Through project funds, the Perryville Village Council is responsible for hiring local assistants, and providing necessary logistical support for the operation of this project. The community has also contributed much in terms of local knowledge of the environment, including: historic to contemporary salmon run timing and numbers, subsistence harvest levels over time, identifying physical changes to the Kametolook River over time, helping ADF&G identify spawning and rearing areas, and identify potential characteristics of the river, such as where winter freeze over or spring and fall flooding might occur.

Several residents of Perryville have worked with ADF&G during assessment and implementation phases of the project. In addition, local assistants will monitor the project throughout the year, when ADF&G personnel will not be present. Local assistants through hands-on involvement have been trained by ADF&G personnel to monitor temperature and water level stations, to monitor the egg incubation boxes, participate in egg takes for seeding the incubation boxes, transporting eggs to the classroom incubator, and will transport fry to nearby lakes or adjacent rivers (depending on what the current review of the Fish Transport Permits allows).

Perryville residents have been kept informed about the progress of the project through the Village Council and village meetings. During these meetings residents have been informed about salmon run strengths, harvest levels, and rearing and habitat issues. The community has been encouraged to come up with ways that they can contribute toward restoring the coho run. Presently, no regulations prohibit fishing in the Kametolook River; however, starting in 1997 and continuing through 1998, the Perryville Village Council voluntarily closed the upper half of the Kametolook River to subsistence salmon fishing in order to not interfere with spawning salmon.

School children have had opportunities to learn, understand and appreciate the complexities of the growth cycle of salmon through the use of a classroom aquarium that is raising coho salmon from egg to fry stages. Fish resource permits have allowed the release of these fry into the Kametolook River (1996-1998). In addition, when allowed by the teachers and parents, older school children have accompanied ADF&G personnel to the Kametolook River and nearby lakes to assist with minnow trapping and biological and habitat sampling. This portion of the project has been in operation for three winters now, and expected to continue through 2002 and possibly beyond if the school continues to support the program.

PROJECT DESIGN

The primary goals of the project are to increase the coho salmon runs to the Kametolook River and to include the people of Perryville through involvement in the project and education. The method(s) used to accomplish this have been determined in 1996 and 1997 by a team of ADF&G specialists, and local Perryville residents. Funding for the first portion of the project was provided through a grant to the Native Village of Perryville from the criminal settlement funds. Beginning in Federal Fiscal Year 1997 funding has been provided by the Trustee Council. Personnel involved with the project have determined that the most appropriate rehabilitation method is through the use of instream incubation boxes. The team has acquired all the necessary permits (with the exception of the school aquarium Fish Transport Permit that is submitted to ADF&G for review annually). The Environmental Assessment and a Finding of No Significant Impact by the US Fish and Wildlife Service was approved in May of 1997. This project has the potential to make restoration of coho salmon in the Kametolook River possible. Similar projects in other regions of Alaska have proven to be successful.

In addition to school and village meetings where salmon life cycle processes were described instream incubation boxes have been determined to be the preferred restoration method. A test incubation box was positioned in a head water tributary of the Kametolook River to use the natural flow of water from the stream to incubate coho salmon eggs. This portion of the project has been successful; swimup fry were produced during April 1997. In the production phase of this project, genetic integrity of the Kametolook River coho salmon will be assured under the guidance of the department's Principal Geneticist. The potential incubation site has water temperatures consistent with natural spawning sites to insure that fry development and emergence occur at the same time as naturally occurring fry. The small scope of this project is not expected to noticeably add any coho salmon to other common property harvest groups (i.e. commercial fisheries).

From similar projects in Norton Sound, it has been found that improved returns were noticeable in about five years. If the number of coho salmon spawners is sufficient to allow an egg take, instream incubators will be employed. (Fish Transport Permits will require a minimum of 60 naturally spawning pairs before an egg take can occur and then 50% of the escapement above the 60 spawning pairs will be available for an egg take.) In 1998 and beyond, the use of salmon holding pens will be used to make the recovery of ripe salmon easier. The incubators are expected to operate annually from 1997 through 2002. Since a major expense is in the boxes (materials and installation), and establishing an incubation site, the annual cost of operation and maintenance is not significant.

Other restoration methods evaluated included a recirculating water incubation facility in the village, potential habitat manipulation to create or provide access to better spawning and rearing habitats, and a remote incubation facility. All of these alternative methods were rejected in favor of the instream incubators.

A. Objectives

There are two main project objectives: the first is community involvement described above, and the second is to restore the coho salmon returns to the Kametolook River and provide local subsistence salmon opportunities. The species of interest for this project is coho salmon. Phase 1 of the project included a complete assessment of the creek and river habitat in proximity to Perryville and interviews to determine salmon run strength, run timing and physical changes to local drainages. Phase 2 (1996) included installation and testing of a streamside incubation box, continuation of the classroom aquarium and education programs for adults and high school students. Phase 3 so far has included installation (August/September 1997) of large capacity streamside incubation boxes, installation and use of the school aquarium, education programs, and biological sampling for pathological and genetic testing. Phase 3 will continue through the end of the project with biological testing (until required amount necessary are obtained for genetic and pathology tests), annual egg takes for the incubation boxes and the school aquarium, continued education and habitat and harvest monitoring.

B. Methods/ May 1996-September 1999

May 1996 through September 1996/ This phase of the project was funded through the Criminal Settlement/ Project Perryville 96-1.

May 1996- Three ADF&G assessment team members traveled to Perryville and joined with local assistants to assess the Kametolook River in order to make recommendations for the best restoration efforts. A small instream test incubator box (2 foot square plywood box) was installed at the headwaters of the river. The incubator box was also equipped with a thermograph to aid in determining the potential of the incubation site. Thermographs were also installed at three other habitat-monitoring locations along the Kametolook River. Perryville guides showed the ADF&G team the different stream reaches; at this time, there was no evidence of blockages to adult or smolt migration. Blockage and breaching events apparently occur on a scale of about 2-10 years. ADF&G personnel were given the impression that the river has relatively unstable spawning areas with current upstream spawning sites improved from prior years. Young-of-the-year and fingerling coho were observed in several slough habitats and small ponds. Several ponds, deep main-stem pools, side-channel sloughs and spring areas apparently do not freeze solid and would provide over winter rearing habitat. During this trip preliminary investigations were also undertaken for possible stocking of rainbow trout or coho salmon into two landlocked lakes (Sandy and Sicken Lakes) in proximity to Perryville. At the high school ADF&G personnel discussed potential education projects such as a classroom salmon aquarium and recirculating egg incubators. (A detailed field trip report is available.)

Project 97247 (October 96-September 97)

October 1996- Three ADF&G assessment team members traveled to Perryville and joined with local assistants to expand the habitat surveys of drainages adjacent to Perryville, to place fertilized eggs in the experimental stream side incubation box and to initiate a cooperative educational program in the Perryville school. Local guides showed us much of the historic and potentially productive reaches of the Kametolook, Three Star and Long Beach Rivers. Long Beach River, although historically productive, presently had no quality spawning or rearing habitat. Three Star River, smallest of the three drainages, had some stable reaches but about half of the discharge had changed course and currently flows into Long Beach River. Some potential rearing habitat is present while spawning habitat appeared to be limited. Kametolook River currently showed the most salmon spawning and rearing potential. However, this system is dynamic and habitat quantity and quality may change annually.

Minnow trapping was conducted in all three drainages. Rearing and spawning habitat in Long Beach River appeared to be negligible. Three Star River had limited high quality slough habitat and supported juvenile coho salmon and Dolly Varden; spawning habitat appeared to be limited to several short stream reaches. Rearing habitat for juvenile coho salmon in the Kametolook River appeared to be quite abundant while upper stream reaches seemed able to support relatively good numbers of spawning salmon. Several high school students assisted with coho fingerling data collection efforts.

A total of 32 adult coho salmon were collected from the Kametolook River during this trip. Few other adult salmon were seen. Genetic and kidney samples, otoliths and scales were taken from each salmon. All observed coho salmon appeared to be recent arrivals to the river and were not ripe; seeding fertilized coho eggs into the incubation box was not possible. High school students, in addition to assisting with fingerling sampling, also explained the field trip experience to their fellow students. Each presented some aspect of the field studies and the ADF&G team participated by asking questions and explaining details. ADF&G personnel also demonstrated scale reading techniques and presented representative samples of all species collected from the minnow traps. Plans were developed with the science teacher to install and permit a classroom aquarium incubator for coho salmon eggs. (A detailed field trip report is available.)

November 1996- Two ADF&G assessment team members traveled to Perryville and joined with local assistants to capture and spawn one pair of coho salmon for the incubation box in the Kametolook River. Gillnetting captured about 20 salmon including 4 sockeye, 13 male coho and 3 female coho salmon. Following standard delayed fertilization techniques, the eggs were fertilized and seeded into the incubation box. A thermograph was deployed in the substrate near the largest group of spawning salmon. Although only a one time event, a survey to enumerate spawning coho was conducted. About 75% of all observed coho were located within 1 mile downstream of the incubation box; the remaining 25% were scattered in small groups throughout the remainder of the drainage. The total observed coho escapement was about 100 salmon with no ocean bright salmon observed. The subsistence harvest continued, and the observed escapement might have been higher than the actual spawning escapement. (A detailed field trip report is available.)

At the high school the ADF&G team assembled the aquarium incubator. When the eggs reach the eyed stage, about 250 eggs from the stream side incubator were transferred to the classroom incubator (January ADF&G field trip). (A detailed field trip report is available.)

January 1997- Two ADF&G team members traveled to Perryville. While waiting in King Salmon for the flight to Perryville they met with the Alaska Peninsula/Becharoff National Wildlife Refuge staff to discuss the Kametolook project and review the draft Environmental Assessment. In Perryville, they joined local assistants and checked the thermograph and staff gauge sites, shocked the incubating eggs, discarding dead eggs, and sorted out about 250 eggs which were transported to the school aquarium. An approved Fish Transport Permit allowed 250 eggs to be raised in the school aquarium and the release of any resulting fry back into the Kametolook River. With the assistance of five high school students the team measured physical characteristics of two landlocked lakes as potential coho fry or rainbow trout release sites and collected gravel for alevin habitat in the aquarium. A slide show of the restoration project and discussion of the life cycle of salmon was presented to all Perryville students. ADF&G personnel also attended a meeting sponsored by the Village Council where they presented a similar slide show. At the village meeting the restoration project and the school aquarium were discussed as well as the life cycle of coho salmon, the 1996 coho salmon escapement, and potential production from the escapement. (A detailed field trip report is available.)

March-May 1997- ADF&G personnel drafted an Environmental Assessment of the Kametolook River Coho Salmon Restoration Project. A FONSI was developed and in May was signed for NEPA compliance. A Habitat Permit was reviewed and accepted which allows the instream incubation boxes to be deployed. Fish Transport Permits were drafted for review to insure that management, genetic, and pathology concerns are addressed. Approximately 125 coho salmon fry were released into the river of origin (Kametolook) from the school aquarium project (Fish Resource Permit P-97-021).

June-July, 1997- Received appropriate fish transport permits from ADF&G for harvesting salmon eggs and releasing fry from incubation box and school aquarium for the 1997/98 season. Purchased materials for two incubation boxes and constructed them for later use. Met with the Chignik Regional Planning Team, Chignik Regional Aquaculture Association and public to development a Western and Perryville Districts coho salmon management plan.

August 1997- Transported incubation boxes to Chignik Bay (ADF&G M/V Resolution) and local Perryville resident transported them to Perryville via fishing boat.

September 1997- Two Perryville personnel were trained (2 weeks) at Pillar Creek Hatchery (Kodiak) in spawning and incubator maintenance techniques. Two ADF&G staff attempted to travel to Perryville to install the two incubation boxes in Kametolook River, sample salmon and trout for age, length and abundance data, however weather prevented them from traveling beyond Chignik Lake. In late September, two Perryville assistants transported two egg boxes and other necessary equipment up Kametolook River to the installation site.

Project 98247 (October 97-September 98)

October-November 1997- The Perryville Village Council voluntarily closed the spawning areas of the Kametolook River to fishing (October 3). One ADF&G personnel traveled to Perryville October 31 through Nov. 6. On this trip ADF&G personnel 1) set up the school aquarium for incubation of coho salmon from egg to fry stages, met with the teachers and this year's upper class members and instructed them on classroom salmon incubation techniques; 2) discussed with the local assistants the placement of thermographs for the fall/winter/spring period of 1997-1998; 3) estimated the total coho salmon escapement to the Kametolook and Three Star Rivers; 4) with help of three local assistants, installed two production type salmon incubation boxes in the Kametolook River; 4) attempted a coho salmon egg take for the incubator boxes and the school aquarium 5) took samples of adult coho salmon for genetic and pathology data. Only two ripe and no spawned out fish were caught and added to one of the egg incubation boxes. Because of the lack of success finding ripe and spawned out salmon, it was decided that four local Perryville assistants would attempt additional egg takes through November.

Local Perryville assistants took 10 additional trips at different stream locations and several sets per day to capture ripe coho for the incubation boxes without much success (total catch: 7 females, 4 of which were partially spent) which were added to the incubation boxes. The problem was not in catching fish, but in catching ripe ones. Samples were taken for pathology and genetic testing from males and females harvested for sampling. They reinstalled and deployed thermographs at designated sites.

December 1997- The assessment team decided to install fish holding pens in 1998 to aid in capturing ripe salmon for egg incubation boxes. Perryville assistants traveled to egg incubation boxes and removed approximately 300-eyed eggs that were put inside the school aquarium.

January-March 1998- Perryville assistants took monthly monitoring trips to Kametolook River to check thermograph sites and egg boxes. Approval to release fry in Kametolook was denied by ADF&G Pathologist due to low number of females harvested; however, approved was granted to release them in local landlocked Sicken and Sandy Lakes in late April or May. The Perryville teacher communicated with ADF&G regarding status of eggs in aquarium. Survival fry from school incubation box will be transported and released in the Kametolook River in late April or May. Two net holding pens were acquired, and prepared for transport to Perryville in May. Present staff attended the State Board of Fisheries meeting and gave staff report regarding the project. They also attended Chignik RPT meeting and provided a project status report. The RPT continued to support project. A fish transport permit request was submitted to ADF&G for review.

<u>October 1998-</u> Jim McCullough participated in a field trip on 21 through 27 October 1998, to Perryville, Alaska. The purpose of the trip included: 1) to install temporary ripening pens for coho salmon, 2) foot survey of salmon in the Kametolook River, 3) capture and place in holding pens adult coho salmon, 4) clean the instream incubation boxes, 5) clean the school salmon egg incubation aquarium, and 5) collect and down load remote thermographs.

<u>October 23</u>- Jim McCullough along with the assistance of Jerry Yagie and Bruce Phillips installed holding pens for ripening coho salmon in a side pond of the Kametolook River. The Kametolook River was also surveyed for adult salmon. Approximately 70 coho and 25 sockeye salmon were observed in the main upriver spawning area located about ¼ mile below the incubation boxes. An additional 4 coho salmon were counted in the main stem of the river below the main spawning site and an additional 15 sockeye salmon in Candlefish Slough. The indexed escapement count for the Kametolook River is 148 coho salmon and 40 sockeye salmon. The indexed count for coho is twice the observed count (sockeye estimate not expanded). Although the river was somewhat turbid below the main spawning area, it was also obvious that there were few salmon present.

<u>October 24</u>- 16 female and 15 male coho salmon were caught and placed in the holding pens to ripen. The instream incubator boxes and water head collector boxes were cleaned and disinfected. The Three Star River was also visited where 5 adult coho salmon were spotted. Jim McCullough met with the new science teacher, Patsy Chapple and discussed report requirements and the permit process for running the school aquarium, and cleaned, disinfected, and filled the aquarium with fresh water and turned the chiller on.

<u>October and November 1998</u>- Jerry Yagie conducted weekly stream surveys of the Kametolook for the presence of coho.

<u>November 1998-</u> Jim McCullough and Melvin Chya participated in a field trip on 9 through 13 November 1998, to Perryville, Alaska. The purpose of the trip included: 1) foot survey of salmon in the Kametolook River, 2) spawn adult coho salmon that were ripening in holding pens, 3) fertilized and place coho salmon eggs in the Kametolook River incubation boxes, and 4) fertilize and place coho salmon eggs in the school aquarium. Melvin Chya works at the Pillar Creek Hatchery in Kodiak, Alaska.

<u>November 10-</u> Jim, Melvin and Jerry Yagie checked the Kametolook River incubation boxes to insure they were operating properly for the next days-planned egg take. The holding pens where checked for adult ripening coho salmon and noticed that the adult male salmon had escaped, the female salmon were still captive in their pen. The Kametolook River was surveyed again for adult salmon with approximately 20 coho and 10 sockeye salmon in the main upriver spawning area located about ¼ mile below the incubation boxes observed. None of these salmon appeared fresh and were likely counted

during the 23 October salmon survey. The indexed escapement count for the Kametolook River should remain at 148 coho salmon and 40 sockeye salmon, the survey count from 23 October.

November 11- Jim, Jerry, Melvin, Austin Shangin caught 7 male coho salmon from the Kametolook River and used them to fertilize the 11 ripe female coho salmon from the holding pen. Standard salmon delayed fertilization techniques were used and the fertilized eggs were immediately rinsed and placed in the instream incubators. All but about 300 unfertilized eggs which were held back for the school aquarium, were distributed between the two instream incubator boxes. Fin and kidney samples were collected form each salmon for genetic analysis and disease screening, and ovarian samples were collected from each female salmon for disease screening.

November 12- Jim and Melvin showed all the Perryville students from kindergarten through the sixth grade how to fertilize salmon eggs. After fertilizing the eggs, they were placed them in the school aquarium where the students will be able to watch their development through the swim up fry stage and their release into the Kametolook River in the spring of 1999.

November 13- Genetic samples were delivered to U.S. Fish and Wildlife laboratory in Anchorage and kidney and ovarian samples taken to Anchorage Alaska Department of Fish and Game laboratory for testing.

November 1998 through April 1999- Jerry Yagie continued to conduct bi-monthly trips to the instream incubation boxes to check their condition. He provided reports to the ADF&G staff.

January 1999- Jim McCullough attended the State Board of Fisheries meeting and gave a status report of this project.

March 1999- Jim McCullough and Lisa Scarbrough attended Chignik RPT and CRRAA meeting March 17-18 and provided project status report of project. Jim McCullough and Lisa Scarbrough constructed a project poster for the 1999, 10th annual EVOS conference "Legacy of an Oil Spill 10 Years After *Exxon* Valdez" March 23-26. Attended the conference and presented the poster during the scheduled poster session.

SCHEDULE

A.1. Measurable Project Tasks remaining for FY 99 (April- September 1999)

April/May 1999-
- -Review meeting with assessment team to evaluate the project.
- -Write DPD proposal for FY00 and FY 98 annual report.
- -Two ADF&G personnel travel to Perryville to assist Perryville assistants with fry release from egg boxes. Students release aquarium fry. Meet with community to review status of project and discuss community involvement activities.
- -Collect additional information from selected households to learn more about the subsistence practices of subsistence salmon by Perryville residents.
- -Perryville assistants continue to monitor incubation boxes.

June-Sept. 1999-
- -Perryville assistants monitor incubation boxes and conduct stream surveys.
- -Two ADF&G personnel travel to Chignik Bay for a Regional Planning Team meeting to review status of the project and discuss community subsistence needs.
- -Two ADF&G personnel travel to Chignik villages to discuss community subsistence harvest prior to Alaska Board of Fisheries fall work session.

A.2. Measurable Project Tasks for FY00 (October 1999 - September 2000)

October 1999-
- -One ADF&G personnel travel to Perryville to capture adult coho salmon (assisted by 2 or 3 Perryville assistants) and place in holding pens until salmon are ripe.
- -ADF&G and PV assistant conducts stream surveys of Kametolook River.
- -Consult with teachers and set up school aquarium and obtain FTP.
- -Perform maintenance of instream incubation system and school aquarium.
- -Status report of project to Alaska Board of Fisheries in Fairbanks.

Nov.-Dec. 1999-
- -Two people (Jim McCullough ADF&G and Pillar Creek Hatchery Specialist) travel to Perryville:
- -Meet with Perryville personnel and conduct escapement surveys.
- -Hatchery Specialist will conduct additional training for Perryville assistants and evaluate project/ make recommendations.
- -Perform a coho salmon egg take, fertilize eggs, place in incubation boxes.
- -Sample salmon for genetic and pathology tests.
- -Meet with school children and community to discuss project.
- -Renew school aquarium FTP

Jan.- Feb. 2000- -Perryville assistants transport a few fertilized eggs from egg boxes and place in school aquarium, continue monthly monitoring trips to check on egg boxes.
-ADF&G analyze subsistence and commercial harvest data.

April/May 2000- -Meeting with assessment team to evaluate the project.
-Write DPD proposal for FY01 and FY 99 annual report.
-One ADF&G personnel travels to Perryville to assist Perryville assistants with fry release from egg boxes. Students release aquarium fry.
-Meet with community to review status of project and discuss community involvement activities.
-Purchase and ship to Perryville any necessary equipment needed for project maintenance.
-Perryville assistants monitor incubation boxes.

June-Sept. 2000- -Perryville assistants monitor incubation boxes, and conduct stream surveys.
-Regional Planning Team meeting in Chignik Bay to review status of the project.

B. Project Milestones and Endpoints

Annually through the duration of the project: One day every month, one or two trained Perryville researchers will return to the Kametolook River to monitor the environment, the egg boxes, net pens and conduct general stream surveys (counting adult salmon). ADF&G will continue to supervise the project and continue to take trips to assist with the project. As this project continues; however, (up through 2002) Perryville assistants will continue to be better trained and will take on additional responsibility for the project. Some of their duties will include: conducting escapement surveys, netting salmon for holding in pens, harvesting and fertilizing eggs and transporting to egg boxes, taking samples of harvested salmon for genetic and pathology tests, assisting school children with obtaining eyed eggs for the school aquarium project, and releasing fry in the spring. (This is necessary because of budget constraints preventing ADF&G from being present at all critical times of the project.)

Annually, ADF&G staff will evaluate the Kametolook coho runs through subsistence harvest reports, evaluate incubator performance and stocking levels, perform egg takes, stocking, update project plan, review FTPs and FRPs, provide annual peer review and write annual reports. ADF&G biologists will determine any significant changes to the coho salmon spawning and rearing habitat of the rivers to determine appropriate stocking levels. ADF&G will also evaluate the use of Kametolook River coho salmon as brood stock and the release of fry back into the Kametolook, Three Star, and Long Beach Rivers and other potential stocking sites include Sandy and Sicken Lakes.

In order to rehabilitate the coho salmon run in the Perryville area, education of villagers through a better understanding of the life cycles and conservation of salmon is essential and will continue every year. The ADF&G team will assist with an educational process that focuses on teaching the community through the both the school children and adults. They plan to continue working with the community and teachers and help with this process. Results from all samples will continue to be shared with the school and community.

In conjunction with all other aspects of this project, the ADF&G team will continue to work with the Village Council to assess the project and look at ways the community can facilitate the success of the project and help increase the number of spawning coho salmon. As mentioned earlier, as of October 1997, Perryville Village council voluntarily closed the upper half of the Kametolook River to salmon fishing as a way to do their part at helping solve the salmon shortage problem. This action as well as other options will be evaluated and discussed with the community annually on a regular basis.

The ADF&G team expects the stream side incubation boxes, in conjunction with some fishing restraints, will provide sufficient coho salmon to rehabilitate the run within two to three life cycles. In addition to the Kametolook River, coho fry from the incubation boxes and school aquarium could also be stocked in both landlocked lakes (Sandy and Sicken), as well as nearby Three Star and Long Beach Rivers (approved by ADF&G FTP reviewers).

C. Completion Date

The project is anticipated to be completed by September 30, 2002.

Cooperating Agencies, Contracts, and Other Agency Assistance

<u>Perryville</u>
Perryville Village Council has hired a local project administrator to track the project, arrange for logistical support, and assist ADF&G with field work and long term monitoring of the project. Three additional Perryville residents have been hired (by the Village Council) to work annually, as needed, to assist ADF&G and the project administrator with building and hauling materials, maintenance of installed egg boxes, site selection and installation of fish holding nets. Local assistants will also help with capturing adult salmon, taking genetic and pathology samples, removing, fertilizing, and seeding eggs into incubation boxes, and releasing fry in spring. Village assistants will also need to continue providing a skiff and 4-wheelers as needed. The project administrator is responsible for checking the boxes and habitat monitoring sites throughout the winter to insure they are operating efficiently, and safe from natural or human harm. Wages for the four village assistants have been included in the cost of the grant.

Alaska Department of Fish and Game

Several ADF&G personnel have provided technical assistance for the project. Personnel responsible for the project include Jim McCullough, Fish Biologist III for Commercial Fisheries, Kodiak, and Lisa Scarbrough, Subsistence Resource Specialist II for Subsistence, Anchorage. Personnel assisting the project include: Bill Hauser, Fish Biologist IV for Habitat and Restoration, Anchorage; Joe Sullivan, Fish Biologist III for Habitat and Restoration, Anchorage, Dave Owen, Fish Biologist III, Chignik/Kodiak; Wayne Dolezal, Habitat Biologist III for Habitat and Restoration, Anchorage and Pete Velsco, Fish Culturist II for Commercial Fisheries, Nome (earlier in project/now retired).

Jim McCullough with ADF&G has several years of varied experience with fisheries enhancement and research projects as well as salmon management in the Alaska Peninsula. Lisa Scarbrough, has been doing subsistence research in the Alaska Peninsula (including Perryville) communities since 1989. Bill Hauser and Joe Sullivan have extensive experience in fisheries restoration and enhancement with the department. Dave Owen is Chignik's Area Management Biologist with several years of experience with fisheries in the Chignik/ Perryville region. Dave Owen is Chignik's Area Management Biologist with several years of experience with fisheries in the Chignik/ Perryville region. Wayne Dolezal is one of the State's leading experts on habitat restoration. Pete has several years of varied experience with instream and recirculating incubation box projects, particularly in Norton Sound. Labor (with the exception of .5 months/year for Lisa) will be provided by ADF&G as part of their normal salary, however, transportation costs and per diem will be covered through the grant.

PUBLICATIONS AND REPORTS

An annual report of activities will be submitted to the Restoration Office before 15 April of each year, commencing in 1998. Similar reports will also be presented to the Chignik Salmon Advisory Committee and the Alaska Board of Fish.

PROFESSIONAL CONFERENCES

None planned at this time.

NORMAL AGENCY MANAGEMENT

This proposed rehabilitation effort is not part of ADF&G's normal management responsibilities in the Chignik area.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project is a continuation of Perryville 96-01, funded by DCRA funds from the EVOS Criminal Settlement (in State Fiscal Year 1996) and Trustee Council Civil projects 97247, 98247 and 99247 (in Federal Fiscal Years 1997, 1998 and 1999).

PRINCIPAL INVESTIGATORS

Jim McCullough, Fish Biologist III
Alaska Department of Fish and Game
Division of Commercial Fisheries and Management
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Phone: (907) 486-1813
Fax: 486-1841
E-mail: jim_mccullough@fishgame.state.ak.us

1 Nov 1995 - Present: FB III Regional Resource and Development Biologist. Co-author of the Pillar Creek and Kitoi Bay basic and annual hatchery plans. Voting member of the Kodiak, Chignik and Alaska Peninsula/Aleutian Islands Regional Planning Teams. Author/Review regional Fish Transport and Fish Resource Permits. Regional Habitat Biologist. Coleader of an EVOS project to restore a coho stock for subsistence purposes in the Chignik Area.

30 June 1990 - 1 Nov 1995: FB III Alaska Peninsula Herring and Southeastern District Salmon Management Biologist. Compiled salmon and herring catch data and herring biomass and salmon escapement data which was analyzed to determine opening and closure of the various commercial fisheries as delegated by the Commissioner of ADF&G.

16 July 1985 - 31 May 1990: FB II Alaska Peninsula and Aleutian Islands Areas Finfish Research Biologist involved the design, organization, and completion of the annual catch and escapement program.

Lisa Scarbrough, Subsistence Resource Specialist II
Alaska Department of Fish and Game
Division of Subsistence
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E-mail: LisaS@fishgame.state.ak.us

Lisa Scarbrough has been a subsistence resource specialist with the Division of Subsistence of the Alaska Department of Fish and Game since 1989. She has extensive subsistence research experience in the Chignik area, including the village of Perryville. This has included research on the effects of the oil spill on local subsistence patterns. Her work has also involved training residents of the Chignik area communities as research assistants. Since 1993, Lisa has been responsible for assessing Chignik Subsistence salmon permit data.

OTHER KEY PERSONNEL

Perryville Traditional Village Council
Gerald Kosbruk, President
Celia Yagie, Village Administrator
P.O. Box 101
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Phone: (907) 853-2203
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Chief Community Coordinator- *Jerry Yagie* - Phone: (907) 853-2261

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Chignik Regional Planning Team and Chignik Regional Aquaculture Association
Chuck McCallum, Chairman
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Bellingham, Washington 98225
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Fax: 733-4744

Melvin Chya
Pillar Creek Hatchery
104 Center Avenue, Suite 202
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Phone. (907) 486-6555

approved TC 8-9-99

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	$2.6	$2.9						
Travel	$6.8	$6.4						
Contractual	$10.0	$11.8						
Commodities	$0.3	$0.3						
Equipment	$0.0	$0.5	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$19.7	$21.9			Estimated FY 2001	Estimated FY 2002		
General Administration	$1.1	$1.3						
Project Total	$20.8	$23.2			$23.5	$30.0		
Full-time Equivalents (FTE)	0.5	0.5						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: An Environmental Assessment was approved in 1997. The final evaluation of the project is projected to be FY 2002.

This project was originally funded by Criminal Settlement funds in 1996. The budget estimate for 2000 through 2002 differs slightly from the projected amount stated on the 1999 DPD. Less money is requested for one less trip for ADF&G to travel to Perryville. Instead a Hatchery Specialist with the Kodiak Pillar Creek Hatchery will travel to Perryville for one trip to assist PI Jim McCullough and Perryville assistants with the November egg harvest and biological sampling. (Expenses are described under the contractual section). In 1998, this project funded the travel, wages and perdiem for two Perryville assistants to travel to Kodiak's Pillar Creek Hatchery for training in egg harvesting and biological sampling. Bringing the Hatchery Specialist to Perryville is less costly than sending Perryville assistants to Kodiak for updated training, and he will be able to evaluate the project and make recommendations, provide additional training to Perryville assistants and help with the egg harvest and biological sampling. In addition, Perryville provided personal gill nets in the past to capture salmon for the project, but a smaller mesh gill net is needed in order not to kill captured salmon that need to be held live in the holding pens and others not needed for the project (i.e. sockeye salmon). One trip was added for Jim McCullough to travel to Anchorage to attend the annual EVOS conference in March. Also, staff time (.5 months in 2000,2001 and 2.0 months in 2002) will continue to be requested annually in order to develop and monitor the subcontract with Perryville and provide other staff support for the project, and write the final report in 02. This amount increased in year 00 slightly due to a step salary increase of personnel listed.

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Agency: Alaska Department of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs: Name	Position Description	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
						0.0
Lisa Scarbrough	Subsistence Resource Specialist II	16J	0.5	5.7		2.9
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.5	5.7	0.0	
					Personnel Total	$2.9

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
					0.0
*Kodiak/ Anchorage	0.4	4	11	0.1	2.7
Anchorage/ Perryville	0.8	3	13	0.1	3.7
					0.0
					0.0
* Note when traveling from Kodiak to Perryville it is necessary to overnight in Anchorage coming and going.					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$6.4

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Agency: Alaska Department of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:		Proposed
Description		FY 2000
		11.8
4A Linkage	1) Contract With Native Village of Perryville (Perryville wages/ gasoline/ ATV or boat use/ insurance/ Village admin. fee (10%) 2) Contract With Kodiak Pillar Creek Hatchery (wages for one employee for 6 days/ travel and perdiem from Kodiak to Perryville) 3) Shipping costs of misc. maintenance supplies to Perryville, via Peninsula Air or USPS	
When a non-trustee organization is used, the form 4A is required.	Contractual Total	$11.8

Commodities Costs:	Proposed
Description	FY 2000
General maintenance supplies for incubation boxes/ egg take equipment/ fish holding pens/ temperature instruments/ school aquarium/ film development etc.	0.3
Commodities Total	$0.3

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Agency: Alaska Department of Fish and Game

FORM 3B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
1 small gill net (100 feet Long X 2 feet deep /mesh 2 inch)	1.0	0.5	0.5
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		New Equipment Total	$0.5

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Agency: Alaska Department of Fish and Game

FORM 3B
Equipment
DETAIL

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	$5.4	$6.2						
Travel	$0.0	$1.2						
Contractual	$4.4	$4.4						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$9.8	$11.8			Estimated FY 2001	Estimated FY 2002		
Indirect								
Project Total	$9.8	$11.8			$12.2	$12.5		
Full-time Equivalents (FTE)	0.0	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Prepared 4/?3/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Name: Perryville Village Council

FORM 4A
Non-Trustee
SUMMARY

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

Personnel Costs:			Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	Position Description					
						0.0
To be determined	Perryville					5.4
	Project Facilitator and assistants					0.0
						0.0
Note: Appx. 54 days of work @ about $100/day labor						0.0
						0.0
						0.0
To be determined	Pillar Creek Hatchery					0.8
	Hatchery Specialist					0.0
						0.0
Note: Appx. 6 days at: $135/ day						0.0
						0.0
		Subtotal	0.0	0.0	0.0	
					Personnel Total	$6.2

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
Description					
(Pilar Creek Hatchery)					0.0
*Kodiak to Anchorage	0.4	1	2		0.4
Anchorage to Perryville	0.8	1	5		0.8
					0.0
*Note: Due to travel from Kodiak to Perryville it is necessary to overnight in Anchorage coming and going.					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.2

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Name: Perryville Village Council

FORM 4B
Personnel
& Travel
DETAIL

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

Contractual Costs: Description	Proposed FY 2000
Perryville contract:	
Approx. 45 days of ATV use @ about $50/ day	2.3
Perryville's admin. fee at 10% of contract (not including insurance coverage)	0.8
Insurance for workman's compensation and general liability required of Perryville as contractor of the project by State of Alaska	1.3
Contractual Total	$4.4

Commodities Costs: Description	Proposed FY 2000
Commodities Total	$0.0

FY00

Prepared: 4/13/99

Project Number: 00247
Project Title: Kametolook River Coho Salmon Subsistence Restoration
Name: Perryville Village Council

FORM 4B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	

FY00	Project Number: 00247 Project Title: Kametolook River Coho Salmon Subsistence Restoration Name: Perryville Village Council	FORM 4B Equipment DETAIL

Prepared: 4/1

00250

approved TC 8-9-99

Project Management

Project Number:	00250
Restoration Category:	Research, Monitoring and General Restoration
Proposer:	All
Cost FY 97:	$641,600
Cost FY 98:	$560,100
Cost FY 99:	$469,700
Cost FY 00:	$401,900
Cost FY 01:	TBD
Cost FY 02:	TBD

ABSTRACT

Project management is an important element of the Trustee Council's restoration activities. Project managers perform tasks which include coordinating the activities between the principal investigators and the Restoration Office, reviewing project expenditure activity, assisting in the development of project budgets, tracking of project reporting, and ensuring that each project is implemented consistent with applicable legal and regulatory requirements and the Trustee Council's operating procedures.

INTRODUCTION

The FY 00 proposal for project management reflects Trustee Council guidance to continue reductions in overall programmatic and administrative costs consistent with the reduced restoration program. In FY 99, the Trustee Council authorized a Work Plan budget of approximately $11.6 million inclusive of project management costs of $466,900. In FY 00, it is anticipated that the Trustee Council will approve a work plan budget of approximately $8-9 million inclusive of project management costs of $401,900. Future funding for project management will be assessed in light of Annual Work Plan needs but it is anticipated to decline consistent with the reduction of overall Work Plan funding.

NEED FOR THE PROJECT

The project manager provides an essential link between the Restoration Office and the principal investigators. Project managers:

- Attend the annual Restoration Workshop;
- Attend Restoration Work Force meetings (roughly 4 a year) and, as appropriate, technical review sessions;
- Ensure that projects are implemented consistent with the Trustee Council Procedures and/or State and Federal procedures, including NEPA compliance;
- Monitor projects to ensure they meet their stated goals, objectives and schedules consistent with the funding authorized;
- Administer contracts that implement approved projects, including reviewing and approving invoices;
- Submit quarterly project reports to the Restoration Office, and ensure that annual and final reports and other contract deliverables are acceptable;
- Facilitate the printing/distribution of project reports to ARLIS; and
- Track the inventory of equipment purchased with Joint Trust Funds.

COMMUNITY INVOLVEMENT

Project managers for each project are available to the public to answer questions and provide information on the restoration projects that they manage. Project managers also work with the Community Involvement Coordinator and Community Facilitators (see Project /052) as appropriate to ensure that community involvement objectives are met.

PROJECT DESIGN

A. Objectives

Project managers ensure that studies funded by the Trustee Council are accomplished on time and consistent with the legal and regulatory requirements governing each project as well as Trustee Council procedures including any applicable conditions or requirements at the time of authorization.

B. Methods

Project managers track project expenditures and status information and provide progress updates to the Restoration Office.

C. Cooperating Agencies, Contracts and other Agency Assistance

Organizational and administrative structures vary by agency. Certain projects have multiple agencies involved; others do not. Some projects involve contracts; others do not. In some cases, an agency's project management functions are accomplished in whole or in part by the agency liaison funded through the Project 00100/Restoration Work Force budget. In other cases, project management funds are provided in addition to liaison funding to support the management of numerous or complex projects.

SCHEDULE

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

October 31: Submit prior year fourth quarter expenditure and project status information to the Restoration Office.

December 31: Submit updated inventory of equipment purchased with Joint Trust Funds to the Restoration Office.

January: Attend Annual Workshop

April 15: Submit Detailed Project Descriptions and detailed budgets for FY 2001 proposals to the Restoration Office.

April 30: Submit second quarter expenditure and project status information to the Restoration Office.

July 31: Submit third quarter expenditure and project status information to the Restoration Office.

B. Project Milestones and Endpoints

Funding for project management will be necessary each year in which restoration projects are funded. Once the transition is made in FY 02 to funding through the Restoration Reserve, the need for project management funds will be reassessed.

C. Completion Date

Funding for project management will be necessary each year in which restoration projects are funded. Once the transition is made in FY 02 to funding through the Restoration Reserve, the need for project management funds will be reassessed.

PUBLICATIONS AND REPORTS

The project managers ensure timely completion of annual and/or final reports and do not prepare reports themselves.

PROFESSIONAL CONFERENCES

All project managers are required to attend the Annual Restoration Workshop.

NORMAL AGENCY MANAGEMENT

The project managers perform tasks specific to the *Exxon Valdez* oil spill restoration program that are not part of normal agency management.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Project managers facilitate communication among projects as well as among researchers and the Restoration Office.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

Not applicable to this project.

PROPOSED PRINCIPAL INVESTIGATOR, IF KNOWN

Not applicable to this project.

approved TC 9-99

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1999	Agency Proposed	Proposed FY 2000	PROPOSED FY 2000 TRUSTEE AGENCIES TOTALS					
				ADEC	ADF&G	ADNR	USFS	DOI	NOAA
				$27.9	$154.9	$25.5	21.4	$70.2	$102.0
Personnel	$405.9	$424.0	$349.5						
Travel	$0.0	$0.0	$0.0						
Contractual	$0.0	$0.0	$0.0						
Commodities	$0.0	$0.0	$0.0						
Equipment	$0.0	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$405.9	$424.0	$349.5		Estimated FY 2001	Estimated FY 2002			
General Administration	$61.0	$63.6	$52.4						
Project Total	$466.9	$487.6	$401.9		$320.0	$280.0			
Full-time Equivalents (FTE)	5.5	5.4	4.5						

Comments:

2000

Prepared: 7/27/99 1 of 7

Project Number: 00250
Project Title: Project Management
Lead Agency:

FORM 2A
MULTI-TRUSTEE
AGENCY
SUMMARY

7/27/99

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1999	Agency Proposed	Proposed FY 2000
Personnel	$11.0	$42.9	$24.3
Travel			
Contractual			
Commodities			
Equipment			
Subtotal	$11.0	$42.9	$24.3
General Administration	$1.7	$6.4	$3.6
Project Total	$12.7	$49.3	$27.9
Full-time Equivalents (FTE)	0.2	0.5	0.3

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2001	Estimated FY 2002			
	TBD	TBD			

Personnel Costs:		FY 1999 Months	FY 2000 Agency	Proposed FY 2000 GS/Range/	Proposed FY 2000 Months	Proposed FY 2000 Monthly		Proposed
Name	Position Description	Budgeted	Request	Step	Budgeted	Costs	Overtime	FY 2000
								0.0
Marianne See		2.0	6.0	26E	3.0	8.1		24.3
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
	Subtotal	2.0	6.0		3.0	8.1	0.0	$24.3

2000

Project Number: 00250
Project Title: Project Management
Agency: Alaska Department of Environmental Conservation

FORM 3A
PROJECT
MANAGEMENT

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1999	Agency Proposed	Proposed FY 2000
Personnel	$207.8	$159.3	$134.7
Travel			
Contractual			
Commodities			
Equipment			
Subtotal	$207.8	$159.3	$134.7
General Administration	$31.2	$23.9	$20.2
Project Total	$239.0	$183.2	$154.9
Full-time Equivalents (FTE)	2.6	2.0	1.7

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2001	Estimated FY 2002			
	TBD	TBD			

Personnel Costs: Name	Position Description	FY 1999 Months Budgeted	FY 2000 Agency Request	Proposed FY 2000 GS/Range/Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
								0.0
W. Hauser	Project Manager	12.0	9.0	20M	9.0	7.5		67.5
C. Slater	Liaison	0.0	2.0	20J	1.0	6.7		6.7
M. Kuwada	Project Manager	12.0	6.0	18K	5.0	6.3		31.5
C. Rozen	Librarian	7.0	7.0	17J	5.0	5.8		29.0
								0.0
								0.0
								0.0
								0.0
								0.0
	Subtotal	31.0	24.0		20.0	26.3	0.0	$134.7

2000

Project Number: 00250
Project Title: Project Management
Agency: Alaska Department of Fish and Game

FORM 3A
PROJECT
MANAGEMENT

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1999	Agency Proposed	Proposed FY 2000
Personnel	$22.2	$22.2	$22.2
Travel			
Contractual			
Commodities			
Equipment			
Subtotal	$22.2	$22.2	$22.2
General Administration	$3.3	$3.3	$3.3
Project Total	$25.5	$25.5	$25.5
Full-time Equivalents (FTE)	0.3	0.3	0.3

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2001	Estimated FY 2002			
	TBD	TBD			

Personnel Costs: Name	Position Description	FY 1999 Months Budgeted	FY 2000 Agency Request	Proposed FY 2000 GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
								0.0
TBD	Natural Res. Manager II	3.0	3.0	20	3.0	7.4		22.2
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
	Subtotal	3.0	3.0		3.0	7.4	0.0	$22.2

2000

Project Number: 00250
Project Title: Project Management
Agency: Alaska Department of Natural Resources

FORM 3A
PROJECT
MANAGEMENT

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

Budget Category:	Authorized FY 1999	Agency Proposed	Proposed FY 2000
Personnel	$19.5	$37.2	$18.6
Travel			
Contractual			
Commodities			
Equipment			
Subtotal	$19.5	$37.2	$18.6
General Administration	$2.9	$5.6	$2.8
Project Total	$22.4	$42.8	$21.4
Full-time Equivalents (FTE)	0.3	0.5	0.3

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2001	Estimated FY 2002			
	TBD	TBD			

Personnel Costs: Name	Position Description	FY 1999 Months Budgeted	FY 2000 Agency Request	Proposed FY 2000 GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
								0.0
								0.0
Vacant	Program Manager	3.0	6.0	GS-13	3.0	6.2		18.6
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
	Subtotal	3.0	6.0		3.0	6.2	0.0	$18.6

2000

Prepared: 7/27/99

Project Number: 00250
Project Title: Project Management
Agency: United States Forest Service

FORM 3A
PROJECT
MANAGEMENT

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1999	Agency Proposed	Proposed FY 2000
Personnel	$63.0	$61.0	$61.0
Travel			
Contractual			
Commodities			
Equipment			
Subtotal	$63.0	$61.0	$61.0
General Administration	$9.5	$9.2	$9.2
Project Total	$72.5	$70.2	$70.2
Full-time Equivalents (FTE)	0.9	0.8	0.8

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2001	Estimated FY 2002			
	TBD	TBD			

Personnel Costs:		FY 1999 Months	FY 2000 Agency	Proposed FY 2000 GS/Range/	Months	Monthly		Proposed
Name	Position Description	Budgeted	Request	Step	Budgeted	Costs	Overtime	FY 2000
								0.0
D. Irons	Project Manager - FWS	4.0	4.0	GS-12	4.0	7.0		28.0
D. Bohn	Project Manager - USGS	7.0	6.0	GS-12	6.0	5.5		33.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
								0.0
	Subtotal	11.0	10.0		10.0	12.5	0.0	$61.0

2000

Project Number: 00250
Project Title: Project Management
Agency: United States Department of the Interior

FORM 3A
PROJECT
MANAGEMENT

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1999	Agency Proposed	Proposed FY 2000
Personnel	$82.4	$101.4	$88.7
Travel			
Contractual			
Commodities			
Equipment			
Subtotal	$82.4	$101.4	$88.7
General Administration	$12.4	$15.2	$13.3
Project Total	$94.8	$116.6	$102.0
Full-time Equivalents (FTE)	1.2	1.3	1.1

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2001	Estimated FY 2002			
	TBD	TBD			

Personnel Costs:		FY 1999	FY 2000	Proposed FY 2000				
Name	Position Description	Months Budgeted	Agency Request	GS/Range/Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
								0.0
								0.0
B. Wright	Project Manager	6.0	9.0	GS-13	8.0	8.4		67.2
								0.0
								0.0
								0.0
TBD	Fisheries Biologist	8.0	6.0	GS- 9	5.0	4.3		21.5
								0.0
								0.0
								0.0
	Subtotal	14.0	15.0		13.0	12.7	0.0	$88.7

2000

Project Number: 00250
Project Title: Project Management
Agency: National Oceanic and Atmospheric Administration

FORM 3A
PROJECT
MANAGEMENT

Revision 7-13-99
approved TC 8-9-99

Assessment, Protection and Enhancement of Salmon Streams in Lower Cook Inlet

Project Number:	00263
Restoration Category:	General Restoration
Proposer:	W. Meganack, Jr./Port Graham Corporation
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	4th yr. 4 yr. project
Cost FY 00:	$23.4
Cost FY 01:	$0.0
Cost FY 02:	$0.0
Geographic Area:	Lower Cook Inlet
Injured Resource/Service:	Salmon, subsistence

ABSTRACT

This project will replace lost subsistence services by constructing enhancement projects on two of the major salmon streams in the lower Cook Inlet spill area. In FY 98, two projects were constructed: a fish pass on the Port Graham River and rearing ponds for coho salmon on Windy Creek Left. In FY 99, vegetation is being planted around the rearing ponds. In FY 99 and FY 00, the success of the two projects will be monitored by surveying use by anadromous fish. Local subsistence users are being employed as technical assistants during construction and monitoring.

INTRODUCTION

Subsistence users in the southern Kenai peninsula and specifically the residents of Port Graham are heavily dependent on these two major salmon streams and the salmon they produce for subsistence needs. These major salmon streams and their tributaries were inventoried and evaluated in FY97.

Year One of this project for FY97 consisted of habitat surveys. Standardized fisheries habitat survey techniques developed by ADF&G and the USDA Forest Service were used. From these surveys, appropriate prescriptions for structural improvement were then proposed based upon the species and the objectives desired for that stream. We proposed six individual projects on three streams. Of these six, two were approved for funding by the EVOS Trustee Council in two phases. Phase One consisted of permitting, environmental assessment and preliminary engineering. Phase Two consisted of final engineering, construction and monitoring in FY98.

In FY98, site specific protection and restoration projects were implemented based upon the information gained from the field inventories completed in FY97. A fish pass on Port Graham River and two rearing ponds on Windy Creek Left were constructed during the fall of 1998. These projects primarily targeted coho salmon for habitat enhancement.

Planting vegetation around the rearing ponds on Windy Creek Left for additional cover coho salmon fry and smolts is underway for FY99. In addition, Year Four will consist of monitoring the success of the Years Two and Three construction and enhancement projects for success. We propose to conduct salmon run surveys on the Port Graham River, above and below the falls on four times basis during the salmon spawning season (early, mid, late and end.) In addition, we will conduct fry and smolt surveys of the Windy Creek Left rearing ponds using the techniques outlined in Section B-Methods.

The emphasis on employing local subsistence users for this project will provide for the high quality protection and enhancement of these valuable resources by the owners and stewards of the land and the users of the subsistence resource.

NEED FOR THE PROJECT

A. Statement of Problem

The loss of traditional subsistence resources and services has been extensively documented in this area. Some subsistence resources may never recover to their pre-oil spill levels. There is a need to substitute and increase the subsistence resources for the residents of LCI using the existing wildstocks of pink, coho and chum salmon. Subsistence harvests remain depressed compared to pre-spill levels. Other species damaged or impacted by the oil spill which would benefit from this project include the marbeled murrelet, the black oyster catcher, the river otter and the harlequin duck. Subsistence will be deemed to be recovered when the local residents have restored confidence of the abundance and safety of this important resource. This project seeks to replace lost or damaged resources by replacing or enhancing the habitat of wildstocks of salmon important to the people who live in Lower Cook Inlet.

B. Rationale/Link to Restoration

The inventory and assessment of these major salmon producing streams and lakes done in FY97 provided the information necessary for the construction of habitat protection and enhancement projects on these streams in FY98. This in turn will increase the salmon runs and therefore increase the available subsistence resources. This project will compensate and substitute for the damaged and lost resources available to subsistence users in the LCI. The protection and enhancement of these streams will not only aid the subsistence users but also the impacted commercial and sport users. The monitoring and additional enhancement projects will ensure the success of these projects.

The policy of the Trustee Council, as stated in the Restoration Plan, is that projects designed to restore or enhance an injured resource: 1) must have a sufficient relationship to the injured resource 2) must benefit the same user group that was injured 3) should be compatible with the character and public uses of the area. This project meets all three portions of the Trustee Council's policy toward restoring or enhancing an injured resource.

C. Location: Lower Cook Inlet

These streams are located in Port Graham and Windy Bay drainages on the Kenai peninsula. These projects will benefit the entire lower Kenai peninsula.

COMMUNITY INVOLVEMENT

This project will involve a significant amount of direct involvement of Port Graham residents and other local subsistence users. This project will be the direct responsibility of PGC. Through the training of PGC people for the field and office work, the depth of understanding of the streams and the fisheries resource will be enhanced. This will develop an awareness of the needs for protection and enhancement of these valuable resources.

Port Graham, Nanwalek and Seldovia residents will be consulted as to their local knowledge of these streams and their historic levels of spawning return. Local hire for field work will be used extensively.Study area is remote, extensive use of locals vehicles and housing will be required.

PROJECT DESIGN

A. ##263 Objectives

1. Monitor the use and success of the in-stream spawning and rearing habitat improvement projects constructed and enhanced in FY98-99 for coho, pink and chum salmon.

2. Continue to enhance existing wildstocks of salmon to serve as substitution and compensation for the lost and damaged subsistence resources important to the subsistence users of the southern Kenai peninsula.

3. Educate and involve the subsistence users in the concepts of fisheries management and wise land stewardship.

4. Update existing information on wildstock salmon habitat from weekly salmon stream surveys. Enter relevant data into a data base for future management decisions.

5. Evaluate escapement levels of salmon returns to Port Graham River and Windy Creek Left. Goal is to build salmon runs to near biological capacity with enhanced habitat.

6. Improve quality and quantity of wildstock salmon as a subsistence resource in the lower Kenai Peninsula. Gauge success by comparing returns in next ten years with historic averages.

7. Discuss and coordinate with Federal, State and local agencies. Maintain permits for any additional enhancement projects.

B. Methods

Field: In FY98, site specific protection and restoration projects were implemented based upon the information obtained from the field inventories completed in FY97. A fish pass on Port Graham River and rearing ponds on Windy Creek Left were constructed in FY98. These projects primarily targeted coho salmon for habitat enhancement.

Monitoring, maintenance and refinement of these enhancement projects are proposed for FY00 for Year Four of ##263. The Port Graham River fish pass will be monitored during four times during the salmon spawning season and the necessary maintenance done during low water in July. The following monitoring plan was revised on November 11, 1999 based upon the input of Dr. William Hauser of ADF&G after a site inspection of the two projects on November 4, 1999 (therefore this monitoring plan is a significantly different than the monitoring plan originally proposed and included in the DPD for FY99:)

Revised (11-11-98) Monitoring Plan and Procedures:

Port Graham River Fishpass FY00 Monitoring:

1. Monitor stream reaches and prime spawning and rearing areas designated from FY99 monitoring work plan for cohos on the ground.

2. FY00 Inventory Procedure: use stream reaches designated in FY99 for monitoring purposes. Use forms developed in FY99 for monitoring by foot surveys which will include the following information:

    - Location by reach and river mile
    - All Anadromous Fish Species (coho targeted species)
    - Number of fish and condition, number of redds (including carcasses in later surveys)

3. Method: The following is the proposed methodology.

    First reach is from 9.5 mile bridge to fishpass.
    Second reach is from fishpass to 6.5 mile bridge
    Third reach is from 6.5 to mouth of Port Graham river.
    Proposed interval: 4 times during the coho run: early, mid, late and end.
    Conduct spot counts at fishpass during or after the above surveys. These will also be done with local knowledge at the time when the fish move upstream. Counts will be for hourly periods late in the day or at the appropriate river stage.

4. Coordination: Supply all data and information collected to COMFISH and Port Graham Hatchery.

Windy Creek Left Rearing Ponds FY00 Monitoring:

1. Monitor staff gauges installed in FY99 in each pond to evaluate water height stability.

2. Measure dissolved oxygen and water temperature on a seasonal basis, once each during spring, summer, fall and winter (under ice if desirable).

3. Conduct fry surveys in May and October using baited minnow traps to determine species composition, length and relative abundance. Five traps will be placed in each pond: three in the main channel, one at the outlet, one at midway and one at the upper reach and then two will be placed midway in the side channels: one in the first channel and the other in the last channel. The soak time will be 24 hours.

4. The data for the above surveys will be analyzed and a report will be prepared and provided to ADF&G COMFISH in Homer and Habitat in Anchorage as well as the EVOS office.

C. Cooperating Agencies, Contracts and Other Agency Assistance

ADF&G will be the lead trustee agency. ADF&G will then contract through KPB-EDD who will then contract with the Port Graham Corp. for the entire project. Technical assistance from ADF&G will be required and sought for all phases of this project. Salmon run surveys will be coordinated with ADF&G and COMFISH utilizing their existing surveys for pink and chum salmon.

SCHEDULE

A. Measurable Project Tasks for FY 2000

January—May 15: Schedule monitoring projects as needed.

May 15—July 15: Maintain Port Graham River Fish Pass, repair or improve if needed. Monitor use of rearing ponds by coho fry and smolt in May.

July 15 — October 15: Conduct salmon run surveys on Port Graham River. Coordinate with ADF&G COMFISH. Monitor Port Graham River Fish Pass and conduct maintenance as needed. Monitor use of Windy Creek Left rearing ponds by coho fry and smolt in October.

October 15- December 15: Final report prepared.

B. Project Milestones and Endpoints

May 2000: Inspect and monitor projects and evaluate monitoring plans.

October 2000: Complete salmon run surveys for FY00. Evaluate success of Enhancement Projects and summarize and report salmon counts to ADF&G and COMFISH.

C. Completion Date

December 15 2000: Complete final report and submit for peer review.

PUBLICATIONS AND REPORTS

Final Report: The Final Report will be prepared in FY00. The survey reports, database and accompanying maps will be delivered to ADF&G upon their completion. The final report will emphasize the subsistence resource enhancement success of this project.

PROFESSIONAL CONFERENCES

The project results will be presented at the appropriate EVOS conferences and technical sessions and other conferences.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project will be coordinated with all previous and ongoing ADF&G and PGC/EVOS Projects. Coordination between the Port Graham Corporation, the Port Graham Village Council, ADF&G and the KPB-EDD will be critical for the success of this project.

PROPOSED PRINCIPAL INVESTIGATOR

Walter Meganack, Jr. will be the principal investigator under the direction of the management of the Port Graham Corporation.

This project will be organized and managed by the following agencies and entities:

Trustee Agency:	**Alaska Dept. of Fish & Game**
ARDOR:	**Kenai Peninsula Borough** **Economic Development District** **Will be the state contracting agency**
Contractor:	**Port Graham Corporation** **Patrick Norman-President** **Walter Meganack, Jr.-Project Manager** **P.O. Box 5569** **Port Graham, Alaska 99603-5569**

PERSONNEL

Overall project management will be under the direction of Walter Meganack, Jr. and Pat Norman of the Port Graham Corp.

John L. Hall & Arvid J. Hall of Taiga Resource Consultants will work under PGC as assistant managers and provide technical advice.

approved 7 8-9-99

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$0.0						
Travel		$0.0						
Contractual		$21.9						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$21.9			Estimated FY 2001	Estimated FY 2002		
General Administration		$1.5						
Project Total	$0.0	$23.4						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Prepared:

Project Number: 00263
Project Title: Port Graham Stream Enhancement
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs			Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	**Position Decription**					
			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	$0.0.
			0	0	0	$0.0.
			0	0	0	$0.0.
	Subtotal		0	0	0	
					Personnel Total	$0.0.

Travel Costs	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 2000
Description					
					$0.0.
					$0.0.
					$0.0.
					$0.0.
					$0.0.
					$0.0.
Subtotal					
				Travel Total	$0.0.

2000

Project Number: 00263
Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement
Name: Port Graham Corporation

FORM 3B
Personnel
& Travel
Detail

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases:	Unit Price	Proposed FFY 2000
Description:		
	$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 the placement of an R.		$0.0.

Existing Equipment Usage:	Number of Units	Proposed FFY 2000
Description		
	0	
		0

2000	**Project Number: 00263** **Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement** **Trustee: ADF&G**	Form 3B Equipment DETAIL

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2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed FFY 2000
Description:	
Contract with Kenai Peninsula Borough Economic Development District	$21.96.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
Contractual Total	$22.0.

Commodities Cost	Proposed FFY 2000
Description	
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
Commodities Total	$0.0.

2000	**Project Number: 00263** **Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement** **Trustee: ADF&G**	Form 3B Contractual &Commodities DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category	Authorized FY 99	Proposed FY 00					
Personnel	$4.5.	$1.5.					
Travel	$1.2.	$2.0.					
Contractual	$27.0.	$15.5.					
Commodities	$2.5.	$.4.					
Equipment	$.5.	$.5.	LONG RANGE FUNDING REQUIREMENTS				
Subtotal	$35.7.	$19.9.	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	
Indirect	$3.6.	$2.0.					
Subtotal	$39.3.	$21.9.	$12.0	$.0	$.0	$.0	$.0
Total	$39.3.	$21.9.					
Full-time (FTE)		$.0.	Dollar amounts are shown in thousands				
Other Resources							

Comments:

• KPB-EDD will receive%10 for indirect, not to exceed $3,500.

•In FY 01 , $12.0 may be needed for additional improvements to Pond #1

2000

Project Number: 00263
Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement
Name: Port Graham Corporation

FORM 4A
NON-TRUSTEE
SUMMARY

Prepared 4/1/99 3:56 PM

Personnel Costs			Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Name	**Position Decription**					
Walter Meganack, Jr.	Project Management		0.5	2.5	0	$1.25
			0	0	0	$0.00
			0	0	0	$0.00
			0	0	0	$0.00
			0	0	0	$0.00
			0	0	0	$0.00
			0	0	0	$0.00
			0	0	0	$0.00
			0	0	0	$0.00
TBN	Admininstrative Support		0.25	1	0	$0.25
	Subtotal		0.25	1	0	
					Personnel Total	$1.50

Travel Costs	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
Description					
RT PG-Homer	$60	4	8	$50	$0.64
RT PG-Anchorage	$190	4	6	$100	$1.36
	$0	0	0	$0	$0.00
			0	$0	$0.00
					$0.00
					$0.00
Subtotal		8	14	150	
				Travel Total	$2.00

2000

Project Number: 00263
Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement
Name: Port Graham Corporation

FORM 4B
Personnel
& Travel
Detail

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 2000
Description:			
Field Equipment	1	$0.5	$0.5
			$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 the placement of an R.		New Equipment Total:	$0.5

Existing Equipment Usage:		Number of Units	Proposed FY 2000
Description			
None			
	0	0	
			0

2000

Project Number: 00263
Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement
Name: Port Graham Corporation

FORM 4B
Equipment
DETAIL

Contractual Costs:	Proposed FY 2000
Description:	
Contract with TRC for Windy Creek Left Rearing Ponds Monitoring	$4.5.
Contract with TRC for Port Graham Fish Pass Monitoring	$6.5.
Contract with TRC for Preparation of Annual Report	$4.5.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
Contractual Total	$0.0.
	$15.5.

Commodities Cost	Proposed FY 2000
Description	
Office supplies & postage	$0.4.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
	$0.0.
Commodities Total	$0.4.

2000	Project Number: 00263 Project Title: PGC Wildstock Salmon Stream Assessment & Enhancement Name: Port Graham Corporation	Form 4B Contractual &Commodities DETAIL

Revision 7-8-99
approved 8-9-99 TC

Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knowledge to Conserve the Resource

Project Number:	00273
Restoration Category:	Research
Proposer:	D. Rosenberg/ADFG
Lead Trustee Agency:	ADFG
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	3rd yr. 3 yr. project
Cost FY 00:	$205.4
Cost FY 01:	$0.0
Cost FY 02:	$0.0
Geographic Area:	Prince William Sound, lower Cook Inlet
Injured Resource/Service:	Subsistence, intertidal community

ABSTRACT

This project will study the life history and ecology of surf scoters that over-winter in or migrate through Prince William Sound. This information will be integrated with traditional ecological knowledge. Scoter populations in Alaska are declining. Communities in Prince William Sound and lower Cook Inlet harvest scoters for subsistence purposes. Scoters are among the least studied of North American waterfowl and little is known of their life history, ecology, and distribution. Scoters will be marked with surgically implanted satellite transmitters to define the breeding areas, molting areas, and wintering areas. To reduce mortality rates, scoters will be transported to the Alaska SeaLife Center for surgery and recuperation. Dialogue with community members will continue in order to collect traditional ecological knowledge and convey project information. Participation of local students will be encouraged through the Youth Area Watch project (/210).

INTRODUCTION

This project will study the life history and ecology of surf scoters (*Melanitta perspicillata*) that winter or migrate through Prince William Sound (PWS) and integrate this information with traditional ecological knowledge collected from community members within the study area. In the first year (FY98) we initiated a pilot project to test the feasibility of catching scoters in PWS. In late-April and early-May, 1998 we marked ten birds with surgically implanted satellite transmitters (Rosenberg and Petrula, in prep.). Satellite telemetry is providing information that allows us to define breeding, molting, and wintering areas of this subsistence resource. In FY99 (April/May) we marked an additional fifteen surf scoters and ten white-winged scoters with satellite transmitters. In both years mortality rates were high. We believe predation within two weeks of surgery was the ultimate cause of mortality. In FY00 we propose changing methods to allow birds to recuperate from surgery in a predator-free environment at the Alaska SeaLife Center (ASLC).

Since 1977, scoters in Alaska have been estimated to decline by as much as 40% (Hodges et al. 1996). Between 1972-1973 and 1989 estimated winter populations of scoters in PWS declined from 56,600 to 14,800 birds. Summer populations (July) declined from 13,000 to 5,400 birds (Klosiewski and Laing, 1994). An estimated 1,000 scoters died as a direct result of the *Exxon Valdez* oil spill (John Piatt, pers. comm.). Since the spill, the number of wintering scoters in PWS may be increasing (Agler and Kendall 1977), but are still below historical levels. Initially, the spill had a negative effect on summer populations of scoters in PWS (Klosiewski and Laing 1994). However, by 1998, Irons et al. (in prep.) no longer detected an oil spill effect in summer.

Scoters are an important subsistence resource to the people living in the communities of PWS and LCI (James Fall, ADF&G, pers. comm., Gary Kompkoff, Tatitlek IRA, pers. comm.) These species of seaducks comprise the large majority of the sea duck harvest in the communities of Tatitlek, Chenega Bay, Port Graham, and Nanwalek (Scott et al. 1996). Residents of the communities affected by the *Exxon Valdez* Oil Spill remain concerned about the abundance of their traditional food resources and maintaining their cultural ties to their traditional use of fish and wildlife (*Exxon Valdez* Oil Spill Trustee Council, 1999). In 1993, 55% of the households in Tatitlek reported using scoters harvested for subsistence purposes, as did 40% of the households in Nanwalek and almost 12% of Port Graham households (Scott et al. 1996).

Scoters are among the least studied of North American waterfowl (Godfrey 1989, Savard and Lamothe 1991, Henny et al. 1995, Savard et al. 1998). Little is known about the ecology, breeding areas, molting areas, and migration routes of these species anywhere in North America (Bellrose 1976; Herter et al. 1989; Goudie et al. 1994, Savard et al. 1998). Surf scoters, black scoters (*M. nigra*), and white-winged scoters (*M. fusca*) all occur in PWS and lower Cook Inlet. Among these, the surf scoter is the most abundant (Isleib and Kessel 1973). It occurs as both a year-round resident and migrant. Surf scoters are most numerous in spring due to the influx of migrants probably in response to spawning Pacific herring (*Clupea pallasi*) (Isleib and Kessel, 1973; Bishop et al. 1995). Nonbreeders remain in PWS in summer, although these birds may not be part of the PWS winter population. Basic ecological information is lacking for scoter populations that use PWS.

Most scoters depart PWS in spring to unknown nesting areas, perhaps in interior Alaska and the Yukon (Gabrielson and Lincoln 1959), as far north as the Mackenzie Delta and the Brooks Range (Johnson and Richardson 1982), and as far east as the Horton River, Yukon Territory

(Rosenberg and Petrula 1999, Rosenberg and Petrula, in prep.). Male seaducks abandon incubating females in early summer and congregate at communal molting sites (Salomonsen 1968). Often these areas are distinct from nesting or wintering areas. Three male surf scoters marked in PWS, bypassed breeding areas and migrated by a coastal route to molting areas at the mouth of the Kuskokwim River (Rosenberg and Petrula 1999, Rosenberg and Petrula, in prep.). As with other waterfowl, wing feathers are lost simultaneously, rendering birds flightless for about one month until new feathers emerge.

In winter, scoters feed in intertidal and subtidal zones, areas susceptible to contaminants (Vermeer and Peakall 1979). Among the three scoter species, surf scoters are most associated with intertidal areas in PWS (Patten et al. 1998). They feed primarily on bivalves, especially mussels (Crow 1978, Vermeer 1981), but in spring they may switch to a diet composed primarily of herring roe (Vermeer 1981, Goudie et al. 1994, Bishop et al. 1995).

Sea ducks are among the species most vulnerable to mortality from oil spills (Piatt et al. 1990). Further compounding any direct mortality from the spill, is contamination or reduction of their principal food resources. Mussels and intertidal sediments in PWS showed increases in petroleum hydrocarbon concentrations directly attributable to *Exxon Valdez* oil (Short and Babcock 1996), and oil in mussel beds in PWS and the Kenai Peninsula persisted for several years after the spill (Babcock et al. 1996). Further, the PWS herring stocks suffered a dramatic decline in 1993 and stocks have remained depressed (Morstad et al. 1997). The large increase in sea otter populations since the mid-1900's may have led to increased competition for food between scoters and otters (Nanwalek residents, pers. comm.). Quite likely, any decline results from a combination of factors such as food and habitat changes, contaminants, or climate change.

The large decline in PWS between 1972-1973 and 1989 may be a result of long-term oscillations in ocean temperatures in the Gulf of Alaska (Piatt and Anderson 1996) or effects from exposure to contaminants. Several studies have shown scoters and other sea ducks to bioaccumulate trace metals and organochlorines from their environment (Vermeer and Peakall 1979, Henny et al. 1991, Olendorf et al. 1991, Henny et al. 1995). White-winged scoter die-offs occurred in the Cape Yakataga area in southeast Alaska during 1990-1992 (Henny et al. 1995). Although no definitive cause could be identified, elevated levels of cadmium were detected in the birds, but no source of contamination could be identified. The difficulty of detecting a source of contamination was confounded by lack of specific information on breeding, molting, or wintering areas.

Human activities, such as hydroelectric development (Savard and Lamothe 1991), estuarine pollution (Ohlendorf et al. 1991), or introductions of exotic species (Bordage and Savard 1995) on the breeding, wintering, or molting areas potentially have profound affects on abundance or distribution of a population. The lack of information on distribution and migration patterns can prevent the identification of potential harmful environmental exposures or alterations and make it extremely difficult to determine possible causes of population declines. Location of and links between breeding grounds, migration routes, and timing of migration are important factors used to evaluate contaminant uptake or loss in a migratory species as well as changes to food resources and other environmental changes (Henny et al. 1991). Nesting is considered one of the weakest links in the life cycle, especially with regard to contaminant effects (Henny et al. 1995).

In the first two years of this project mortality rates of surgically implanted birds were high. Within the first two weeks following surgery, mortality was about 50% for both surf and white-winged scoters. This compares with a mortality rate of 3.4% in the same 14-day post-release period for harlequin ducks with similar surgeries to implant lighter VHF transmitters (Mulcahy and Esler, in press). In 1998, poor weather was thought to be a contributing factor. However, weather did not appear to be a factor in 1999 and mortality rates were equally high. Ninety percent of the mortality we observed occurred within the first seven days after surgery. In 1999, we detected no significant difference in internal body temperature in the first two week period after surgery between the birds that survived and those that died (p=.197). Among those that survived, body temperatures were not significantly different, during the first two week period after surgery than later periods (p=.361).

PWS has a large population of bald eagles (*Haliaeetus leucocephalus*) and glaucous-winged gulls (*Larus glaucescens*). These species, which are waterfowl predators, concentrate in areas of herring spawn. Other potential predators also exist in the nearshore environment. Unlike harlequin ducks, our surgeries were conducted in spring when important food sources, such as pacific salmon, are less available to these predators. Nineteen ninety-eight and 1999 were also poor years for herring spawning activity (ADF&G 1999), perhaps further concentrating predators or increasing the necessity to find additional food sources.

We suspect that behavior of implanted scoters is altered as a result of surgical trauma, increasing their vulnerability to predators. Once birds survive two weeks post-surgery, mortality rates decline significantly. In 1998, of the four birds that survived beyond two weeks, only one died. This bird, a female surf scoter died nine weeks after surgery and five weeks after travelling to the nesting grounds in the Northwest Territories. In 1999, 3 of 15 implanted birds, alive after 14 days, died as of June 28, 1999. Two of these birds died within 16 and 20 days of surgery and one died in the interior, during migration, in very close proximity to a subsistence hunting camp. No post-release mortality occurred in five surgically implanted white-winged scoters in the interior of Alaska (Deborah Rudis, USFWS, pers.comm.). As surgical methods were similar, we attribute their success to few predators. We propose to test this hypothesis by holding birds in a predator-free environment at the ASLC for two weeks following surgery. Birds will then be released in PWS.

External backpack-mounted transmitters attached with harnesses have the potential to eliminate the need for surgery. However, internal transmitters have the advantage of eliminating hydro- and aerodynamic drag. Hydrodynamic drag is an important consideration in diving birds. Further, an external satellite transmitter reinforced for dive pressure will increase the transmitter weight from a minimum of 20 grams to 28 grams (Paul Howey, Microwave Telemetry, pers. comm.). In addition to increased drag (Gessaman and Nagy 1988, Holliday et al. 1988), harness arrangements have caused increased feather wear, lower survival rates, and lower reproductive success in wild mallards (Chabaylo 1990, Pietz et al. 1993, Dzus and Clark 1996, Paquette et al. 1997). With future advancements in transmitter and receiver design, harness and other alternative attachment methods will warrant experimentation in sea ducks. Currently though, we believe implants have the best potential to document scoter distribution without interfering with survival and reproduction.

In summary, little is known about the ecology, breeding areas, molting areas, and migration routes of scoters anywhere in North America. Population trends in scoters are uncertain, but appear to be declining in most regions. Affiliations between breeding and wintering areas are unknown, compounding meaningful integration of survey data. The susceptibility of seaducks to contaminants is a concern to resource managers and subsistence consumers. Determining distribution is the first step in assessing breeding, wintering, and molting ecology. Potential breeding and molting sites range throughout Alaska and western Canada. We propose a program that will integrate traditional knowledge, scientific methods, and modern technology to perpetuate the subsistence patterns of these communities. This will be accomplished through greater understanding of scoter life history and ecology, sharing knowledge with local community members, involving the youth of the communities in the restoration process, and improving conservation strategies for this species.

White-winged scoters, black scoters, and Barrow's goldeneyes (*Bucephala islandica*) are also an important subsistence resource to communities in PWS and LCI (Scott et al. 1996). Using EVOS funds as a financial match, we received a grant to purchase and monitor 10 satellite transmitters. These were placed in White-winged scoters in PWS in 1999. This year we will pursue grants to fund the purchase of additional satellite transmitters.

This project is integrated with project \052B Traditional Ecological Knowledge, project \210 Youth Area Watch, project \025 Nearshore Vertebrate Predator Project, \320 Predation on Herring Spawn, project \407 proposed Harlequin Duck Recovery Monitoring, and project \159 Prince William Sound Marine Bird Surveys.

We have created an Internet site that provides information on this project and tracks the movements of satellite transmitted birds (Rosenberg and Petrula 1999). Movements of marked birds will be regularly updated.

NEED FOR THE PROJECT

A. Statement of Problem

Scoters are an important component of the traditional culture of the communities affected by the oil spill and scoter populations in Alaska and PWS have been declining. Native inhabitants of PWS have used scoters (locally known as black ducks) as a subsistence resource for centuries. Surf scoters, black scoters, and white-winged scoters, are the most abundant avian species found at archeological sites in PWS (Linda Yarborough, USFS, pers. comm). However, little is known about the distribution or movements of these birds within or outside of PWS. Although scoters are known to breed throughout much of Alaska and Canada (Gabrielson and Lincoln 1959; Godfrey 1986), until this project (Rosenberg and Petrula in prep.) nothing was known about specific populations and the affiliations between winter, breeding, and molting areas. The few studies that have identified molting sites have not made the link between these and winter and breeding areas (Johnson and Richardson 1982, Dau 1987).

In marine environments, scoters feed on bivalves, especially blue mussels (*Mytilius edulis*), species known to concentrate contaminants. Herring roe, another important food source has become less abundant, as herring stocks have recently declined in PWS. As mentioned, scoters are known to bioaccumulate contaminants and die-offs have occurred, including several among white-winged scoters at Cape Yakataga, in southeast Alaska (Henny et al. 1995). The cause of this die-off was undetermined. Individual scoters range over a broad geographic area. They are susceptible to environmental changes and habitat alterations over their entire range.

Exposure of migratory waterfowl to contaminants or other mortality factors may occur during migration, nesting, molting, or at wintering areas. To begin to understand factors such as contaminants that may limit or reduce populations we first need to make the affiliations between winter, breeding, and molting areas. This would allow us to direct sampling and monitoring efforts at specific population segments. Traditional marking of birds with metal leg bands has little success with sea ducks because so few birds are killed in the harvest. The vast geographic range of the birds (Rosenberg and Petrula 1999, Rosenberg and Petrula in prep.) makes conventional telemetry impractical and costly. Satellite telemetry studies offer the best method for identifying migration routes, staging areas, and breeding, molting, and wintering sites.

Finding a solution to the high rate of mortality experienced by implanting satellite transmitters in sea ducks in winter and spring in marine environments will allow for the continued use of this valuable technology.

B. Rationale/Link to Restoration

The location of breeding grounds, migration routes, winter areas, and the timing of migration are all critical factors used to evaluate contaminant uptake or loss in a migratory species as well as evaluating the consequences of other environmental disturbances or changes (Henny et al. 1991). Scoter populations are susceptible to natural and man-made disturbances over a wide and inaccessible geographic area.

To conserve these subsistence resources and restore the traditional activities associated with these two species, we have proposed to identify their movements, distribution, and ecological relationships using satellite telemetry. This information is necessary to identify problems and develop and implement management strategies to promote the species long-term conservation. We hope this information and the activities associated with collecting this data will 1) allow resource managers to reverse population declines; 2) renew local confidence in the health of this food supply; 3) help maintain traditional lifestyles; 4) provide opportunities to the youth of local communities to promote their historical connection with this subsistence resource; 5) merge traditional knowledge with modern science to develop a more complete understanding of scoter and goldeneye life history and ecology; and 6) help students develop skills to promote the long-term conservation of this species and others important to their economy and lifestyle.

Restoration requires assessment of population health and definition of impediments to recovery. The tasks presented in this proposal will begin the process of understanding the factors that affect population dynamics in surf scoters and develop management strategies to ensure the long-term health and welfare of the population. Without an understanding of the underlying events that influence population change, we can not prescribe specific activities to conserve or enhance the population.

C. Location

In FY 00 capture work will be conducted in Prince William Sound. Capture sites will occur in northern PWS between Valdez and Cordova and on northern Montague Island. The abundance and distribution of birds will ultimately determine sites. Surgery and recuperative care will be conducted at the ASLC in Seward.

In FY00, community involvement (Chugach School District, Youth Area Watch, and traditional knowledge) will be focused in the villages of Tatitlek, Chenega Bay, Nanwalek, and Port Graham. Nanwalek and Port Graham are not within the Chugach School District and are not part of the Youth Area Watch Program.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

This program will continue to exchange information with residents of the communities of Prince William Sound and lower Cook Inlet. In FY98 and FY99 the principal investigator exchanged information and attended workshops in Tatitlek, Chenega Bay, Nanawalek, Seldovia, and Port Graham. The principal investigator was a member of the planning team for the youth-elders subsistence conference in Cordova and presented findings of this study at the conference and at the EVOS annual workshop. The principle investigator has also made presentations and exchanged information and ideas at community facilitator meetings in Anchorage.

Efforts have and will continue to be made throughout the restoration process to participate in and provide public involvement in the design and implementation of this project. The project will continue to inform and coordinate our community involvement activities, including the collection of indigenous knowledge with Dr. Henry Huntington, TEK specialist Chugach Regional Resources Commission; Hugh Short, Community Coordinator, EVOS Restoration Office; Roger Sampson and Rick DeLorenzo, Chugach School District; and the Subsistence Division of the Alaska Department of Fish and Game.

Information gathered from this project will continue to be shared with local communities. We will continue to gather information on TEK through synthesis workshops, local community facilitators, and residents. The Chugach School District, through Youth Area Watch, will provide interested students and teachers to participate in capture and monitoring. We have initiated a sea duck monitoring program in the Tatitlek Narrows through the YAW program and Tatitlek School. The school district will provide classroom aides (computer and software, maps etc.) to be used in local schools for monitoring bird movements throughout the year. ADF&G will relay satellite-monitoring information to local communities. Students will assist in collecting information from local residents on TEK, and report band returns from local hunters.

Project personnel will adhere to the protocols for including indigenous knowledge in the restoration process presented in Appendix C of the Invitation to Submit Restoration Proposals for Federal FY 2000. Boat and air charter contracts, and other services will be contracted from local sources when possible.

PROJECT DESIGN

A. Objectives

<u>FY 00:</u>

1) Capture 15 surf scoters and 10 white-winged scoters in spring on saltwater in PWS,

2) Mark 8 adult female and 7 adult male surf scoters and 6 female and 4 male white-winged

scoters with surgically implanted satellite telemetry transmitters*;

3) Capture and band as many additional seaducks as time and budget allows;

4) Collect and archive blood and feather samples for contaminant and genetic studies;

5) Determine migration routes, breeding areas, and molting and wintering sites;

6) Compare mortality rates of surgically implanted scoters with 1998 and 1999 results;

7) Compare behavior and health of surgically implanted scoters and untreated scoters during the captive phase;

8) Compare survival of surgically implanted scoters with VHF (externally attached) transmitted scoters for a 2-4 week period following release,

9) Document traditional ecological knowledge about seaducks from residents of PWS and LCI communities (and perhaps communities in the breeding and molting areas, and migration paths); and

10) Incorporate local residents through the Chugach School District and Youth Area Watch program in the collection and monitoring of data, including traditional knowledge.

* Funds for white-winged scoter transmitters and Argos data processing will be sought through additional grants.

B. Methods

Capture and Marking

ADF&G will capture, mark, and monitor scoters with professional staff, veterinarians, and local assistance. We will capture adult birds between late March and late April during the herring spawn, when large flocks of sea ducks aggregate to feed on herring roe. The commercial herring gillnet fishery, which precedes major spawning events by a few days, ranges from April 9-28 for the period from 1972-1993 (Donaldson et al. 1995). Capture sites will be determined by monitoring known areas of herring spawn deposition (Morstad et al. 1996), scoter concentrations, ADF&G Commercial Fisheries Division aerial spawn and survey maps, and local knowledge. Scoters will be captured at one or two locations in northern PWS. Results in FY99 may dictate FY00 capture sites.

Scoters will be captured with floating mist nets suspended among decoys. Trap locations will be mapped using Global Positioning Systems and nautical charts (NOAA).

Once transported to the work vessel all captured seaducks, in addition to those marked with telemetry, will be banded with USFWS aluminum leg bands. Sex and age will be identified based on plumage characteristics and age may further be determined by bursal probing. Adults do not have a bursa and if possible, second-year birds will be distinguished from third year subadults by bursa depth. Scoters will be weighed, measured (culmen, tarsus, and wing length) and blood and feather samples will be collected and archived for future contaminant, genetics, and stable isotope studies.

To facilitate the release of captive birds back to their original flock, five scoters, not slated for surgery or controls, will be marked with external VHF transmitters. These birds will be marked at the capture site and immediately released. If no large flocks remain at the original capture location, these birds will be located, and birds held at the ASLC will be released in the vicinity of these VHF marked birds.

Scoters will be housed in pet kennels with absorbent materials and kennels will be placed in cool, dry areas. Birds will be gavaged, via temporary esophageal intubation, with an electrolyte solution to prevent dehydration. A temporary holding pen will be constructed, if necessary, to allow birds to be removed from the kennels in order to swim and preen while in field captivity. Birds will be transported daily by small aircraft to holding facilities at the ASLC. The capture, marking, and handling of birds will follow procedures of the Ornithological Council (1997).

Experimental treatment, observation, and care of captive birds will occur at the ASLC by prior arrangements with the staff. Once at the ASLC birds will be allowed to acclimate to the facility. A certified veterinarian, trained in avian implant surgeries, will place transmitters in the peritoneal cavity with the antenna exiting caudally, following procedures described by Korschgen et al. (1996). Two variations of satellite transmitters will be used (Microwave Telemetry, Columbia, Maryland). The first, which will be deployed in female surf scoters, measures 10 mm deep, 55 mm long, 35 mm wide and weighs approximately 36g. Battery life can be expected to last about 10 months depending on advances in technology at time of purchase. Efforts will be made to maximize battery life by adjusting the programmable duty cycle. A larger transmitter, designed to have a longer battery life (up to 18 months) will be used in male surf scoters and all white-winged scoters. These weigh approximately 52 grams and are similar in size and shape to the smaller transmitters but with an extra 25mm x 31mm x 8mm "box" protruding from one side. Each transmitter will be hermetically sealed with a Teflon-coated multi-strand stainless-steel antenna. Transmitters will be programmed and calibrated to record and transmit body temperature to confirm that signals are being emitted from live birds.

Following surgery birds will remain in captivity for 14 days. Protocol for post-surgical care and health assessment and monitoring will be developed in consultation with ASLC staff and veterinarians. At a minimum, blood samples will be collected prior to and 48 hours after surgery in both the treated birds and the control group. Complete blood panels will be analyzed. Final protocols for blood sampling, and measuring morphological and physiological parameters during captivity will be determined prior to capture.

A control group of 15 surf scoters and 10 white-winged scoters will also be transported to the ASLC and kept under identical conditions. Birds will be subject to the same experimental protocols for health assessment and monitoring. Non-implanted birds will be marked with short-term (up to 60 day) 4 gram external VHF transmitters (Advanced Telemetry Systems). To assure high retention rates transmitters will be attached mid-dorsally using a subcutaneous anchor attachment, subcutaneous suture, and epoxy (Pietz et al. 1995, Newman et al. 1999). Birds will be sedated with a gas anaesthetic (Isoflurane) during the procedure. Transmitters will be equipped with a mortality signal.

Small fixed-wing aircraft will transport all birds from the ASLC to release site(s) in PWS. Captive birds will all be released at either the capture location, if scoter flocks are still present, or if not, with other large scoter flocks in PWS (see above). Small fixed wing aerial flights will be conducted weekly to locate VHF transmitted birds. Flights will be terminated when the majority of satellite transmitted birds leave PWS or by June 1. In the event of post-release mortality of satellite transmitted birds in PWS, a Cospas-Sarsat Ground Receiver (UHF pulse direction finder) will be employed to retrieve transmitters.

This study will test the following hypotheses

1. Objective 6.
   Ho: The survival rate of scoters implanted with satellite transmitters and held in captivity is greater than or equal to the survival rate of scoters implanted with satellite transmitters (from prior years) that were not held in captivity.

   H_1: The survival rate of scoters implanted with satellite transmitters and held in captivity is less than the survival rate of scoters with implanted satellite transmitters (from prior years) that were not held in captivity.

A two-sampled proportion test will be used to test for differences in the survival rate between the two groups (Fleiss1981, Zar 1984).

2. Objective 7.
   Additional hypothesis will be developed to test for differences in blood parameters and health indicators between surgically implanted birds and the control group.

3. Objective 8.
   H_o: The survival rate of scoters implanted with satellite transmitters and held in captivity is greater than or equal to the survival rate of scoters held in captivity but not implanted with satellite transmitters.

   $H_{1:}$ The survival rate of scoters implanted with satellite transmitters and held in captivity is less than the survival rate of scoters held in captivity but not implanted with satellite transmitters.

A two-sampled proportion test will be used to test for differences in the survival rate between the two groups (Fleiss1981, Zar 1984). Using a sample size of 25 surgically implanted birds (15 surf scoters and 10 white-winged scoters) and 25 controls of the same species composition we will have the power to detect a mortality difference of 25% between the two populations, 75% of the time at @=.10 (Fleiss 1981). Funding for satellite transmitters to be used in the additional 10 white-winged scoters will be obtained through grants.

Satellite signals will be analyzed using Service Argos Data Collection and Location System (Landover, Maryland). Argos Standard and Animal-Tracking data processing services will provide near real-time information on the precision of each location through on-line interrogation. Movements will be monitored throughout the life of the transmitter. Locations will be mapped using a Geographic Information System (GIS) and posted on the Internet. Movements and locations of scoters will be forwarded to the Chugach School District and affected communities so students can monitor the progress and movements of birds between breeding, molting, and wintering areas.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Dan Mulcahy, a licensed veterinarian with USGS-BRD, will assist in satellite telemetry implants. All data collection and analysis will be supervised by ADF&G. Private sector contracts for fuel purchase, equipment, vessel support and air charter will be solicited, usually from the local Prince William Sound or lower Cook Inlet region. Contracts for satellite transmitters and data downloading will be solicited from the private sector.

The project will be pursued in cooperation with the ASLC. Funding for ASLC ("bench fees") has been included in this proposal.

Cooperation for community involvement will be sought through the EVOS Restoration Office, Chugach School District, the villages of Tatitlek, Port Graham, and Nanwalek, and the Alaska Department of Fish and Game Subsistence Division (see above).

SCHEDULE

A. Measurable Project Tasks for FY 00

October-December: 1999	Coordinate and plan community involvement, Youth Area Watch and TEK. Attend Synthesis Workshops in local communities. Meet with local subsistence harvesters. Order satellite and VHF transmitters and field gear. Contract for vessel support, veterinary services. Apply for grants for additional transmitters
January-March: 2000	Attend Restoration Workshop. Hire field technicians. Organize field gear, test equipment. Plan field logistics and organize equipment and personnel. Coordinate community involvement, Youth Area Watch, and TEK. Reconnaissance surveys for scoter concentrations. Capture birds for radio implants.
April-June:	Continue with capture activities. Monitor birds at ASLC. Conduct surgical implants and attach VHF transmitters. Release birds in PWS. Conduct VHF tracking flights to measure mortality. Monitor satellite transmitters. Maintain and store field equipment.
July-September	Monitor movement of satellite transmitted birds Maintain Web site. Organize and analyze data

B. Project Milestones and Endpoints

FY00

October-March:	Monitor FY99 satellite transmitter birds. Post results on the Internet. Coordinate and plan community involvement.
March-April:	Capture birds for transmitter implants and VHF marking.
April:	Submit annual report for FY99 Monitor birds at ASLC. Release captive birds
May-September:	Monitor birds for defining migration routes, breeding areas, and molting areas. Monitor for mortality. Coordinate with local communities. Maintain Web site.

FY01

October-March:	Monitor satellite transmitter birds. Post results on the Internet. Coordinate and plan community involvement, Youth Area Watch, and TEK.
April:	Submit final report.
May-September:	Continue to monitor any active transmitters.

C. Completion Date

All project objectives, except continued monitoring of active transmitters, updating the web page, and completion of final reports and publications, will be met following FY00.

PUBLICATIONS AND REPORTS

An annual report of FY00 activities will be submitted to the Restoration Office before 15 April 2000. Journal publications will be prepared upon completion of all fieldwork.

PROFESSIONAL CONFERENCES

To be determined.

NORMAL AGENCY MANAGEMENT

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

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

As described in the Introduction, this research relies on incorporation of methods and data from other EVOS Trustee sponsored research, including projects /427 and /025. Equipment purchased by those projects will be used to conduct this research. Location of research sites, and data collection and analysis will follow previously established standards. All efforts will be made to share vessel support, telemetry monitoring, study sites, and equipment with other EVOS projects.

This project is integrated with project \052B Traditional Ecological Knowledge; project \210 Youth Area Watch; project \025 Nearshore Vertebrate Predator Project; project \320 Predation on Herring Spawn; project \427 Harlequin Duck Recovery Monitoring; and project \159 Prince William Sound Marine Bird Surveys.

See Community Involvement and Traditional Ecological section above for more details on coordination of TEK and Youth Area Watch activities.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

Due to the results of the FY99 field season, major changes from the FY99 and original FY00 proposal include the following: 1) Surgery will be conducted and scoters will temporarily be held in captivity at the ASLC in Seward, 2) Components of the FY99 and FY00 proposals that included nesting and molting surveys will be eliminated and the FY99 component will be used to reduce FY00 expenses, and FY00 funds will be reallocated to cover some costs attributed to use of the ASLC, 3) Due to increased costs attributed to use of the ASLC, no capture will be attempted in lower Cook Inlet, 4) A control group of 25 birds will also be held in captivity and marked with VHF transmitters to compare the effects of surgery.

PROPOSED PRINCIPAL INVESTIGATORS

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Revision -27-99
approved TC 8-9-99

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	$90.2	$84.2						
Travel	$11.7	$8.4						
Contractual	$38.3	$67.7						
Commodities	$49.8	$27.1						
Equipment	$0.0	$0.6	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$190.0	$188.0			Estimated FY 2001	Estimated FY 2002		
General Administration	$12.9	$17.4						
Project Total	$202.9	$205.4			$160.0	$160.0		
Full-time Equivalents (FTE)		1.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
The cost of satellite transmitters and related data downloading expenses from Service Argos Inc., a satellite based location and data collection system are sole source.

Major changes from the April 15, 1999 DPD have been explained in the accompanying cover letter. Increases are from Alaska SeaLife Center bench fees.

No money is allocated for NEPA compliance. Only salary money is allocated for attendance at Anchorage workshops. Travel to villages for TEK "Synthesis Workshops" is included. Travel for students to participate in field work as part of Youth Area Watch and school district programs is not included in this budget.

The ten days allocated for vessel charter assumes a minimum of 8 days of good operating weather.

Estiamted FY2001 expenses include continued Argos data downloading and processing costs, web page updating, report writing and satellite transmitter marking in lower Cook Inlet.

FY00

Prepared:4/9/99,Rev7/7,7/27

Project Number: 00273
Project Title: Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knowledge to Conserve the Resource.
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
D. Rosenberg	WBIII, Principal Investigator	18J	6.5	5.9	1.0	39.4
Mike Petrula	WBII, Data analysis, report prep., graphic	16B	6.5	4.5	1.0	30.3
1 F&G Tech.	F&G Tech. III, Field Tech/graphics	11F	2.5	3.7	1.0	10.3
1 F&G Tech.	F&G Tech. III, Field Tech	11F	1.0	3.7	0.5	4.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		16.5	17.8	3.5	
					Personnel Total	$84.2

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Portage-Whittier Alaska Railroad vehicle,boat, and 1 psng.	0.4	2			0.8
Portage-Whittier Alaska Railroad vehicle and psng.	0.2	4			0.8
Portage-Whittier Alaska Railroad Psg. fare	0.1	1			0.1
Anchorage-Tatitlek by air	0.4	3	3	0.1	1.5
Anchorage -Valdez by air	0.2	2	4	0.1	0.8
Anchorage-Chenega by air	0.3	2	2	0.1	0.8
Anchorage -Port Graham/Nanwalek by air	0.3	3	4	0.1	1.3
Anchorage-Cordova by air	0.2	2	2	0.1	0.6
Airport parking, taxi fare, excess baggage					0.2
Per diem, Seward, Whittier			15	0.1	1.5
					0.0
				Travel Total	$8.4

FY00

Project Number: 00273
Project Title: Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knowledge to Conserve the Resource.
Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL

ared:4/9/99,Rev7/7,7/27

2000 EXXON VALDEZ TRUSTE_ _)UNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed
Description	FY 2000
Air charter for field support 36 hrs @ $275/hr (incl. recon, bird transport to Seward & back, post-release monitoring	10.0
Boat and outboard motor repair	0.8
Trailer and boat moorage Whittier	0.2
Photo processing, presentation productions	0.3
Vessel support for bird capture and marking 10 days @1300/day	13.0
Satellite telemetry data downloading 15 birds at $900/bird	13.5
Air freight - equipment shipment	0.5
SeaLife Center Bench Fees (fee schedule attached)	22.4
Blood analysis, $45/sample x 100 samples	4.5
Cospass-Sarsat ground receiver rental $38.50/day x 30 days,insurance, shipping	1.5
Refurbish 5 satellite transmitters	1.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$67.7

Commodities Costs:	Proposed
Description	FY 2000
Boat fuel 175 galllons @ $1.50/gal	0.3
Boat supplies- parts, props, fuel lines, fuel filters, water filters, battery, absorbent rags, oil, emergency provisions	0.5
Field survey supplies- rite-in-rain notebooks/paper, nautical charts, batteries,	0.6
Computer software for analysis, graphing, mapping, web page development	0.6
VHF Transmitters 30 @ 190.00 each	5.7
Mist nets and trapping equipment	1.8
Satellite radio transmitters - 6 @ $2,700 each	16.2
Veterinarian surgical supplies	1.0
Blood sampling supplies	0.4
Commodities Total	$27.1

FY00

Prepared:4/9/99,Rev7/7,7/27

Project Number: 00273
Project Title: Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knowledge to Conserve the Resource.
Agency: ADFG

FORM 3B
Contractual &
Commodities
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
EPIRBS	2	0.3	0.6
			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**	$0.6

Existing Equipment Usage: Description	Number of Units	Inventory Agency
20 ft. Caribe rigid hull inflatable	1	ADFG
17 ft. Boston Whaler	1	ADFG
10x40 binoculars	4	ADFG
Spotting Scopes	2	ADFG
Achilles 8 ft inflatable dinghy	2	ADFG
Remington Shotguns	2	ADFG
Honda generators	3	ADFG
Survival Suits	2	ADFG
Outboard Motors/various hp	6	ADFG
Magellan GPS	3	ADFG
Marine VHF radios	4	ADFG

FY00

Project Number: 00273
Project Title: Scoter Life History and Ecology: Linking Satellite Technology with Traditional Knowledge to Conserve the Resource.
Agency: ADFG

FORM 3B
Equipment
DETAIL

ared:4/9/99,Rev7/7,7/27

Revision 7/23/99
approved TC 8-9-99

PROJECT TITLE: Development of an Ecological Characterization and Site Profile of the Kachemak Bay Watershed/Lower Cook Inlet Area

Project Number:	00278
Restoration Category:	Ecosystem Synthesis, General Restoration (suggested)
Proposer:	ADFG
Lead Trustee	ADFG
Duration:	2nd year of 2-year project
Cost FY 00:	$44.1
Geographic Area:	Kachemak Bay, Southern Kenai Peninsula, and Lower Cook Inlet

Injured Resource/Service: Kachemak Bay includes all injured resources (except cutthroat trout, Dolly Varden, and AB Killer Whale pod) and all the lost or reduced services, each of which will be addressed in the development of this ecological characterization and site profile of the Kachemak Bay Watershed/Lower Cook Inlet area.

ABSTRACT

This project will develop an ecological characterization and site profile to collect, synthesize, analyze, and document available physical, biological, and human or socioeconomic information on the Kachemak Bay/Lower Cook Inlet area. The project will result in the development of a database management system with products produced in electronic format (hypertext markup language with selective use of compact computer disk – CD – and Internet media) and summarized on paper. Three main project components of the overall project include: 1) the ecosystem narrative description; 2) a spatial data component using a Geographic Information System (GIS); and 3) the annotated bibliography and research summary/tracking system. EVOS funds will focus on the spatial data component and annotated bibliography. The products will be presented in an interactive, easy-to-use information source to: (1) to improve accessibility of ecological information to public, researchers, and managers; (2) assist in the use and protection of land (including parcels purchased by the EVOS Trustees); (3) help plan for a possible long-term ecological monitoring and research program in the Northern Gulf of Alaska; and (4) assist in agency management and planning for the Lower Cook Inlet area.

INTRODUCTION

The proposal to develop an ecological characterization and site profile (hereafter referred to as the "characterization") of Kachemak Bay is a continuation of a project funded in FY99. FY00 will be the final year of this project.

The overall project goal is to: 1) provide stakeholders with ecological information from EVOS and other sources, and 2) develop a research, management, and planning tool for the EVOS restoration effort and other organizations making natural resources decisions. The overall project was based on an initial user need survey (Enclosure 1), and we continued to develop and implement year one of this project in year one with the users in mind. We are collecting, synthesizing, and analyzing ecological information about the Lower Cook Inlet area, with an emphasis on the Kachemak Bay Watershed. This information base covers all elements of the ecosystem, including the biological, physical, human, and socioeconomic elements. The project will deliver the information through these tools: 1) an interactive ecosystem description; 2) a Geographic Information System (GIS); and 3) an annotated, searchable bibliography and current research synthesis and tracking system. Information will be presented electronically in hypertext markup language (HTML) on a CD-ROM and ultimately via the Internet. Additionally, as funding permits, we hope to produce the information in hard copy format. Data and information are being gathered from existing literature and the management and scientific communities. The resulting interactive digital characterization will include detailed, site-specific information that both novice and technically sophisticated users can access and understand.

To begin this rigorous project in FY98, the department secured additional funding and partners, hired staff, and established additional cooperative agreements. The principal contributing partner in this continuing project is the National Oceanic and Atmospheric Administration (NOAA), Coastal Services Center (CSC). While a major player, the CSC is not requesting funding from the Trustee Council. The Center has done a similar ecological characterization for Otter Island, S.C. and is completing a second ecological characterization in the Ashepoo-Cambahee-Edisto (ACE) Basin in South Carolina (SCDNR, NOAA/CSC, NGDC, 1996). The CSC not only brings a great deal of experience and expertise, but also brings substantial cost sharing opportunities to this EVOS restoration effort. The Center funded a two-year "Coastal Management Fellowship" (October 97 to September 99), partnered with ADFG to collect existing spatial data through a NOAA National Spatial Data Infrastructure Program, and entered into a two year cooperative agreement with ADFG for the overall project (April 1, 1998 to March 31, 2000).

Creating and integrating the extensive ecosystem description, GIS atlas and models, searchable bibliography, and research synthesis in an electronic format represents a large and complex undertaking. Sufficient resources to complete all aspects of the project, will result in a more comprehensive, easy-to-use product of substantial value to many users (resource managers, scientists, land owners and the general public). Continued Trustee Council participation will play a critical role in the successful completion of this project.

Kachemak Bay was designated as the 23rd National Estuarine Research Reserve (NERR) in the National System on February 12, 1999 (ADFG and NOAA, 1998). The NERR System is a non-regulatory program of estuaries designated to support and promote long-term research, monitoring, and education. The KBNERR will play a lead role in maintaining the ecological characterization and the associated GIS. The goals and objectives of the proposed reserve are compatible with the goals of the Trustees Council as presented in the EVOS Restoration Plan (EVOS Trustee Council, 1994). Reserve designation presents numerous cost-sharing opportunities, and can bring additional NOAA expertise and public participation into the EVOS restoration effort. Moreover, the NERR System as a whole, and in particular the Kachemak Bay NERR, places an emphasis on getting scientific information to managers, resource users, and the general public. Through this project and future efforts, we can assist the Trustees in getting EVOS funded and other information to stakeholders.

NEED FOR THE PROJECT

Statement of Problem

To date, EVOS restoration efforts have focused largely on restoration projects, research, and monitoring. The Invitation to Submit Restoration Proposals for FY99 and FY00 indicated a shift in emphasis from research to synthesizing and integrating information (see pp. 31 and 32, Ecosystem Synthesis section). The Ecological Characterization is designed in part to meet this need -- summarize existing information, involve stakeholders in its development, and develop an easy-to-use product of value to many stakeholders.

The EVOS Chief Scientist and visiting scientists at the 10th annual EVOS Restoration Workshop have pointed to the need to compile comprehensive baseline data on the ecosystem's physical, chemical, biological, and human elements. Such data would serve as the backbone of a long term monitoring program such as that being developed by the Trustee Council for the Restoration Reserve. This project will provide a synthesis of available information for all these elements, establishing baseline data for future monitoring efforts in Lower Cook Inlet an Kachemak Bay..

At the beginning of this project, ADFG conducted an extensive survey of potential ecological characterization users to determine their information needs and the most appropriate delivery and presentation format (Callahan et al, 1998). The survey summary is provided in Enclosure 2. Some of the highlights include:

Assessment Participants: Over forty managers, researchers, and educators from 28 organizations active in the Kachemak Bay/Lower Cook Inlet area were interviewed. These include researchers involved in the EVOS restoration studies.

Management Issues: This section lists some of the primary management issues identified in the survey. Respondents noted the importance of distinguishing between human-induced and natural changes. In addition to meeting the needs of EVOS, compiling this information in a single source can significantly help managers and resource users of the region.

Primary Information Needs for Managers and Researchers: Managers and researchers need to better understand the whole ecosystem and how its components interact. In addition, they agreed that the current information is too general. This project proposes to update existing information and develop more site-specific spatial information.

Geospatial Information Needs, Capabilities, and Uses: To better understand the audience, this section of the survey identified spatial data needs, agency capabilities, and existing and potential uses of GIS. This project will provide GIS data and training for users of this project.

Product Format and Access Recommendations: Respondents identified the primary problem as inability to access information. They prefer to have ecosystem information readily available using a combination of CD, Internet, and paper media.

Summary: Respondents voiced a need to develop a socioeconomic and ecological database for research, management, and planning. At present, managers and researchers seek information from a wide array of sources, leading to time-consuming and often fruitless searches for site-specific details. Data and qualitative information are separately archived in management agencies throughout the state. The daunting task of searching for information and the lack of access drives repeated requests for a centralized source of site-specific details on the Kachemak Bay watershed. For community members, obtaining information is frequently even more frustrating and unsuccessful.

All of the interview participants valued the proposed characterization products and data management systems as tools for management and research. The respondents said a site-specific knowledge base that identifies and summarizes what is known and not known about the Bay's ecosystem would be very useful for daily and long-term activities. The information in the characterization may be used in developing plans and recommendations for use of the Bay's resources, restoration, research, and ecological monitoring.

Interaction with the potential Characterization users continues to address the needs of the EVOS restoration effort, by interviewing PIs of ongoing research and long-term monitoring projects. Community involvement and participation is also built into the characterization and has been a significant part of our outreach efforts to date.

Rationale/Link to Restoration

The proposed project is closely linked to the mission, policies, and objectives of the Trustee Council. With respect to goals and objectives of the Trustee Council, the ecological characterization will:

1. Elucidate the state of knowledge of injured species, resources, and services in Lower Cook Inlet and Kachemak Bay;
2. Identify gaps in ecological knowledge of Kachemak Bay;
3. Facilitate identification of restoration and enhancement opportunities for these resources and services;
4. Assist in collection of information for other EVOS efforts related to restoration, research, and long-term monitoring;
5. Provide an information base and data management system for future EVOS and agency restoration efforts (both research and long-term monitoring), management, and natural resource planning.

The ways in which this project addresses the Trustee Council policies are summarized below. Policy numbers refer to those listed in Chapter 2 of the 1994 EVOS Restoration Plan (pages 12 to 17).

Ecosystem Approach, Policies 1 and 2 – A primary focus of this project is to promote an ecosystem approach towards restoration, management, and use of Kachemak Bay. The study area includes the Kachemak Bay Watershed, encompassing those lands purchased by the Trustee Council on the south side of the Bay and the proposed purchases on the north side. This ecological nature of the project synthesis will clearly benefit multiple species and services.

Injuries Addressed by Restoration, Policies 3, 4, and 6 – Tasks 1 to 5 above relate to the restoration of injured species and resources. Many of the injured species and services have substantial economic, cultural, and subsistence value to the state, regional, and local economies.

Location of Restoration Actions, Policy 8 – Kachemak Bay is in the spill area. Council policy allows study of other areas of the ecosystem that may affect marine resources.

Restoring a Service, Policy 9 – Most of the injured services occur within the Kachemak Bay area. Through an analysis of present and historical information, this project will identify services that can be protected, restored, or enhanced.

Efficiency, Policies 11 and 14 – This project maximizes cost sharing. The EVOS restoration effort can gain significant benefits from this product with relatively little expense. Proposed EVOS funding represents a relatively small but critical component of total costs for creating the information synthesis.

Partnerships, Policy 15 – This project emphasizes establishing partnerships with governmental and non-governmental agencies to define user needs, develop the product, and maintain it.

Clear, Measurable, and Achievable Endpoint – The ecological characterization will be completed in mid FY00. The products will be available to managers, researchers, local governments, and the public. ADFG is requesting FY00 funds to complete the complete the GIS component, the final production and evaluation phases of the project, and produce 200 copies of the CDs for EVOS PIs.

Synthesis of Findings/Project Integration/Remaining Issues and Information Gaps, Policy 18 – The project summarizes and synthesizes available information (EVOS and non-EVOS), and by the synthesis, identifies information gaps. Monitoring efforts and any other field efforts are not part of the characterization, rather they are NERR related. In addition, small parcels in the Homer area (Beluga Slough and Homer Spit) and large parcels of Seldovia Native Association land purchased by the Council are included in the study area. This project can help support protection of those lands and the injured species and services they support.

Public Participation, Policy 19 – ADFG has sought comments from several non-governmental entities in project design, and has completed an extensive need assessment (Enclosure 4). Continued involvement of agencies and the public will foster ownership and product use.

Access to Information and Data, Policy 20 – A major focus of this effort is to make EVOS-funded and other information readily available to the public and agencies in a user-friendly form. Involving representative users in the project assures the usefulness of the product. This project will complement other efforts of the Trustee Council's staff to disseminate information.

Normal Agency Activities – The preparation of an ecological characterization is not a normal ADFG activity and has not been conducted by the department in any other area. Ecological characterizations are NOAA requirements for the Kachemak Bay National Estuarine Research Reserve.

C. Location

The project study area is mapped in Figure 1 (next page). Figure 1-A represents the "focus area," or the area of intensive data collection and synthesis. This includes

Kachemak Bay and its watershed. Data collection and synthesis in the focus area will include updating existing data and incorporating additional scientific and local knowledge. To illustrate how Kachemak Bay is influenced by and influences the larger ecosystem, the overall extent of spatial data collection will be extended to all of Cook Inlet and parts of the outer Kenai Peninsula as delineated on Figure 1-B. Outside the focus area, spatial data capture will be limited to priority existing data sets. The primary affected communities include Homer, Anchor Point, Kachemak City, Kachemak Selo, Halibut Cove, Seldovia, Port Graham, Nanwalek, and adjacent areas.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The original Year 1 proposal included a fairly aggressive outreach to inform the communities of this project and provide opportunities for public input. A high level of community involvement would both improve the information base presented in the product and enhance stakeholder ownership and use of the product. Due to the reduction in funding and the Trustee Council staff recommendation to focus on the GIS and annotated bibliography aspect of the proposal, this element was scaled back from our original proposal. Information collection will be limited largely to more traditional scientific, professional sources of information.

PROJECT DESIGN

As noted previously, the proposed project is part of a larger cooperative effort with NOAA/CSC to develop a characterization for Lower Cook Inlet and the Kachemak Bay Watershed. The following narrative summarizes key aspects of the project related to the collection of GIS spatial data and the annotated bibliography that would be funded through EVOS Restoration funds.

The proposal to the CSC was prepared with an understanding that we would seek additional resources and partners to create the most comprehensive and useful product. The ecological characterization represents a major effort that will have extensive utility for many audiences. However, the primary "target audience" (the primary audience that will guide the development of the project) is researchers and managers, with full consideration of EVOS information and information management needs with Trustee funding. The Trustee Council has goals and objectives in common with those of the NERR characterization project. Thus the Trustee Council is a logical partner in this endeavor. The Council's involvement would also gain efficiencies in cost by jointly addressing specific EVOS restoration, research, and monitoring needs. Council participation will, in part, result in (1) a more comprehensive product; (2) an update of existing information; and (3) collection and synthesis of more detailed and site-specific spatial information on the human, biological, and physical elements of the ecosystem.

A. Objectives

Trustee Council funded objectives partially under this project are as follows :

1. Collect existing GIS data and develop a personal computer-based GIS for the Kachemak Bay/Lower Cook Inlet ecosystem for use in the characterization and as tool for research, monitoring, and resource management and planning.
2. Develop GIS applications to demonstrate how it can be used for management, research, monitoring, education, and restoration.
3. Develop an annotated bibliography of available information and summarize research for the Kachemak Bay/Lower Cook Inlet ecosystem.
4. Publish the ecosystem information, information needs, and the GIS data and applications as an ecological characterization on a compact computer disk (CD) and, as appropriate, on the Internet.

EVOS funded staff will focus on the collecting existing and developing new GIS data, development of an annotated bibliography, and publishing this information.

B. Methods

Project Framework: The ecological characterization will present information through three components: (1) the ecosystem description; (2) the GIS/spatial data; and (3) annotated bibliography/research synthesis. EVOS project staff will focus on the 2nd and 3rd components, as described below.

1. *GIS/Spatial Data Component*: The GIS database and its demonstration component will contain digitized spatial data and associated metadata (i.e., a description of the data). GIS layers of habitat, natural resources, physical processes, human use, roads, land use, management status, and other features will allow managers and researchers to better analyze problems from an ecosystem perspective. The GIS demonstrations will show how to use this tool to investigate questions specific to Kachemak Bay. Included will be GIS analyses of subjects such as land use planning and fisheries management for this area. In addition to the research, management, and modeling applications, the educational benefits of visualizing the data will help involve and educate the community. With the Trustee Council's support, the community will also participate by bringing their knowledge of the region into the GIS.

   Progress Update: ADFG has completed an initial inventory of available spatial data which includes the Kachemak Bay/Lower Cook Inlet Area. The available information does not have the high resolution that the local residents can provide, and that researchers and managers need. Data capture has focused on the Kachemak Bay Watershed, but we will also capture data to analyze ecological relationships between the Bay, Cook Inlet, and the Northern Gulf of Alaska (see Figure 1B). The GIS component has taken substantially longer than anticipated, due to the unanticipated large amount of time required to FGDC compliant metadata and cleaning the GIS data. A summary of the GIS data captured at the time of project submittal is included in Enclosure 1.

2. *Annotated Bibliography*: This component will include a searchable, partially annotated bibliography of EVOS research and other information about the ecosystem. It will greatly increase access to and use of this information. The bibliography will encompass journal articles, unpublished reports, EVOS projects, gray literature, and major public documents on the watershed and resource that inhabit the area. All of the documents will be searchable by key words, author, title and date.

   Progress Update: All free databases (approx. 25) have been searched and citations entered into the Procite database. The KBNERR and Homer Public Library have gleaned for all pertinent references. The ADFG library search will be complete by the end of April, 1999. Other smaller libraries in Homer will be searched upon completion of the ADFG library search. Approximately 400 citations are entered with 70 annotations. Fee required databases will be searched by end of May, 1999.

3. *Research Synthesis*: This section will summarize current research, monitoring and restoration projects. Thus making the information from those projects more valuable for promoting an ecosystem perspective for users of the characterization. This summaries will also facilitate better coordination among organizations working in the Bay, and assist others in accessing the latest research.

   Progress Update: PIs at USFWS, ADFG, Center for Alaska Coastal Studies, Cook Inlet Keeper, and Cook Inlet RCAC have been interviewed. Once summaries are complete for those projects, interviews will continue with the principle investigators from USGS, Coble Geophysical, City of Homer , Pratt Museum and SeeMore Wildlife Systems.

4. *Database Design:* ADFG and CSC will design the characterization database to provide easy information access, analysis, and update. This database will also work with the search software of the bibliography and the GIS/spatial data component. The database design must also accommodate the Internet and CD interfaces.

   Progress Update: The database framework is in place. Project staff are filling in the information.

5. *Interviews*: This EVOS project will involve networking and outreach with the scientific and management communities to collect the most recent, accurate, and site specific information available. Information from the literature will be supplemented with interviews of researchers and managers. This will include university, agency, and other EVOS researchers who are conducting studies in the Kachemak Bay area.

ADFG project staff will collect most of this information [note: the contractor under (b) below (i.e., CSC funded aspect of the project) will assist in collecting historical information].

Progress Update: Interviews have begun and should be completed by late summer.

Year 2 Tasks – FY00

A. Completion of GIS Data Collection and Metadata Development

It was initially anticipated that all the data collections and compilation would be completed by September 99. In actuality, we found that the work load associated with the collection and "cleaning" of data, as well as the development of FGDC compliant metadata, was substantially greater than anticipated. ADFG will be compiling 100's of data sets for inclusion of the products, all of which require various levels of modification to create a clean, easy-to-use product. Some of the problems we encountered include:

Spatial Data Collection and Cleaning: The development of a spatial database on GIS requires the collection of spatial data from multiple sources. Spatial and associated attribute data are collected from multiple data sources, frequently developed using a different software programs than used in this project (ArcInfo and ArcView). Data conversions are rarely perfect, and require a lot of "cleaning" (e.g., correcting or closing arcs, edge matching, reformatting or clarifying attribute data for easy access and use) before it can be utilized. Date cleaning is require to establish and user-friendly product.

Development of Metadata: ADFG will develop Federal Geographic Data Committee (FGDC) compliant metadata (to the extent that available information will allow) for all data layers captured or developed as part of this ecological characterization. We have found that the vast majority of the data layers did not have FGDC compliant metadata (many did not have any metadata at all). Metadata documentation is necessary to describe the source of the data and its limitations. Metadata collection will also benefit other ongoing and future EVOS project that utilize this data.

ADF&G is requesting an additional three months of time for our GIS specialist in FY00 to assist in completing metadata development.

B. Completion of CD, Internet Products, Project Evaluation, and Maintenance Plan

It is essential that project staff continue to work with the CSC to review products, conduct the project evaluation, and complete the other tasks below. Descriptions of FY00 tasks are provided below. The estimated $35.0K in needed FY00 to assist in the completion of the below tasks. This is expected to cover approximately one fourth of the costs of completing these tasks, the balance of which will be covered through NOAA funds.

Development of CD/Internet Products: The information collection and synthesis phases will be approximately 60 percent completed at the end of FY99. September 30, 1999, also marks the end of the two-year Coastal Management Fellowship project. As part of the cooperative agreement, the CSC is responsible for incorporating the information compiled by ADFG into the CD/Internet products. The anticipated completion date is April 2000.

Reproduction and Distribution of CDs: As part of the cooperative agreement, CSC will produce a limited number of copies of the CD. Depending on the number desired by the Trustee Council staff, additional funding may be necessary to reproduce additional CDs.

Production of the Paper Copy: In the needs assessment, several respondents recommended that a paper copy of the ecological characterization be produced. As part of the EVOS project, ADFG will provide the Trustees Council with a hard copy of bibliography. GIS data will be be made available on the CD and be made available to the general public through the KBNERR web page. A paper copy of other parts of the characterization will be developed as time and finding allows.

Product Evaluation: ADFG and CSC intend to conduct an evaluation of the product before it is distributed. Appropriate refinements will be made to the product will be made before the product is released.

Maintenance Plan: ADFG intends to develop a product that can be maintained. ADFG will develop the plan to update and maintain key products of the ecological characterization. This will include an identification of potential uses, product evaluation, and recommendations for further work.

Coordinate With Other EVOS Projects: ADFG will coordinate with other EVOS projects to collect and synthesize information and make it available to the stakeholders in EVOS restoration process. Our ability to coordinate will be dependent on other EVOS project staff willingness to coordinate and share information for public dissemination.

Coordinate with CIIMMS Project: KBEC project staff will coordinate with the EVOS-funded Cook Inlet Information Management and Monitoring System (i.e., "CIIMMS") as appropriate. This will likely involve sharing GIS spatial data and associated metadata. We will also coordinate with CIIMS project staff to ensure the projects are compatible and complementary.

C. Cooperating Agencies, Contracts, and other Agency Assistance

Agency Requesting Funding:

ADFG is the only Trustee Council agency requesting funding. NOAA/NOS/CSC is a cooperating agency, but is not requesting funding as part of this project.

Contractors:

The Coastal Management Fellowship is being administered through the Alaska Sea Grant Office through the University of Alaska/Fairbanks. A total of $12K will be provided to the Alaska Sea Grant Office through a Reimbursable Services Agreement to cover three months of the Fellow's time toward project coordination and the GIS/spatial data and annotated bibliography components of this project.

SCHEDULE

A. Measurable Project Tasks for FY00 (only tasks funded in part by EVOS)

1st Quarter:

- Collect and capture of existing spatial data and include in the GIS.
- Digitize new spatial data.
- Develop metadata for existing and new GIS data.
- Serve GIS spatial data and associated metadata on the KBNERR web page.
- Add entries to bibliography.
- Provide narrative and spatial information to CSC as it is completed.

2nd Quarter:

- Collect and capture of existing spatial data and include in the GIS.
- Digitize new spatial data.
- Develop metadata for existing and new GIS data.
- Serve GIS spatial data and associated metadata on the KBNERR web page.
- Add entries to bibliography

3rd Quarter:

- Develop draft CD.
- Project evaluation.
- Train select managers, researchers, and users of the product.
- User evaluation.
- Attend 10th Annual Workshop and associated meetings.

4th Quarter:

- Continue development of CD.
- User evaluation.
- Product evaluation.
- Develop product maintenance plan.
- Develop Internet product.

B. Project Milestones and Endpoints (tasks funded in part by EVOS)

1st Quarter:

- Complete clipping and cleaning of existing spatial data.
- Complete establishment of metadata for existing spatial data.
- Continue digitizing new spatial data
- Bibliography 90% complete.
- Continue to provide spatial and other data to CSC.

2nd Quarter:

- Distribute sections for review.
- 100% of existing GIS spatial data captured (with metadata).
- 100% of new spatial data digitized (with metadata)
- Bibliography 100% complete.
- All data and components provided to CSC.

3rd Quarter:

- Begin review and evaluation of draft product with users.
- Peer review of draft narrative and spatial data completed.
- Begin GIS training of select users.
- Participate in Annual EVOS Workshop.

4th Quarter:

- Complete CD.
- Begin development of Internet Product (ADFG input and assistance to CSC).
- Complete training.
- Complete user evaluation and make appropriate modifications.

C. Completion Date

Estimated completion date of the CD is September 30, 2000. The Internet version of the characterization may be completed after this date (probably by April 2001).[1]

PUBLICATIONS AND REPORTS

The ecological characterization will be published in electronic media (CD and the Internet).

[1] The development of the Internet product is the responsibility of the CSC, which is not funded by the Trustees Council. ADF&G/KBNERR will work with CSC in development of the product to be included on the Internet.

PROFESSIONAL CONFERENCES

Not applicable.

NORMAL AGENCY MANAGEMENT

Neither ADFG nor NOAA requires development of a characterization. All aspects of this project – the Coastal Management Fellowship project, the NSDI project and the cooperative agreement with NOAA – were funded through a competitive process. Through this proposal, we are seeking to fund staff to complete the characterization and address the EVOS restoration effort's needs.

COORDINATION AND INTEGRATION WITH THE RESTORATION EFFORT

Coordination with the EVOS Restoration Effort: ADFG has begun coordination with restoration projects on several fronts. We have initiated coordination with the APEX project (\163), which has a significant study effort in Kachemak Bay/Lower Cook Inlet. We will work with project staff to help define data needs (e.g., spatial data and other information we can collect to assist the modeling or other aspects of their project) and will incorporate their findings in the characterization.

We continue to coordinate with the staff of other EVOS projects (APEX , CIMMS and Mariner Park Restoration Project) to include the most up-to-date information in the characterization. Four EVOS-funded staff, presented a poster at the 1999 annual EVOS workshop in Anchorage. We will present a poster or make a presentation at the 2000 annual EVOS workshop.

Other Funds/Major Contributors: ADFG has secured substantial financial resources and established cooperative agreements in this project. These are detailed below.

FY99 and FY00 Contributions

NOAA/CSC Coastal Management Fellowship: The CSC is providing funds to support a Fellowship position in ADFG's Habitat and Restoration Division. The Fellowship will end October 1999. The approximate NOAA contribution (21 months)was $64,000.

NOAA/CSC – ADFG Cooperative Agreement: On April 1, 1998, the CSC and ADFG entered into a two-year cooperative agreement to "Develop an Ecological and Socioeconomic Characterization of Kachemak Bay, Alaska." This involves $140,000 for each of two years, or $280,000 to ADFG. As part of this agreement, ADFG is responsible for data collection, synthesis, and analysis. We are presently in the second year of this agreement (April 99 to March 00), which includes partial funds for two

Habitat Biologist I's, a Fish and Game Technician, an GIS specialist, and intern time for the GIS work. This does not include the CSC staff's contribution.

The CSC will be responsible for producing the CD and Internet products. The Center has budgeted approximately 1 full-time-equivalent (FTE) in year one and 2 FTE's in year two. The CSC will also reproduce and distribute the CDs. The CSC will also reproduce and distribute several hundred copies of the CD. No precise estimate for the CSC contribution has been established, but will likely exceed $150,000 before project completion.

Project Management: Approximately 1.5 months of staff time during the first six months of this project (October 97 to September 98) was devoted to project management. This amounts to approximately $10,000.

Kachemak Bay NERR: The Kachemak Bay NERR was officially designated by NOAA on February 12, 1999. The Kachemak Bay NERR Manager and Research Coordinator will assist with this project in a review and advisory capacity and eventually assume the responsibility for project management. The Reserve Research Coordinator is expected to be hired by July and Education Coordinator by October, 1999. The Research Coordinator will contribute to the effort by leading an effort to further define and prioritize information needs and future research and monitoring. This will be integrated with researchers and general public through a "Research and Monitoring Advisory Group" that will be set up by the developing NERR. Information, research, and monitoring needs will be presented in the ecological characterization. We estimate that this will take approximately two months of staff time, or about $12,000 of personal services time.

PRINCIPAL INVESTIGATOR

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Revision 23/99
approved TC 8-9-99

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$36.6						
Travel		$2.0						
Contractual		$0.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$38.6			Estimated FY 2001	Estimated FY 2002		
General Administration		$5.5						
Project Total	$0.0	$44.1			$0.0	$0.0		
Full-time Equivalents (FTE)		0.8						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: ADFG originally underestimated the cost in FY99 of the developing the GIS component of this project, including data collection, cleaning, and development of Federal Geographic Data Committee-compliant metadata standard (i.e., the national metadata standard). Supplemental funds are needed for data collection, cleaning, and the establishment of FGDC compliant metadata. These funds are necessary to produce a more complete and useful product for managers, researchers, and other data users. A total of $44.1 are requested in FY00 to:

(1) to complete the GIS component at the level originally proposed ($12.6, three months of our GIS specialist); and (2) assist in the development of the final CD and Internet products -- subtotal of $35.0 (the previously estimated amount for year 2 funds).

This project includes substantial cost sharing, with other partners contributing more than 75% of the project. EVOS Trustee Council is critical to the successful completion of the project and the development of a more comprehensive, useable product. Trustee Council involvement at the level requested will also ensure the the project is integrated with the overall EVOS restoration effort and that and Internet product, as south by Trustee Council Staff, is produced.

FY00

Prepared:

Project Number: 00278
Project Title: Development of an Ecological Characterization and Site Profile for Kachemak Bay/Lower Cook Inlet
Agency: ADFG

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Bridget Callahan	Habitat Biologist II	16A	2.0	4.2		8.4
Lisa Thomas	Habitat Biologist I	14A	2.0	3.6		7.2
Curtis Smith	Research Analyst II	16A	5.0	4.2		21.0
						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	$36.6

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Four Round Trips Between Homer and Anchorage	0.2	4	12	0.1	2.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.0

FY00

Project Number: 00278
Project Title: Development of an Ecological Characterization and Site Profile for Kachemak Bay/Lower Cook Inlet
Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL

I ired:

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

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

Commodities Costs:	Proposed
Description	FY 2000
Commodities Total	$0.0

FY00

Prepared:

Project Number: 00278
Project Title: Development of an Ecological Characterization and Site Profile for Kachemak Bay/Lower Cook Inlet
Agency: ADFG

FORM 3B
Contractual &
Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Project Number: 00278
Project Title: Development of an Ecological Characterization and Site Profile for Kachemak Bay/Lower Cook Inlet
Agency: ADFG

FORM 3B
Equipment
DETAIL

Prepared:

00287

approved TC 8-9-99

Seabird-Oceanographic Relationships in the Northern Gulf of Alaska: Integration with NSF/NOAA Study GLOBEC

Project Number:	00287-BAA
Restoration Category:	Research
Proposer:	R. Day/ABR, Inc.
Lead Trustee Agency:	NOAA
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	New
Duration:	1st yr. 1 yr. project
Cost FY 00:	$151.3
Cost FY 01:	$0.0
Cost FY 02:	$0.0
Geographic Area:	Northern Gulf of Alaska
Injured Resource/Service:	Seabirds, marine mammals

ABSTRACT

This project will conduct a study of seabirds in the Northern Gulf of Alaska (Aialik Bay to Montague Island) by using a ship-of-opportunity sampling platform that is being used by the National Science Foundation/National Oceanographic and Atmospheric Administration project GLOBEC (U.S. Global Ocean Ecosystem Dynamics), which also will provide access to an extensive series of oceanographic data. This project is designed to identify ecological processes affecting temporal (seasonal and interannual) and geographic variability in the distribution and abundance of seabirds, including several species that were injured by the oil spill. It also will be useful to the restoration program by providing data on the year-round status of seabird populations and the processes that influence variability in their numbers.

INTRODUCTION

This study will use an available ship-of-opportunity platform to investigate temporal (seasonal and interannual) and geographic (cross-shelf) patterns of distribution and abundance of seabirds in the Northern Gulf of Alaska (GOA). The Trustee Council will benefit from this study in three ways. First, this study will provide quantitative information on bird communities in the first part of the GOA where the oil went after it left Prince William Sound. Second, I have been offered free space on a ship that is being used for the NSF/NOAA program "GLOBEC" (Global Ocean Ecosystem Dynamics), which is a project that during years 1998-2000 will study temporal and geographic variations in thermohaline, chemical, and biological structure of the Northern GOA shelf (Appendix 1). The overall thrust of the GLOBEC study is to determine ecosystem-level causes (particularly climatic variability) of successful versus unsuccessful recruitment in juvenile salmon. Second, I will provide to this study an extensive data-set that I will have collected for this study over the period 1997–1999. This additional data-set will provide information on interannual variability in the distribution and abundance of seabirds and marine mammals.

The goal of this study will be to identify ecological processes affecting temporal and geographic variability in the distribution and abundance of seabirds by capitalizing on data generated by the GLOBEC study. The proposed research described here is designed to provide new information on the causes of temporal and geographic variability in the distribution and abundance of these seabird species. I believe that this information will be important for effective conservation and management of these species.

The primary reasons for this study are: (1) it will collect ecological data on a diverse suite of seabird resources, including several that the *Exxon Valdez* Oil Spill Trustee Council concluded were injured by the spill (*Exxon Valdez* Oil Spill Trustee Council 1999); (2) these data can be used, not just to examine temporal and geographic variations in distribution, abundance, and species composition of these seabird species, but to examine the effects of ecological processes on those variations; (3) it will describe the natural variability of the ecosystem, particularly with respect to seabirds; and (4) it will be useful in establishing criteria for ecosystem-level monitoring. I also will be able to collect supplementary data on the distribution and abundance of marine mammals, some of which (e.g., Killer Whale) were identified as having been injured by the spill (*Exxon Valdez* Oil Spill Trustee Council 1999). Finally, this is the first opportunity for systematic seasonal and interannual sampling of the cross-shelf distribution of seabirds in the Northern GOA.

NEED FOR THE PROJECT

A. Statement of Problem

This study will examine the distribution and abundance of seabirds and marine mammals in the Northern GOA and will attempt to relate variability in that distribution and abundance to variability in ecosystem-level properties. This variability will be examined temporally (both seasonal and interannual variability) and geographically (i.e., cross-shelf variability). This project also will describe systematically for the first time the seasonal and interannual patterns of occurrence of seabird and marine mammal species on the northern GOA shelf, which was the first place where oil leaving Prince William Sound went. From data collected so far, several species of seabirds and marine mammals that were recorded as being impacted by the *Exxon Valdez* oil spill occur in this region during the winter (e.g., common murre, pigeon guillemot, Kittlitz's murrelet, killer whale), with common murres apparently constituting an important component of this wintering community and a significant percentage of the entire Northern-GOA population of Kittlitz's murrelets wintering out here (Day, unpubl. data). The strength of this proposed study is that it will be used to develop an understanding of those processes that cause variability in the at-sea distribution and abundance of seabirds and that it will lead to a long-term data set that will be examined for the study of variability, yet will cost little because of my ability to use a ship-of-opportunity for sampling and an extensive oceanographic data set for interpreting my data-set in an ecological context.

In addition to the practical applications of learning about the at-sea ecology of seabirds in the area where most of the mortality occurred, understanding the causes for temporal and geographic variability in seabird distribution at sea is one of the greatest challenges facing marine bird researchers. Understanding such variability also is important in determining why and how seabirds may or may not recover from injury such as that following an oil spill: after all, the sea is where they secure food, not only for themselves but also for any young that they produce.

The strength of this proposed study is that it will be used to develop an understanding of those processes that cause variability in the at-sea distribution and abundance of seabirds and that it will lead to a long-term data set that will be examined for the study of variability, yet will cost little because of my ability to use a ship-of-opportunity for sampling and an extensive oceanographic data set for interpreting my data-set in an ecological context. Most importantly, this study will collect data on a large suite of seabird species (and, to a lesser extent, marine mammals), including several species that were impacted by the oil spill.

B. Rationale/Link to Restoration

There are at least 12 reasons why this study is important. First, most of the avian mortality (particularly of murres, but also of many other species) after the *Exxon Valdez* oil spill is believed to have occurred in the Northern GOA, rather than in Prince William Sound (Piatt et al. 1990, Ford et al. 1996, Piatt and Ford 1996). Second, breeding seabird colonies are both larger and more numerous in the Northern GOA than in Prince William Sound (USFWS Seabird Colony Catalog, electronic version), as generally are seabird at-sea densities (Day, unpubl. data). In spite of these facts, however, the amount of effort dedicated to post-spill research in the GOA was a fraction of that dedicated in Prince William Sound. Third, knowing where seabirds occur at different times of the year will enable one to predict those species that probably will be affected by an oil spill. For example, if a spill occurs at the shelf-break off of Hinchinbrook Entrance, one would predict that species concentrated downstream, along the shelf-break within the study area, will be affected more than inshore species will be. Fourth, this study will collect ecological data on a diverse suite of seabird resources that the *Exxon Valdez* Oil Spill Trustee Council concluded were injured by the spill (*Exxon Valdez* Oil Spill Trustee Council 1999), including common loon, cormorants (any or all of three species), common murre, pigeon guillemot, marbled murrelet, and Kittlitz's murrelet, as well as even recording the endangered Short-tailed Albatross. In fact, common murres appear to be a dominant species over the inner and central continental shelf in this region, and Kittlitz's murrelets appear to winter in this sector of the GOA shelf in substantial numbers, with perhaps the entire Prince William Sound population occurring here at that time (Day, unpubl. data). Fifth, this study will provide the first systematic, year-round, and interannual surveys of seabird and marine mammal populations on the shelf of the northern GOA. Sixth, the three years of data collected for this study (including data collected in 1998 and 1999) possibly will lead to another five consecutive years of data collection (funded by NSF and NOAA), thus potentially providing one of the temporally longest sets of at-sea data on seabirds ever collected in one part of Alaska. Seventh, this study also will be able to collect supplementary data on the distribution and abundance of marine mammals, some of which (e.g., killer whale) were found to have been injured by the spill (*Exxon Valdez* Oil Spill Trustee Council 1999). Eighth, this study would enable one to collect data as a long time-series that would enhance one's understanding of the patterns of variability in at-sea communities of seabirds. Understanding these patterns of natural variability in at-sea populations of seabirds will enable realistically measurable recovery criteria to be developed. Determining the natural variability of the system, particularly with respect to seabird abundance, will enable one to measure better what constitutes "recovery" of a species (i.e., take into account the natural "noise" in the system) and to determine what are meaningful recovery and monitoring criteria. Ninth, this study will capitalize on the findings of other GLOBEC researchers to identify causes and sources of this variability in the at-sea distribution and abundance of seabirds. Tenth, because the overall goals of the GLOBEC program are (a) to understand the effects of climate variability and climate change on the distribution, abundance, and production of marine organisms and (b) to incorporate this knowledge into diagnostic and prognostic models (Appendix 1), identifying these relationships may help in the future prediction of seabird distribution, abundance, and productivity in the face of global change, thus enhancing one' ability to manage these resources. Eleventh, this study will examine the seasonal and interannual importance to seabirds of oceanographic frontal structures, which tend to concentrate not only marine organisms and their seabird predators, but also floating pollutants such as oil and marine debris (Bourne and Clark 1984). Twelfth, because the first year of the study (1997–1998) was conducted during the large El Niño event that affected most of the North Pacific, subsequent years also will provide a nice contrast to help one understand the effects of such events on at-sea bird communities.

C. Location

This study will be conducted in the open waters of the continental shelf of the northern GOA, from the Pye Islands to Hinchinbrook Entrance. Because Seward is the home port for the cruises, it will be the primary community that will realize financial benefits from this study. To my knowledge, no communities will be affected by this project other than financially.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Community involvement will encompass the use of Seward as a home port for the research cruises. This is the home port of the R/V *Alpha Helix*, which is the University of Alaska's oceanographic research vessel. When requested, I will provide articles and photographs for the Trustee Council Newsletter and will be available to make public presentations of this study at appropriate forums. (I already have assisted Jody Seitz of Cordova with interviews about Kittlitz's Murrelets for public radio stations throughout the spill-affected area.) These articles and presentations will disseminate information on the objectives and major findings of this study to the general public.

My understanding is that seabirds on the open continental shelf of the Northern GOA play no role in subsistence use by local Natives in Prince William Sound (M. Vlasoff, pers. comm.). I would, however, draw on any local information that is available on these species on the open shelf and, especially, to be able to collect samples from any seabirds that are killed there for subsistence use.

Although no communities would be directly involved in this study, local communities such as Seward would benefit because they are involved in tourist-based industries. These industries are involved in wildlife viewing, with seabird viewing in particular playing a major part in that industry.

PROJECT DESIGN

A. Objectives

The overall goal of this study is to understand better the causes of temporal (seasonal and interannual) and geographic (cross-shelf) variability in the distribution and abundance of seabirds (and, secondarily, marine mammals) in the Northern GOA shelf. Specifically, it aims to relate quantitatively this variability in seabird abundance and distribution to oceanographic parameters, including the thermohaline, chemical, and biological structures of the Northern GOA shelf. The specific objectives of the proposed research program are:

1. To measure and describe temporal (seasonal and interannual) and geographic (cross-shelf) variation in seabird distribution and abundance on the Northern GOA shelf.

2. To relate these patterns of temporal and geographic variation to patterns of contemporaneously collected physical and biological characteristics.

3. To examine the ecological importance to birds of fronts at the outer edge of the Alaska Coastal Current and at the shelf-break.

4. To relate the observed natural variability in seabird populations to an assessment of recovery.

B. Methods

This study proposes using a ship-of-opportunity to collect at-sea transect data that will be used to examine the distribution and abundance of seabirds on the shelf of the Northern GOA during 6 cruises/year. (See letter of support offer from GLOBEC researchers in Appendix 2.) These data will be collected as standard at-sea transect samples as developed by the USFWS and others.

The GLOBEC cruises will be conducted during six periods of biological interest in the region:

- March (upward migration of oceanic zooplankton to surface layers);
- April (spring phytoplankton bloom);
- May (maximal biomass of oceanic copepods in surface layers);
- July/August (juvenile salmon first enter the sea);
- October (juvenile salmon prepare to leave the shelf and enter the Alaska Gyre); and

- December (minimal biological activity).

Each cruise has budgeted enough time to sample the Seward Line of standardized oceanographic stations, which have been sampled irregularly since the mid-1970s (i.e., around the time of the marine regime shift); on that line, Station GAK1 has been sampled nearly continuously for 29 years. Additional station lines (primarily to the east) also are sampled, when possible. These latter station lines are laid out between the Seward Line (which lies off the mouth of Resurrection Bay) and Hinchinbrook Entrance and include (so far) lines south from Cape Fairfield, Cape Suckling, and Cape Cleare, two lines off of the southern entrance of Montague Strait, and two lines south from central and eastern Montague Island. This oceanographic sampling is envisioned to be adjusted to some extent for conditions that are met on each particular cruise; however, the Seward Line always will be sampled on each cruise.

Through the GLOBEC program, I will have access to the following oceanographic data:

- CTD (conductivity, temperature, and depth) data collected at a series of fixed stations that are 10 km apart on the inner half of the shelf and 15 km apart on the outer half;
- ADCP (Acoustic Doppler Current Profiler) data on water-column velocity profiles of currents (continuously collected);
- Through-hull surface property values of sea-surface temperature, salinity, and fluorescence (continuously collected);
- Nutrients and primary productivity (collected at a series of fixed stations);
- Zooplankton and micronekton species composition and biomass collected with CalVET, MOCNESS, and bongo nets (collected at a series of fixed stations);
- Hydroacoustically measured biomass of zooplankton and micronekton (continuously collected); and
- Biomass, species composition, and energy content of fishes (primarily salmon, but also forage fishes) collected with MOCNESS and mid-water trawls (collected at a series of fixed stations; the mid-water trawling will be conducted during the July/August and October cruises only).

During each cruise, I will sample at-sea densities of seabirds with standardized seabird transects (Tasker et al. 1984, Gould et al. 1989, van Franeker 1994). The preferred method is the "snapshot method," which has less bias in density estimates of flying birds, particularly tubenosed birds (albatrosses, fulmars, shearwaters, petrels, and storm–petrels), than do other methods (van Franeker 1994). (Tubenosed birds are common in the sampling area at certain times of the year [Day, unpubl. data].) Transects will be 300 m wide as the ship moves ahead in a fixed and known direction at a fixed and known speed. Then, for analyses, I will calculate the density of birds for each transect by dividing the total count by the total area sampled (trackline length × 0.3 km total width). Initial ("raw") transect units in the field will be 5 min long, with data recorded by minute, as the ship travels between each pair of fixed oceanographic stations or runs between station lines. This is the approximate scale at which the finest-scale data (hydroacoustic biomass of zooplankton) of interest will be collected by the GLOBEC study. Then, for later analyses, these "raw" transect samples can be collapsed into larger "analytical" transect units, depending on the scales at which the other oceanographic data are summarized; because they will have been collected by the minute, the data can be analyzed by minute, if necessary. Such a flexible data collection/analytical program will enable one to examine the distributional data at the scales at which I find oceanographic features of interest (also see Haney and Solow 1992).

I will evaluate three primary hypotheses about seabirds, with additional hypotheses generated by the results of the field work:

H_o 1: There is no temporal (seasonal and interannual) variation in seabird distribution and abundance; if there is, it is independent of seasonal and annual variation in physical and biological oceanographic features.

This is the primary line of investigation of the GLOBEC study and will be an emphasis of this study. I will use the transect data in a series of analyses that will test whether there is seasonal and/or interannual variation in seabird distribution and abundance. As described above, I will test the temporal data at the scales that are most appropriate (i.e., pooling the raw data into larger analytical data sets as needed). At this time, I envision analyzing for temporal differences with a three-way MANOVA on ranked (if necessary) data, with habitat (i.e., water mass), season, and year as the treatments and the species or functional groups as the dependent variables. If pseudoreplication appears to be a problem with the data sets (see Hurlbert 1984), I might explore testing for differences with paired-sample tests (e.g., MANOVAs that use differences in densities between sampling periods as the sampling unit). These tests that use changes in numbers of birds may be used in a "before-after" type of analysis to examine changes in abundance among seasons and years (Stewart-Oaten et al. 1986, Murphy et al. 1997). The use of changes in densities (rather than testing with actual densities) between periods (with 1998 being labeled the "before" period and subsequent years being the "after" periods) results in independent data sets that minimize problems caused by pseudoreplication (Stewart-Oaten et al. 1986, Wiens and Parker 1995).

To examine whether there are relationships between seabird distribution and abundance and physical/biological oceanographic features, I will work with the GLOBEC researchers to use their data products for determining which scales to use in the analyses. First, I will plot seasonal (and interannual) variations in various oceanographic measurements and seabird distribution and abundance and interpret trends visually. Second, I will use a multivariate technique (e.g., MANOVA, MANCOVA, PCA) to test for relationships between multiple oceanographic measurements (e.g., water-column structure [strength of stratification, presence of fronts and other structures]; mixed-layer depth; biomass of zooplankton, micronekton, and fishes) and abundance measurements of multiple seabird species. I envision conducting these analyses on two seabird data sets: individual species and functional groups (guilds). In terms of the latter, I will assign each species to functional groups involving primary feeding method (e.g., surface feeding, pursuit diving) and primary prey type (e.g., zooplankton, fishes, squids) before conducting the analyses.

H_o 2: There is no geographic (cross-shelf) variation in seabird abundance; if there is, it is independent of geographic variation in physical and biological oceanographic features.

This is the secondary line of investigation of the GLOBEC study. I will use the transect data in a series of analyses that will test whether there is geographic variability in seabird distribution and abundance. As described above, I will test the geographic data at the scales that are most appropriate. I will use the oceanographic data to stratify the cross-shelf zone into a series of oceanographic habitats that can be used to test for differences in seabird distribution and abundance. Such habitat stratification has been used successfully in many other seabird–oceanography studies (e.g., Wahl et al. 1989, Haney 1991, Day 1992). At this time, I predict that there will be at least three habitat strata: the Alaska Coastal Current (extending from shore to ≤25 km offshore), the mid-shelf region (whose ecology is poorly understood at this time), and the oceanic region (from around the shelf break to over the continental slope and including at least part of the Alaska Current). Although published literature indicates that densities of zooplankton and larval fishes in Shelikov Strait often are higher in the Alaska Coastal Current than in surrounding areas (Incze and Ainaire 1994, cited in Napp et al. 1996; Napp et al. 1996), my impression from six winter cruises so far is that densities of zooplankton, fishes, and seabirds are highest in the inner half of the mid-shelf water and much lower in the Alaska Coastal Current. Densities also appear to be fairly high around the shelf-break front during most cruises.

Again, I will use the GLOBEC data products for determining which scales to use in the analyses. I will plot cross-shelf variations in various oceanographic measurements and seabird abundance and interpret differences visually. I also will test for differences in habitat use with a multi-factor MANOVA on ranked (if necessary) seabird data. As described in the temporal tests (above), habitat would be one of the factors included in the MANOVA. I also will use the guild data in a similar multi-factor MANOVA.

H_0 3: There is no association between seabird abundance and the location and strength of oceanographic fronts and other physical structures; if there is, it is independent of geographic variation in physical and biological oceanographic features.

Seabirds exhibit variability in at-sea distribution and foraging with respect to oceanographic features: fronts of various types (e.g., Schneider 1982, Haney 1985b; Haney and McGillivary 1985a, b; Harrison et al. 1990, Schneider et al. 1990, Day 1992, Hunt et al. 1996, Mehlum et al. 1998; but also see Loggerwell and Hargreaves 1996, and Mehlum et al. 1996), frontal eddies (Haney 1986a, b), internal waves (Haney 1987), upwelling (either within cyclonic eddies or bathymetrically driven; Haney 1985a), pycnocline topography (Haney 1991), and water masses (e.g., Wahl et al. 1989, Haney 1991, Day 1992, Ribic et al. 1992). Fronts tend to be areas of enhanced productivity and concentration of both zooplankton and larval fishes and squids (e.g., Owen 1981, Munk et al. 1995, Sabatés and Olivar 1996), and seabirds appear to be "physical oceanographers" that are highly efficient at locating such structures. Hence, I will examine the association between seabirds and other physical structures, when possible, in addition to examining the association between seabirds and frontal structures.

I specifically will investigate the importance of these fronts to seabirds on a seasonal and interannual basis. I will use the GLOBEC data products for determining which scales to use in the analyses and will plot cross-shelf variations in various oceanographic measurements and seabird distribution and abundance and interpret differences visually. I also will test for relationships between seabird abundance and the distance from the center of each front with correlation analyses (e.g., Spearman rank correlation; see Day 1992: 36–45).

In addition to the hypothesis testing, I will use the seabird data to conduct power analyses. These analyses will examine the questions: "Given the variance in the data and the sampling scheme that is set up, how small a change in seabird abundance can one detect?" and "Given the variance in the data, how many samples would one need to detect an X% change in abundance?" These calculations will be made at the end of the study, with all three years of data combined. Hence, they will provide insights into criteria that will be useful in ecosystem monitoring.

Although it will not be a primary focus of this study, I also will be able to collect supplementary data on the distribution and abundance of marine mammals concurrently with the seabird data. Because the emphasis will be on seabird data, however, I probably will be unable to collect marine mammal data on standardized surveys. Instead, I will record any marine mammals seen out to the horizon. Such opportunistic data provide relative numbers that are adequate for interannual comparisons, however (Baretta and Hunt 1994).

As an example of the kinds of data that will be available for this study, Figure 1 shows the vertical structure of the water column along the Seward Line during the first GLOBEC cruise in October 1997. There are three primary features along this line: (1) the Alaska Coastal Current from Stations 1 to 3, with a strong salinity and density front at its outer edge; (2) the inner edge of the large Alaska Stream from Stations 9 (the shelf break) to 13; and (3) the poorly understood and sluggish Mid-shelf Water between these two large current systems.

Figure 2 shows an example of data that I was able to collect on the same GLOBEC cruise. The plot is of uncorrected seabird abundance along the Seward Line, which is the primary sampling location for this study. Data points represent individual 5-min transects and are uncorrected for sampling area; because they have not been proofed or corrected and because a few data are off-transect records, these results should be considered to be preliminary at this time. From the individual plots, one can see (1) the concentration of all birds of all species combined at the microscale surface convergence between Stations 3 and 4 and in what is probably the shelf-break front at the inner edge of the Alaska Stream (top); (2) the concentration of fork-tailed storm-petrels in what is probably the shelf-break front at the inner edge of the Alaska Stream (middle); and (3) the concentration of Dall's porpoises in the outer edge of the Alaska Coastal Current and in the front separating that current from the mid-shelf water (bottom). Hence, these preliminary results suggest that there is extensive geographic variability in total seabird abundance and in the abundance of at least some individual species.

Figure 3 shows another example of data along the Seward Line that I was able to collect on the same GLOBEC cruise. In these plots, one can see: (1) the concentration of northern fulmars in the Alaska Coastal Current, in the convergence between Stations 3 and 4, and near what may be a small front near Station 12 (top); (2) the concentration of common murres in the Mid-shelf Water, with peak numbers occurring at the convergence between Stations 3 and 4 (middle); and (3) the non-overlapping distribution of the tufted puffin, which was restricted to the outer shelf and (primarily) the Alaska Stream (bottom).

Figure 4 shows an example of fish data along the Seward Line that were collected during the October 1998 cruise (L. J. Haldorson, University of Alaska, Juneau, AK; unpubl data). In these plots, the CPUE for all fish species combined is shown on the top, and catch per unit effort (CPUE) for selected species groups is shown on the bottom. In both plots, CPUEs are highest in the inner half of the mid-shelf water. This region qualitatively appears to consist of some sort of physical structure, such as an eddy, that seems to be fairly stationary in both time and space. Hence, although this cruise occurred at a time that is different from the above data, similar across-shelf patterns are present.

Although not shown here, data from the March and April 1998 cruises showed dramatic differences from the October 1997 cruise (Day, unpubl. data). For example, species diversity along the Seward Line was high (21 species) in October 1997 but low (only ~8 species) in March 1998 and increasing in April 1998 (~15 species) and May 1998 (~21 species), then decreasing again the following winter (~15 species in December 1998); species richness on the Seward Line in March 1999 was only ~7 species, a number nearly identical to that for March 1998 and suggestive of a pronounced seasonal/annual pattern in species richness. In addition, species evenness clearly had changed from October 1997 to spring 1998, in that the distribution of common murres was restricted to the inner half of the shelf in October, whereas they had become dominant across the shelf and probably represented ~75% of all birds seen in March and ~50% of all seen across the entire Seward Line in April. In addition, they occupied essentially the entire shelf in March and April, whereas tufted puffins were absent at that time, having moved farther offshore, into the deep North Pacific. Clearly, there are oceanographic and ecological reasons for such seasonal and geographic changes in both species diversity and the abundance and distribution of individual species.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

I will have free use (ship-of-opportunity) of a research vessel that is being used by the Institute of Marine Sciences (IMS), University of Alaska, Fairbanks, for the GLOBEC studies. All field and office work will be conducted by ABR, Inc. The Trustees Council will need to pay an outside agency for a Program Manager and for general administration. (These management costs will be funded directly from the Trustee Council to the agency, which is how my other Trustee-funded contracts were set up. Hence, that management money is not listed on the enclosed budget.)

SCHEDULE

A. Measurable Project Tasks for FY00 (October 1, 1999-September 30, 2000)

deleted per peer reviewers; budget reflects this

Mar 2000:	First cruise (emphasis: upward migration of oceanic zooplankton)
Apr 2000:	Second cruise (emphasis: spring phytoplankton bloom)
May 2000:	Third cruise (emphasis: maximal biomass of oceanic copepods)
~~July/August 2000:~~	~~Fourth cruise (emphasis: juvenile salmon first at sea)~~
Oct 2000:	Fifth cruise (emphasis: juvenile salmon prepare to leave the shelf)
Dec 2000:	Sixth cruise (emphasis: minimal biological activity)
Mar-Dec 2000:	Keypunch data and QA/QC (after each cruise)
Dec 2000–Jan 2001:	Data analysis
Jan-Apr 2001:	Preparation of Final Report
January–February 2001:	Presentation of paper at scientific meeting
15 April 2001:	Submit Final Report

B. Project Milestones and Endpoints

1. "To measure and describe temporal (seasonal and interannual) and geographic (cross-shelf) variation in seabird distribution and abundance on the Northern GOA shelf." Densities will be estimated and will be tested for seasonal and geographic differences during each year of

the study (FY00). Interannual differences will be tested during the one year of the study with data collected that year (FY00) and the two earlier years.

2. "To relate these patterns of temporal and geographic variation to patterns of contemporaneously collected physical and biological characteristics." Relationships will be tested, both among seasons within years and during the same season among years, during the one year of the study, with data collected that year (FY00) and the two earlier years.

3. "To examine the ecological importance to birds of fronts at the outer edge of the Alaska Coastal Current and at the shelf-break." Relationships between the location of fronts and the abundance of seabirds will be tested, both among seasons within years and during the same season among years, during the one year of the study with data collected that year (FY00) and the two earlier years.

4. "To relate the observed natural variability in seabird populations to previous assessments of impact and recovery." At the end of the study, analysis of variability and power calculations will be done for each year separately and for all years of the study combined (i.e., FY00).

C. Completion Date

Sampling for the project will be completed in FY00. Data analysis and preparation of the Final Report and publications will be completed in FY00.

PUBLICATIONS AND REPORTS

I will submit a Final Report to the Chief Scientist no later than 15 April 2001. This Final Report will synthesize results from the study. I also will prepare one or more manuscripts reflecting the results of this study. I envision that these manuscripts generally will be written with one or more of the GLOBEC researchers as co-authors.

PROFESSIONAL CONFERENCES

To save money, I do not plan to attend a scientific conference in FY00.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

I hope to be able to integrate the results of this study with those of the SEA study and the APEX study. My understanding is that SEA will be ended and that APEX will be in the final year of its funding by the time this project begins, so the chances for extensive interaction and integration may be small. Further, those projects are concentrated on the summer months, whereas most of the data collected for this study are collected during the winter, making many comparisons difficult. In addition, the SEA study was entirely concentrated within Prince William Sound, as was most of the APEX study, whereas this study will be conducted in the Northern GOA. Nevertheless, I will have a great opportunity to build on some of their findings.

The NSF/NOAA oceanographic study GLOBEC is co-funding this proposed study. It will provide an oceanographic platform (at the cost of $12,500/day) and an extensive set of oceanographic data that will cost ~$1,500,000 and take 3 years to collect.

This project will describe the natural variability of the system, particularly with respect to seabirds, enabling one to know better what natural variability in patterns of abundance are. Knowing this variability will enable researchers to predict better what sorts of differences might be detected in the wake of a large ecological perturbation, such as the *Exxon Valdez* oil spill or a large El Niño. Further, knowing this variability and its causes may affect interpretations of what constitutes "recovery" of a species (i.e., if determining recovery is an objective, one need to know what is the natural "noise" in the system is, since impact analysis involves comparing "signal-to-noise" ratios).

Although the *Exxon Valdez* Oil Spill Trustee Council expressed interest in this study in FY98, funding was not allocated for the first and second years of this project. Because of the importance of collecting as many data as possible so that the time-series is as extensive as possible, ABR has funded four cruises of data collection so far (October 1997 and March, April, and May 1998), and the Principal Investigator (RHD) has funded the December 1998 and March 1999 cruises and will fund at least the April, May, October, and December 1999 cruises. Hence, ABR and RHD will have invested a great deal of money and time in co-funding this study. Thus, in addition to the strong co-funding component in the form of ship-of-opportunity sampling coming from NSF and NOAA, there will be a strong co-funding component coming from both ABR and the Principal Investigator. Consequently, I will have the strongest and most complete data set available for testing these hypotheses.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This is a proposed 1-year project. Hence, there are no proposed changes in this year. Please note that the budget includes additional time and money for analyses of the extensive data set that already will have been collected in 1997–1999 (~11 cruises worth of data). Additional time also has been budgeted for necessary coordination and synthesis of oceanographic information that will help to determine the direction of some of the analyses. This coordination will occur with other investigators on the GLOBEC study.

PRINCIPAL INVESTIGATOR

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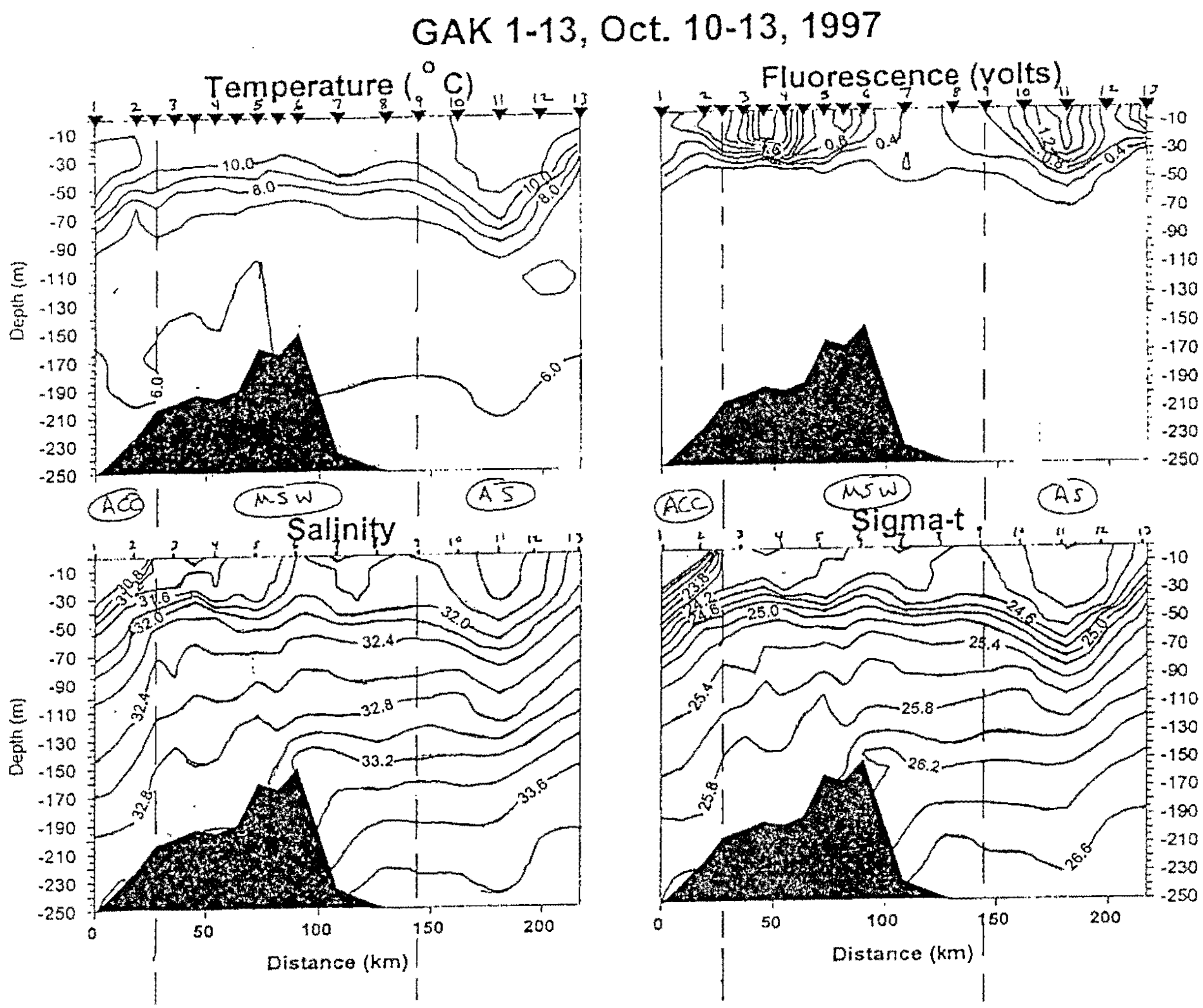

Figure 1. Vertical cross-sections of temperature, salinity, density (sigma-t), and fluorescence along the Seward Line, October 1997 (T. Weingartner, University of Alaska, Fairbanks, unpubl. data). Data are plotted with inshore on the left end of the plots. Abbreviations are: ACC = Alaska Coastal Current; MSW = Mid-shelf Water; AS = Alaska Stream. Inshore is on the left side of this plot.

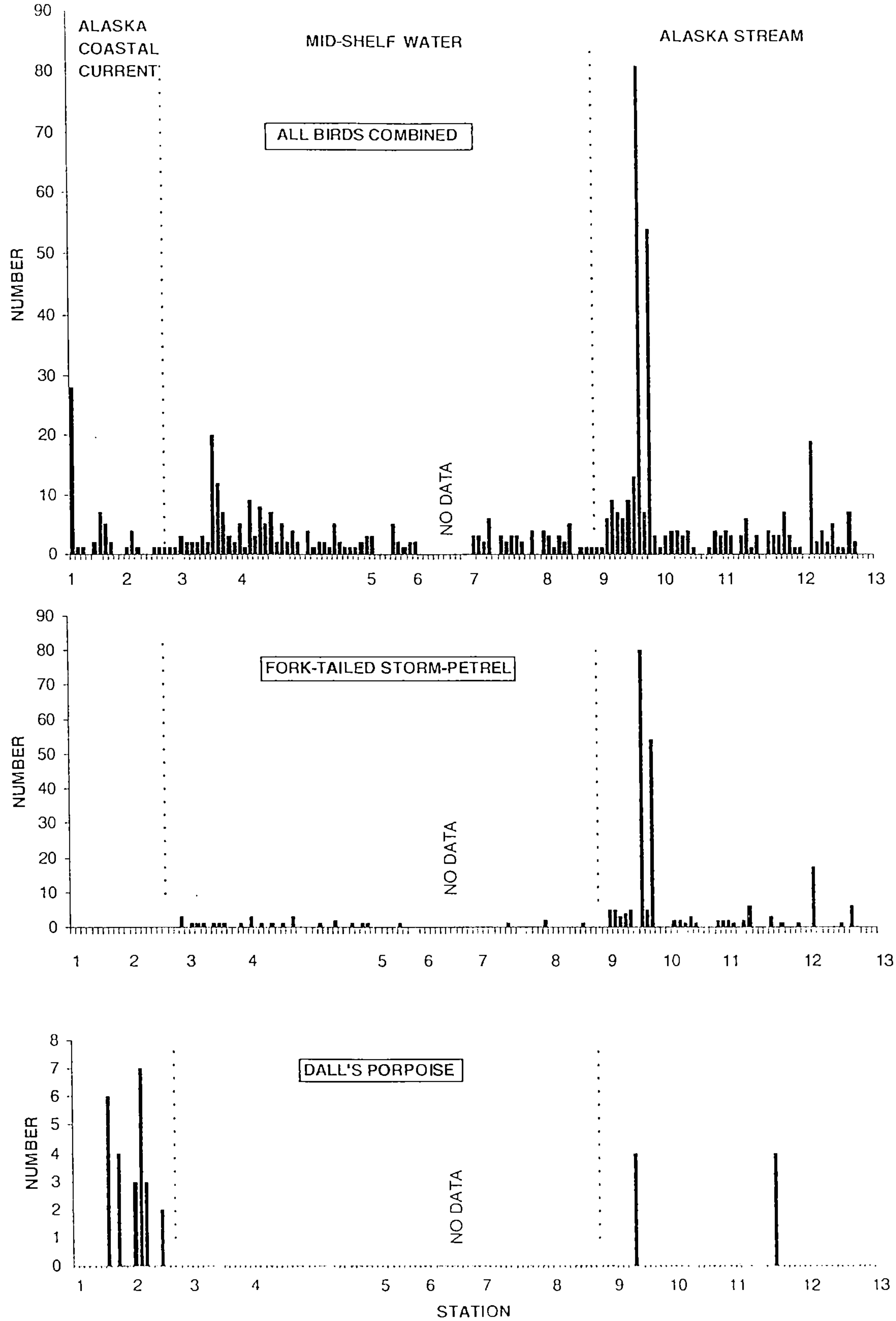

Figure 2. Cross-shelf distribution and abundance of all seabird species combined, fork-tailed storm-petrels, and Dall's porpoises along the Seward Line, October 1997. Data are preliminary and are not to be cited. Inshore is on the left side of this plot.

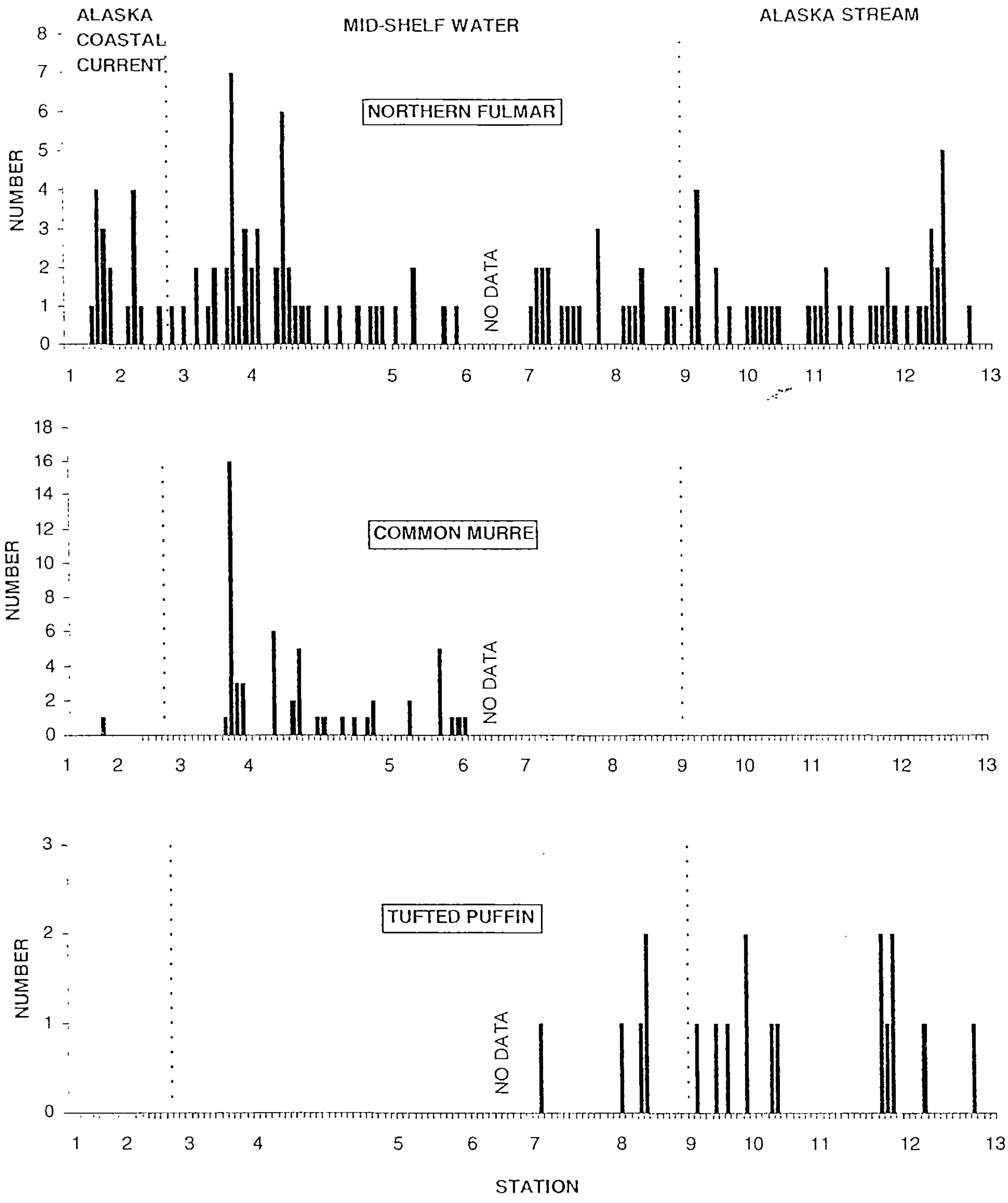

Figure 3. Cross-shelf distribution and abundance of northern fulmars, common murres, and tufted puffins along the Seward Line, October 1997. Data are preliminary and are not to be cited. Inshore is on the left side of this plot.

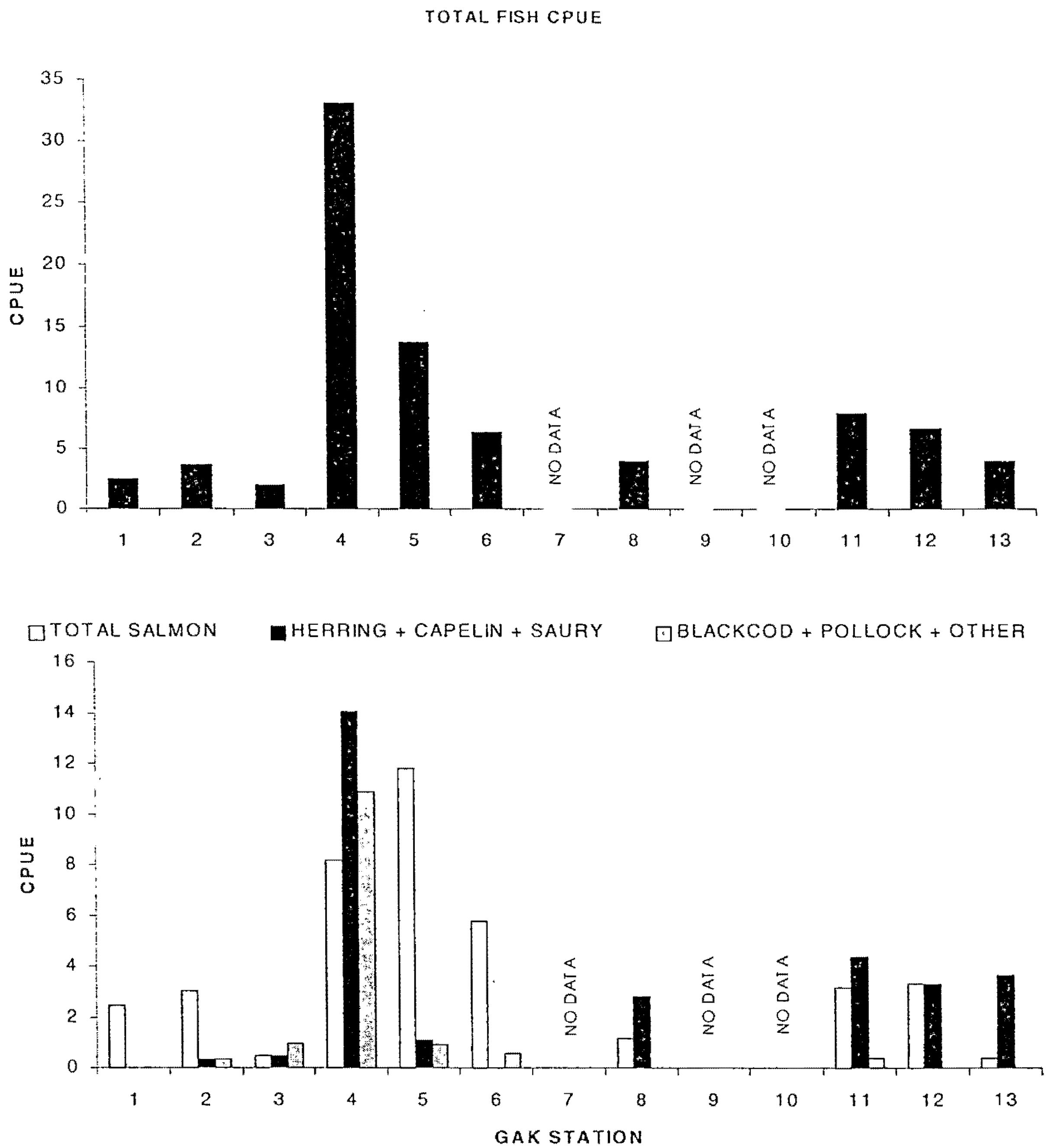

Figure 4. Cross-shelf distribution and abundance of all fish species combined and of three ecological groups along the Seward Line, October 1998 (L. J. Haldorson, University of Alaska, Juneau, AK; unpubl. data). Data are preliminary and are not to be cited. Inshore is on the left side of this plot.

Revision 7-7-99
approved vc 8-9-99

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$0.0						
Travel		$0.0						
Contractual		$141.4						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$141.4			Estimated FY 2001	Estimated FY 2002		
General Administration		$9.9						
Project Total	$0.0	$151.3						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Project Number: 00287-BAA
Project Title: Seabird-Oceanographic Relationships in Northern GOA
Agency: NOAA

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared:

Revision 7-7-99

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

Budget Category:	Authorized FFY 1999	Proposed FFY 2000						
Personnel	$0.0	$132.6						
Travel	$0.0	$4.3						
Contractual	$0.0	$4.3						
Commodities	$0.0	$0.2						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$141.4	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Indirect	$0.0	$0.0						
Project Total	$0.0	$141.4	N/A	N/A	N/A	N/A	N/A	N/A
Total Personnel Hours *	0	2,058						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:
ABR,Inc. has used **Hourly Rates** instead of **Monthly Costs.** The hourly rate shown is an all inclusive rate. ABR, Inc. requested permission from EVOS Trustee Council and received verbal permission from **Sandra Schubert** on April 12, 1999 to substitute fully burdened hourly rates for monthly costs and indirect costs.

Full-Time Equivalents (FTE's) have been changed to fully burdened Total Personnel Hours.

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Project Number: 00287
Project Title: **SEABIRD-OCEANOGRAPHIC RELATIONSHIPS IN THE NORTHERN GULF OF ALASKA: INTEGRATION WITH NSF/NOAA STUDY "GLOBEC"**
Name: **ABR, Inc.**

FORM 4A
Non-Trustee
DETAIL

F 'ed: 7/7/1999

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

Personnel Costs:				* Hours	* Hourly		Proposed
Name		Position Description		Budgeted	Costs	Overtime	FFY 2000
Ritchie	R	Principal		4.0	$100.00	$0	0.4
Murphy	S	Research Coordinator		16.0	$94.00	$0	1.5
DeLong	T	Office/Contracts Manager		8.0	$69.00	$0	0.6
Day	R	Senior Scientist I		1080.0	$75.00	$0	81.0
Staff	D	Research Biologist II		740.0	$52.00	$0	38.5
Smith	M	GIS Specialist		100.0	$57.00	$0	5.7
Zusi-Cobb	A	Graphics Technician/GIS		56.0	$51.00	$0	2.9
Harshburger	D	Word Processor/Administrative Assistant		46.0	$39.00	$0	1.8
Staff		Clerk		8.0	$29.00	$0	0.2
		Subtotal		2058.0	N/A	0	
						Personnel Total	$132.6

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 2000
EVOS Meetings in Anchorage (FAI-ANC)	275	1	5	140	1.0
Travel to/from Cruises (FAI-ANC)	275	7	0	140	1.9
Per Diem for Cruise travel (17 days @ $60/day)					1.0
Seward (6 person nights @ $40/night)					0.2
Fee (5%) on Travel Costs					0.2
				Travel Total	$4.3

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Prepared:7/7/1999

Project Number:
Project Title: **SEABIRD-OCEANOGRAPHIC RELATIONSHIPS IN THE NORTHERN GULF OF ALASKA: INTEGRATION WITH NSF/NOAA STUDY "GLOBEC"**
Name: **ABR, Inc.**

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed
Description	FFY 2000
1 Field Laptop Lease (1.5 months @ $350/month)-No 5% Fee on ABR Equipment Lease	0.5
2 Phone/Fax/Modem/Courier	0.1
3 Printing/Off-Site Photocopying	2.1
4 Publication Costs (1 paper @$1,000)	1.0
5 Slide preapration services for meetings	0.4
6 Fee (5%) on Contractual Costs (excluding ABR Equipment Lease)	0.2
Contractual Total	$4.3

Commodities Costs:	Proposed
Description	FFY 2000
1 Misc. Gear and Supplies	0.2
2 Fee (5%) on Commodity Costs	0.0
Commodities Total	$0.2

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Prepared:7/7/1999

Project Number:
Project Title: **SEABIRD-OCEANOGRAPHIC RELATIONSHIPS IN THE NORTHERN GULF OF ALASKA: INTEGRATION WITH NSF/NOAA STUDY "GLOBEC"**
Name: **ABR, Inc.**

FORM 4B
Contractual &
Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY2000
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	
1 Library reference books		
2 Computer Resources		
3 GIS/Digitizing Station (s)	2	
4 Office Space		
5 Equipment Storage		
6 Binoculars	2	
7 Cameras	2	

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Prepared: 7/7/1999

Project Number:
Project Title: **SEABIRD-OCEANOGRAPHIC RELATIONSHIPS IN THE NORTHERN GULF OF ALASKA: INTEGRATION WITH NSF/NOAA STUDY "GLOBEC"**
Name: **ABR, Inc**

FORM 4B
Equipment
DETAIL

Revision 7/21/99

Project Title: Hydrocarbon Data Analysis, Interpretation, and Database Maintenance for Restoration and NRDA Environmental Samples Associated with the *Exxon Valdez* Oil Spill

Project Number:	00290
Restoration Category:	
Proposer:	Bonita D. Nelson and Jeffrey W. Short NMFS, Auke Bay Laboratory ABL Program Manager: Dr. Stan Rice NOAA Program Manager: Bruce Wright
Lead Trustee Agency:	NOAA
Cooperating Agencies:	None
Alaska SeaLife Center:	No
Duration:	Service Ongoing
Cost FY 00:	55.5
Cost FY 01:	35.0
Cost FY 02:	35.0
Geographic Area:	Not Applicable
Injured Resource/Service:	Maintenance of the Trustee hydrocarbon database, archival of environmental samples, interpretative services

ABSTRACT

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 hydrocarbon database. Updated summary report for investigators and managers will be produced along with an electronic copy of the data for all data queries. A database for pristane sample collection and analysis information will be maintained .

INTRODUCTION

The Auke Bay Laboratory provides data and sample archiving services for all samples collected for hydrocarbon analysis in support of *Exxon Valdez* Trustee Council projects. These data represent samples collected since the oil spill in 1989 to the present and include environmental and laboratory Response and Restoration data . Additionally, we provide interpretive services for the hydrocarbon analyses. Currently, the database contains results of the hydrocarbon analysis of more than 13,000 samples and collection information from more than 47,000 sediments, tissues, water, or oil samples. The primary purpose of this project is to maintain the integrity of the database, incorporate new data and continue hydrocarbon data interpretive services. This year we are proposing to continue the task of maintaining a pristane database. The second purpose is to make the results of the hydrocarbon analyses available to principal investigators, resources managers and to the public. This service is expected to have activity through synthesis period of the next one year. The third purpose of this project is to maintain the integrity of archived samples in freezers many of which have not yet been analyzed for hydrocarbons.

The Trustee hydrocarbon database not only contains sample collection and hydrocarbon analyses information, but also has data concerning sample shipping and location information as well as lists of other database identifiers (such as species and location codes). A public version of this database containing the sample collection and environmental hydrocarbon sample analyses was released in 1996 (*Exxon Valdez* Oil Spill of 1989: State/Federal Trustee Council Hydrocarbon Database 1989-1995 -EVTHD) . Updating the database is an on-going program, samples from Chenega cleanup (98291) final analysis (98291) were added in 1998 and samples collected from from mussel beds are projected to be added in 1999 as well as any other samples collected from Trustee projects submitted for FY2000.

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

NEED FOR THE PROJECT

A. Statement of Problem

The Trustee hydrocarbon database is a dynamic structure which requires updating and maintenance. Currently, the database contains an inventory of the Trustee hydrocarbon sample collection and provides for retrieval of hydrocarbon analyses by principal investigators and managers. This project is designed to provide easy access to the Trustee hydrocarbon database and ensure the accuracy of the data. The volume of data contained in the database suggests that other users will benefit from access, particularly as more data is added (Chenega project; oiled mussel bed project, and pink salmon) and as more synthesis products are produced (salmon and herring).

B. Rationale/Link to Restoration

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

C. Location

While this project resides at the Auke Bay Laboratory, Juneau , Alaska, the service provided serves the entire spill area.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

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

PROJECT DESIGN

A. Objectives

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

2. Continue interpretation of hydrocarbon data, including new data produced for principal investigators and resources managers and for syntheses products as needed.
3. Maintain Pristane database for Trustee funded projects

4. Provide a new software product for the publicly accessible database which includes hydrocarbon samples analyzed through 1999.

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

6. Design a long-term archiving plan for the Trustee hydrocarbon database PWSOIL.

B. Methods

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

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

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

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

C. Contracts and Other Agency Assistance

No contracts are anticipated

SCHEDULE

A. Measurable Project Tasks for FY00

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

B. Project Milestones and Endpoints

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

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

C. Completion Date

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

PUBLICATIONS AND REPORTS

The public release of the hydrocarbon database for projects funded in FY98 will be available 15 April, 1999 in the form of the annual report.

PROFESSIONAL CONFERENCES

One meeting is required, an annual Quality Assurance Control meeting attended by ABL's Senior Analytical Chemist. The results of an international calibration exercise by participant is reviewed for the integrity and credibility of chemical analyses. This meeting usually occurs in the Washington D.C. area, and is sponsored by National Institute of Standards and Technology (NIST).

NORMAL AGENCY MANAGEMENT

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

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

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

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This ongoing service project has no significant project design or schedule differences from the project funded in FY98, it is a continuation of the same service. The project has been downsized, as the input volume has decreased somewhat, although interpretation services will probably increase.

PROPOSED PRINCIPAL INVESTIGATOR

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

PRINCIPAL INVESTIGATOR

Bonita D. Nelson

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

Other Revelant Experience:
Database manager of the Trustee hydrocarbon data for 4 years. Responsibilities include: supervision of data entry of sample and analytical data; processing and dissemination of data after interpretation by chemist; database management including data retrieval for production of the public versions of the database. Nelson has designed and managed databases as well as analyzed data for the radio telemetry program at the Auke Bay Laboratory for 10 years.

Revision ..6/99
approved TC 8-9-99

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel	$44.4	$41.7						
Travel	$4.2	$2.9						
Contractual	$1.5	$1.5						
Commodities	$2.0	$3.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$52.1	$49.1			Estimated FY 2001	Estimated FY 2002		
General Administration	$6.8	$6.4						
Project Total	$58.9	$55.5			$35.0	$35.0		
Full-time Equivalents (FTE)	0.6	0.5						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$20.9	$20.9						

Comments:
This project is ongoing to support the m aintenance of samples collected for petroleum hydrocarbon analyses; storing and archiving of samples; interpretation of chemical data; release of data to principal investigators and to the public and pristane and liipid database.

NOAA Contribution:
Habitat Senior Research Chemist, J Short 1.0 mo.@ 9.4 K, Fishery Biologist J. Maselko 1.0 mo @ 4.8 K, Senior Analytical Chemist, M. Larsen 1.0 month @6.7K, for a total of 20.9K

FY00

Project Number: 00290
Project Title: The Hydrocarbon Database and Interpretation
Agency: National Oceanic and Atmospheric Administration

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 7/6/99

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs: Name	Position Description	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
Bonita Nelson	Fisheries Biologist/Database Manager	11/3	5.5	6.1		33.6
Marie Larsen	Senior Analytical Chemist	11/6	0.5	6.7		3.4
Jeff Short	Senior Research Chemist	13/4	0.5	9.4		4.7
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal	[redacted]	6.5	22.2	0.0	[redacted]
					Personnel Total	$41.7

Travel Costs: Description	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 2000
Anchorage Workshop	0.4	1	3	0.2	1.0
(Miscellaneous - car rental, telephone, POV mileage etc)					0.0
					0.0
Quality Assurance/Quality Control Annual Meeting, 1 senior chemist	1.5	1	2	0.2	1.9
national Institute for Standards and Technology					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.9

FY00

Project Number: 00290
Project Title: The Hydrocarbon Database and Interpretation
Agency: National Oceanic and Atmospheric Administration

FORM 3B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed
Description	FY 2000
Disposall of Archival Samples (classified as hazardous materials)	1.5
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$1.5

Commodities Costs:	Proposed
Description	FY 2000
Computer sortware and hardware upgrades, storage media	2.0
Production of updated public information of chemical data (lipids, hydrocarbon or pristane)	1.0
Commodities Total	$3.0

FY00

Project Number: 00290
Project Title: The Hydrocarbon Database and Interpretation
Agency: National Oceanic and Atmospheric Administration

FORM 3B
Contractual &
Commodities
DETAIL

Prepared:7/6/99

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Project Number: 00290
Project Title: The Hydrocarbon Database and Interpretation
Agency: National Oceanic and Atmospheric Administration

FORM 3B
Equipment
DETAIL

Prepared:7/(

Approved TC 8-9-99

Ecology and Demographics of Pacific Sand Lance, *Ammodytes hexapterus* Pallas, in Lower Cook Inlet, Alaska

Project Number:	00306
Restoration Category:	Research
Proposer:	USGS Biological Resources Division
Lead Trustee Agency:	DOI
Cooperative Agencies:	ADF&G, AMNMR, NMFS (not funded)
Alaska SeaLife Center	no
Duration:	4th year, 4 year project
Cost FY 00:	$20,000
Geographic Area:	Cook Inlet, Gulf of Alaska
Injured Resource:	Multiple (forage fish)

ABSTRACT

The purpose of this study is to characterize the basic ecology, distribution, and demographics of sand lance in the Gulf of Alaska. 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. In this final year of the project we will focus on finishing reports and submitting publications to peer-reviewed journals.

INTRODUCTION

An estimated 250,000 seabirds were killed by *Exxon Valdez* oil pollution. Based on comparisons of pre-spill (1970s) and post-spill (1989-1995) data, long-term effects on seabirds attributed to oil pollution included: i) population declines, ii) reduced breeding success, and, iii) delayed breeding phenology. However, some purported effects of the spill may have been due in large part to natural changes in the Gulf of Alaska marine ecosystem-- in particular, declines in forage fish abundance (Piatt and Anderson 1996). The rate at which seabird populations will recover from effects of oil mortality are unknown, but is probably linked to population dynamics of forage fish species, of which sand lance is the most important.

Sand lance (genus *Ammodytes*) are zooplanktivorous, semi-demersal, schooling perciforms. They are ubiquitous to the boreo-arctic regions of the North Atlantic and North Pacific and are particularly abundant in coastal regions. There are three genera of sand lance; Hyperoplus, Gymnammodytes, and Ammodytes. Ammodytes is distributed in the Northwestern Atlantic from West Greenland to Cape Hatteras, North Carolina (Leim and Scott 1966, Winters and Dalley 1988) and in the North Pacific from the Bering Sea to southern California (Wilimovsky et al. 1988). Although several species of *Ammodytes* have been described for the North Atlantic and at least two in the North Pacific, *Ammodytes hexapterus* is the only species currently described in the Gulf of Alaska.

Sand lance serve as an important trophic link between zooplankton and marine vertebrate piscivores (Winters 1983) particularly in continental shelf ecosystems (Springer *et al.* 1996). In the North Pacific, sandlance are forage for fish, seabirds, and marine mammals. Seabirds consuming sand lance include red-faced cormorant (Hunt et al. 1981), black-legged kittiwake, common murre, thick-billed murre, pigeon guillemot, horned puffin, tufted puffin, brachyramphus murrelets, and rhinoceros auklet (Wilimovsky *et al.* 1988, Springer 1991, Piatt and Anderson 1996). Marine mammals consuming sand lance include Stellar sea lion, minke, sei, and humpback whales (Wilimovsky et al. 1988). Commercially important fish preying on sand lance include Pacific cod, halibut, lingcod, rockfish, and salmon (Wilimovsky et al. 1988).

Due to commercial fisheries for sand lance in the North Sea and around Japan, much is known about sand lance in these regions. In the North Pacific, however, sand lance are of little commercial importance. Despite their role as a forage species, there is a paucity of published information on their biology and population dynamics in this area.

NEED FOR THE PROJECT

A. Statement of Problem

Lack of recovery of species injured in the *Exxon Valdez* oil spill is currently thought to be linked to changes in forage fish abundance or composition. Changes in species composition or abundance of forage fish will have marked effects on predators, in terms of the time needed to find and consume fish, as well as in the relative energy value of that fish once consumed. Therefore, an understanding of the factors affecting forage fish distribution, abundance, and quality is vital to an understanding of predator distribution, abundance and recovery.

B. Rationale

It is important to study the ecology and demographics of sand lance because i) sand lance are one of the most important prey species consumed by seabirds, marine mammals, and commercial fish in Alaska; ii) changes in sand lance abundance and distribution therefore have direct effects on predators; and, iii) natural environmental changes may have reduced sand lance populations in recent years. These population changes may limit the ability of higher predators to recover from oil spill impacts. In this final year of the project we will focus on writing a final report and submitting manuscripts for publication in peer-reviewed journals.

C. Location

The project is a portion of an ecosystem study of lower Cook Inlet (EVOS APEX project 00163m). In this final phase of the project, no field work is planned. Data analysis and report writing will take place in Anchorage at USGS offices.

COMMUNITY INVOLVEMENT

None for final phase of project.

PROJECT DESIGN

A. Objectives

1. To establish how seasonal and diel movements of sand lance impact their availability as a food source for marine piscivores.

2. Measure demographic parameters of sand lance including age composition, growth rate, patterns of growth, and sex ratios and compare between regions.

3. Characterize critical burrowing and spawning habitat of sand lance will be described in relation to physical parameters (e.g., temperature, substrate type, salinity, and turbidity). Physiological adaptations will also be explored in relation to their habitat.

4. Sand lance early life history and decadal scale changes will be investigated using a 20 year historical database provided by Paul Anderson.

5. Seabird diet data (tufted puffin, horned puffin, rhinoceros auklet) will be used to help establish sand lance distribution and growth within the Gulf of Alaska. These data are

also expected to provide insight into critical environmental parameters needed for optimal sand lance habitat.

B. Methods

No field work is planned for this final year. Methods for field work have been described in previous proposals. Reports and papers are being written that will address the objectives described above.

C. Contracts and Other Agency Assistance

A contract will be used to fund Martin Robards to complete products in this final phase of the project.

SCHEDULE

A. Measurable Project Tasks for FY 00

1. M.Sc. thesis will be submitted to fulfill requirements for graduation from Memorial University of Newfoundland.

2. Report on sand lance energetics will be published.

3. Report on sand lance growth and otolith development will be published.

4. Review of sand lance biology will be published.

4. Collaborative work to compare sand lance habitat in Kachemak Bay with that in Prince William Sound will be completed and submitted for publication.

5. Historical database of larval sand lance will be analyzed and a manuscript prepared for publication.

6. Final fishing dataset from Lower Cook Inlet (5 years data) will be analyzed for annual variation in sand lance distribution and habitat preferences. A manuscript will be prepared for publication.

B. Project Milestones and Endpoints

FY 00 is the final year of this project. All data will be finalized and manuscripts submitted for publication.

C. Completion Date

Field work for this project will be completed in the summer of 99. Compilation and analysis of all data and production of a final report will be finalized in FY00.

PUBLICATIONS AND REPORTS

These are broken down here into categories. Some papers are completed and in press, and minor final editing will take place in FY99. Other papers are submitted and/or under revision, and since we are now entering the field season, it is likely that revisions and final editing of proofs will take place in FY00. Finally, some papers are in preparation or planned, and most of this will take place in FY00.

NO WORK REQUIRED IN FY00

Robards, M.D., J. F. Piatt, and G.A. Rose. 1999. Maturation, Fecundity, and Intertidal Spawning of Pacific Sand Lance (*Ammodytes hexapterus*) in the Northern Gulf of Alaska. Journal of Fish Biology 54: *In Press.*

Robards, M., J.F. Piatt, A. Kettle, and A. Abookire. 1999. Temporal and geographic variation in fish populations in nearshore and shelf areas of lower Cook Inlet, Alaska. Fishery Bulletin. *In Press.*

SOME WORK WILL BE REQUIRED IN FY00

Robards, M.R., and J.F. Piatt. 1999. Biology of the Genus *Ammodytes* - The Sand Lances. U.S. Forest Service Technical Report Series. *Accepted, under revision.*

Willson, M.F., R.H. Armstrong, M.D. Robards, and J.F. Piatt. 1999. Sand lance as cornerstone species for predator populations. U.S. Forest Service Technical Report Series. *Accepted, under revision.*

Willson, M.F., R.H. Armstrong, M.D. Robards, and J.F. Piatt. 1999. An annotated bibliography of sand lance. U.S. Forest Service Technical Report Series. *Accepted, under revision.*

Robards, M.D., J.A. Anthony, G.A. Rose, and J.F. Piatt. 1999. Changes in proximate composition and somatic energy content for Pacific sand lance (*Ammodytes hexapterus*) relative to maturity, season, and location. Journal of Experimental Marine Biology and Ecology. *Submitted.*

Robards, M.D., G.A. Rose, and J.F. Piatt. 1999. Somatic growth and otolith development of Pacific sand lance (*Ammodytes hexapterus*) under different oceanographic regimes. Mss. under final revision for submission to Fisheries Oceanography.

Litzow, M.A., J.F. Piatt, A.A. Abookire, A.K. Prichard and M.D. Robards. 1999. Pigeon Guillemot Nestling Diets as Monitors of Nearshore Fish Communities. Mss. under final review for submission to Marine Ecology Progress Series.

Abookire, A.A., J.F. Piatt and M. Robards. 1999. Stratification and small-scale thermohaline differences influence nearshore fish distributions in an Alaskan estuary. Mss. under final revision for submission to Estuarine, Coastal and Shelf Science.

Robards, M.D. 1999. Ecology and Demographics of Pacific Sand Lance, *Ammodytes hexapterus* Pallas, in Alaska. M.Sc. Thesis, Memorial University of Newfoundland.

MOST OR ALL WRITING WILL TAKE PLACE IN FY00

Robards, M.D., J.F. Piatt, and G.A. Rose. 2000. Ecology and Demographics of Pacific Sand Lance, *Ammodytes hexapterus* Pallas, in lower Cook Inlet, Alaska. Exxon Valdez Oil Spill Trustee Council Restoration Project 00306 Final Report.

Robards, M.D., W. Ostrand, and J. Piatt. 2000. Prediction of sand lance habitat using hydroacoustic bottom type assessment in Lower Cook Inlet and Prince William Sound, Alaska. Field work in FY99, and data analysis and writing in FY00

Robards, M.D., J.F. Piatt, and P. Anderson. 2000. Decadal-scale changes in abundance of Pacific Sandlance in the Gulf of Alaska. Historical trawl data analysis and writing in FY00.

Robards, M.D., J.F. Piatt, and S.A. Hatch. Geographic variability in sand lance growth and development in the Gulf of Alaska. Historical data on puffin diets will be analyzed and written up in FY00.

Robards, M.D., J.F. Piatt, and A. Abookire. Temporal and spatial variability in abundance of Pacific sand lance in lower Cook Inlet, 1995-1999. Field work in FY99, and data analysis and writing in FY00.

We project that all results from this study will be fully analyzed, written and submitted to peer review journals by October 2000. Journals that we are targeting include: Marine Biology, Transactions of the American Fisheries Society, Journal of Fish Biology, Fisheries Bulletin, Fisheries Oceanography, and Experimental Marine Biology and Ecology.

PROFESSIONAL CONFERENCES

Work from this project was presented at the 1999 Pacific Seabird Group (PSG) meeting in Blaine, Washington. Further results will be presented at the PSG meeting in 2000.

NORMAL AGENCY MANAGEMENT

This work would not be conducted as part of normal USGS activities.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Close coordination has, and will continue to be developed between ADF&G, UAF, NMFS, and USFWS for collections of sand lance offshore and in other areas of Alaska. Work in FY99 on sand lance will also continue to be coordinated with other APEX investigators working in Prince William Sound such as Dan Roby, Bill Ostrand, and David Irons. In FY00, coordination will consist largely of collaboration on analysis and reporting of results.

EXPLANATION OF CHANGES IN CONTINUIING PROJECTS

This proposal differs from the FY99 proposal in that we are conducting no field work in FY00, and all efforts will be concentrated on publishing results. The proposed cost ($20,000) is the same as indicated in previous proposals.

PRINCIPAL INVESTIGATOR

Dr. John F. Piatt
Alaska Biological Science Center
Biological Resources Division
USGS, 1011 E. Tudor Road
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fax (907) 786-3636
E-mail: john_piatt@usgs.gov

PRINCIPAL INVESTIGATOR

Dr. John F. Piatt, Research Biologist (GS-14) with the Alaska Science Center, Biological Resources Division, USGS in Anchorage. Obtained a Ph.D. in Marine Biology from Memorial University of Newfoundland in 1987 (dissertation on seabird-forage fish interactions). Since 1987, studied seabirds at colonies and at sea in Gulf of Alaska, Aleutians, Bering and Chukchi seas. Author on 75 peer-reviewed scientific publications about seabirds, fish, marine mammals, and effects of oil pollution on marine birds. Responsible for coordination and oversight of the proposed research.

Approved - 8-9-99

2000 EXXON VALDEZ TRUSTE)UNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$0.0						
Travel		$0.0						
Contractual		$18.7						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$18.7			Estimated FY 2001	Estimated FY 2002		
General Administration		$1.3						
Project Total	$0.0	$20.0			$0.0	$0.0		
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: Close out year. Costs for write-up only.

FY00

Prepared: 4/10/99

Project Number: 00306
Project Title: Ecology and demographics of Pacific Sand Lance, Ammodytes hexapterus, Pallas, in lower Cook Inlet,. Alaska
Agency: USGS (BRD)

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRUSTI UNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
None						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	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 2000
None					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

FY00

Prepared:

Project Number: 00306
Project Title: Ecology and demographics of Pacific Sand Lance, Ammodytes hexapterus, Pallas, in lower Cook Inlet,. Alaska
Agency: USGS (BRD)

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FY 2000
Personal Services Contract with Martin Robards to complete manuscripts	18.7
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$18.7

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

FY00	Project Number: 00306 Project Title: Ecology and demographics of Pacific Sand Lance, Ammodytes hexapterus, Pallas, in lower Cook Inlet,. Alaska Agency: USGS (BRD)	FORM 3B Contractual & Commodities DETAIL

Prepared:

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

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY00

Project Number: 00306
Project Title: Ecology and demographics of Pacific Sand Lance, Ammodytes hexapterus, Pallas, in lower Cook Inlet,. Alaska
Agency: USGS (BRD)

FORM 3B
Equipment
DETAIL

Prepared:

00320

Approved TC 8-9-99

SOUND ECOSYSTEM ASSESSMENT (SEA): PUBLISHING THE INTEGRATED FINAL REPORTS AND A PROGRAM SYNTHESIS.

"Submitted Under the Broad Agency Announcement"

Project Number:	00320Z2
Restoration Category:	Research
Proposer:	Prince William Sound Science Center
Principal Investigator:	Jennifer Allen
Lead Trustee Agency:	NOAA
Cooperating Agencies:	ADF&G
Alaska SeaLife Center:	no
Duration:	October 1, 1999 to September 30, 2000. 2nd year of a two-year program
Cost FY 00:	$ 120,000
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pink salmon and Pacific herring

ABSTRACT:

This proposal will provide coordination to print, copy and distribute the Final Report package from the EVOS TC Sound Ecosystem Assessment (SEA) project and to review, publish and distribute a SEA synthesis written for a dedicated volume of the prestigious journal, Fisheries Oceanography (Blackwell Science, Ltd). The integrated final report is a required document expected to exceed 1000 pages (some with color). The FO volume will be an externally peer-reviewed scientific treatise designed to address ecosystem-level aspects of the SEA study not covered adequately by the reports of the individual projects. These products represent the close-out documentation for SEA specified in the FY99 single integrated DPD.

INTRODUCTION

The Sound Ecosystem Assessment (SEA) program was initiated in April 1994 to evaluate possible environmental suppression of pink salmon and Pacific herring following the oil spill. The goals of SEA were to understand and model numerically the physical and biological processes that influence pink salmon and herring production in Prince William Sound (PWS). In its closeout year, FY99, the major focus of the SEA program was synthesis and subsequent report and manuscript preparation. These reports and manuscripts will be extensively reviewed and published. Since the review of its documents will not begin until mid June, 1999 (for the integrated Final Report package) and 15 September, 1999 (for the synthesis manuscripts), it is unlikely that all revisions will be completed in FY99. This proposal provides support only to complete the publication and distribution of these documents in FY00.

NEED FOR THE PROJECT

A. Statement of the Problem

Successful completion of this multidisciplinary investigation requires peer authentication and publication of all Final Reports and an integrated synthesis of findings and conclusions that addresses hypotheses at the ecosystem level. Production of an integrated synthesis volume will require substantial coordination and editorial effort during and following the external review phase. This project provides services to assist the former SEA lead scientist to complete the tasks required to publish the required final reports of all projects and the Fisheries Oceanography synthesis volume for subscribers and the Trustee Council.

B. Rationale/Link to Restoration

Knowledge gained through work of the SEA program is adding to the understanding of factors that may limit recovery of two injured species, pink salmon and herring. This project supports the publication of information that can be used by the Trustee Council and its member agencies to enhance management of these important commercial fishes, and by other projects studying linkages between forage fishes and higher level consumers, as part of the overall EVOS restoration effort.

C. Location

SEA was designed and implemented in Prince William Sound.

COMMUNITY INVOLVEMENT

Spill-affected communities may obtain information on, and provide input to the SEA program via a dedicated web site created and maintained by the principal investigator (PI). Presentations to the Prince William Sound community are made by the PI from time to time as opportunity permits. Final reports and the special synthesis volume will be available to all agencies and, by request, to users of pink salmon and herring resources in PWS and elsewhere though the Council's distribution and archival activities.

PROJECT DESIGN

A. Objectives

Specific project objectives are:

1. To collect, copy, bind and distribute the collection of bundled SEA final reports as required by the Trustee Council;

2. To provide coordination for review, revision and final publication of the SEA synthesis volume for the journal Fisheries Oceanography.

B. Methods

Receiving, copying and distributing the integrated package of approved SEA Final Reports will be accomplished at ADF&G Habitat Division, Anchorage, Alaska, by Celia Rozen and her staff. These costs are shown on the attached ADF&G portion of the this project's budget.

SEA synthesis publication activities coordinated by Dr. Allen for the journal Fisheries Oceanography will be facilitated by Dr. William Pearcy (Oregon State University, retired). Dr. Pearcy, a former EVOS TC peer reviewer, will serve as the Fisheries Oceanography guest editor for the SEA special volume. He will be responsible for externally reviewing synthesis manuscripts and for writing a preface for the publication.

Though retired after June, 1999, Dr. Ted Cooney will continue his association with SEA publication tasks and the PI, agreeing to maintain an engagement until both the Final Reports and the special journal volume are completed in 2000. Travel is requested for joint meetings of Drs. Pearcy, Cooney and Allen as needed to expedite the FO publication process.

C. Cooperating Agencies, Contracts and Other Agency Assistance

Project 00320Z2 will provide funding to enable coordination of synthesis and joint reporting activities among SEA scientists at the University of Alaska Fairbanks, Alaska Department of Fish and Game, Prince William Sound Science Center and USFS/Copper River Delta Institute as they address manuscript and report revisions

SCHEDULE

A. Measurable project tasks for FY00 (October 1, 1999 - September 30, 2000)

Oct. 1, 1999 - Feb. 1, 2000	Manuscript package for FO under review by Dr. Pearcy Final Reports copied and distributed by ADF&G
Nov. 1, 1999 - Feb.1, 2000	Synthesis revisions (as needed) by authors
March 1, 2000	Reviewed package sent to F.O. for publication (out of our hands)
September1, 2000	Published volume ready for distribution (out of our hands) Final publication costs paid to Blackwell Science, Ltd.

B. Project milestones and endpoints

The publication process detailed in this proposal will be completed when the Final Report package and FO journal volume are printed and distributed to the EVOS Trustee Council and its agencies.

C. Completion Date

The publication of SEA close-out documentation is expected to be concluded in FY00. The only uncertainty is the actual publication schedule for the Fisheries Oceanography special volume.

PUBLICATIONS AND REPORTS

SEA Integrated Final Reports

The approved final reports from all SEA projects will be copied and bound with a summary chapter for distribution and archival by the Trustee Council.

Special Volume for Fisheries Oceanography

The Fisheries Oceanography special volume of SEA results will be published by Blackwell Science Ltd. for its subscribers, with sufficient copies made to address the special needs of the Trustee Council and its agencies.

The SEA Synthesis package contains the following papers:

Chapter 1. Ecosystem controls of pink salmon (*Onchorynchus gorbuscha*) and Pacific herring (*Clupea pallasi*) production in Prince William Sound, Alaska. T. Cooney, et al. (the entire SEA team).

Chapter 2. Physical processes that influence the biology of Prince William Sound. S.

Vaughan, et al.

Chapter 3. Plankton dynamics: observed and modeled responses to physical forcing in Prince William Sound, Alaska. D. Eslinger, et al.

Chapter 4. Physical and ecological processes influencing mortality of juvenile pink salmon (*Onchorynchus gorbuscha*) in Prince William Sound, Alaska. M. Willette, et al.

Chapter 5. Biological and physical effects on the early life history of herring (*Clupea pallasi*) in Prince William Sound, Alaska. B. Norcross, et al.

Chapter 6. Inter-seasonal and annual changes in the distribution and abundance of walleye pollock (*Theragra chalcogramma*) in Prince William Sound. G. Thomas et. al.

Chapter 7. Seasonality in surface-layer net zooplankton communities in Prince William Sound, Alaska. T. Cooney, et al.

Chapter 8. Vertical and horizontal patterns in the distribution of *Neocalanus* spp. in Prince William Sound, Alaska. J. Kirsch, et al.

Chapter 9. Predation on Pacific herring (*Clupea pallasi*) spawn by birds in Prince William Sound, Alaska. M. Bishop, et al.

Chapter 10. Seasonal hydrography and tidal currents in bays and fjords in Prince William Sound, Alaska. S. Gay, et al.

Chapter 11. A simulation of the seasonal ocean circulation patterns/regimes of Prince William Sound, Alaska. J. Wang, et al.

Chapter 12. Effects of fall physiological condition and winter temperature on over-winter survival of age-0 Pacific herring (*Clupea pallasi*). Patrick, et al.

Chapter 13. Effects of juvenile salmon size and foraging behavior on predation risk. M. Willette et al.

PROFESSIONAL CONFERENCES

Results from the first six chapters of this synthesis were used to project SEA findings at the EVOS 10-year symposium, Anchorage, Alaska, March 23-26. Papers published in the SEA synthesis and/or final report may also be presented and discussed at scientific meetings in 2000, but those costs will be assumed by the presenters.

NORMAL AGENCY MANAGEMENT

n/a

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Publication tasks will be performed in close coordination with the former SEA Lead Scientist, Dr. T. Cooney and Dr. William Pearcy. Travel is requested for Drs. Cooney, Pearcy, and Allen to meet when necessary to facilitate the publication of the SEA synthesis volume.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

n/a

PROPOSED PRINCIPAL INVESTIGATOR

Jennifer R. Allen will continue as the PI of project 00320Z2.

PRINCIPAL INVESTIGATOR

Dr. Jennifer R. Allen
Prince William Sound Science Center
P.O. Box 705
Cordova, Alaska 99574
(907) 424-5800 Office (907) 424-5820 Fax
jrallen@grizzly.pwssc.gen.ak.us.

Dr. Allen is presently the PI for project 99320Z2 (SEA Synthesis Editor). She has had a central role in developing and maintaining coordination and communication mechanisms within the SEA program, and in communication of SEA findings to the scientific community and the public. She is an experienced author and editor and a graphic presentation specialist.

Other Key Personnel

Dr. Ted Cooney, SEA Lead Scientist (Institute of Marine Science, University of Alaska Fairbanks, retired as of 1 July, 1999) - Co-PI

Dr. Bill Pearcy, SEA Synthesis volume guest editor (Oregon State University, retired).

Budget Justification

Introduction

Publication of the major results of SEA will assure both national and international exposure for the Council's restoration work. Much of what is being attempted in Prince William Sound and other locations in the spill-influenced area has application elsewhere. We also predict there will be a demand for the bundled SEA results by those exploring ways tomove toward whole-ecosystem management in the future. Getting SEA's integrated synthesis in front of the broader scientific community will guarantee that Trustee Council restoration results contribute to a growing understanding of how coastal ocean dynamics. This at a time when over fishing, climate change and ocean regime shifts are threatening our living marine resources.

Integrated Final Reports of the 5-year SEA program

Alaska Department of Fish and Game has responsibility for copying, binding and distributing the peer-reviewed final report package from SEA. A total of 88 copies will be prepared including 33 for the required ARLIS distribution and 50 copies for SEA program members; PIs, senior scientists technicians and students.

The Fisheries Oceanography dedicated volume

The Journal of Fisheries Oceanography provides special volume publication opportunities for large programs relating the production and dynamics of fish production to the marine environment. These dedicated volumes or special supplements are cleared for publication following an extensive external review of manuscripts by a guest editor selected by the Editor-In-Chief (Dr. Michael Mullin, Professor, Scripps Institution of Oceanography, La Jolla, CA.). Dr. Mullin, at the request of Dr. Cooney, appointed Dr. William (Bill) Pearcy to serve as the SEA guest editor.

Research programs seeking single volume publication in Fisheries Oceanography must assume all costs, including a fee for the guest editor, for printing sufficient copies for the current membership, and for printing reprint copies for local distribution. The annual cost of a subscription to this journal in the U.S. is $310.

Our budget request for publishing a special SEA volume includes 650 copies for the regular FO subscription list, and 250 copies for EVOS distribution (100 for SEA and stakeholders in Prince William Sound, and 150 for the
Trustee Council and its agencies including the required ARLIS distribution.). This number of copies will assure local distribution in the spill effected region, and some for requests that will come in world-wide to the Trustee Council for reprints. We have restricted the use of color and imposed strict page limitations on manuscripts to control the printing costs of the SEA special volume.

Two months of salary are requested for Dr. Allen to coordinate the tasks leading to the successful publication of a SEA special volume of Fisheries Oceanography in 2000. The editors fee for Dr. Pearcy is for professional duties associated with externally reviewing manuscripts.

Revision -14-99
approved TC 8-9-99

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

Budget Category:	Authorized FY 1999	Proposed FY 2000	PROPOSED FY 2000 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
				$6.2				$113.8
Personnel	$0.0		[redacted]					
Travel	$0.0	$0.0						
Contractual	$0.0	$112.2						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$112.2			Estimated FY 2001	Estimated FY 2002		
General Administration	$0.0	$7.8						
Project Total	$0.0	$120.0			$0.0	$0.0		
			[redacted]					
Full-time Equivalents (FTE)	0.0	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	$0.0			$0.0	$0.0		

Comments:

Changes in this revised budget include:
- replace paper 55 cc of the final report with CD cc.
- Increased indirect rate for the PWSSC from 20 to 25%
- 850 cc of the dedicated volume of the journal, Fisheries Oceanography; each - an estimated 230 pages in length.

FY00

Prepared:
rev 14 July 99/wjh

Project Number: 00320Z2
Project Title: SEA: Publishing the Integrated Final Reports and a Program Synthesis
Lead Agency: NOAA

FORM 2A
MULTI-TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$0.0						
Travel		$0.0						
Contractual		$5.8						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$5.8			Estimated FY 2001	Estimated FY 2002		
General Administration		$0.4						
Project Total	$0.0	$6.2						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00	Project Number: 00320Z2 Project Title: SEA: Publishing the Integrated Final Reports and a Program Synthesis Agency: ADF&G	FORM 3A TRUSTEE AGENCY SUMMARY

Prepared:

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs: Name	Position Description	GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 2000
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	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 2000
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

FY00

Prepared:

Project Number: 00320Z2
Project Title: SEA: Publishing the Integrated Final Reports and a Program Synthesis
Agency: ADF&G

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:				Proposed
Description				FY 2000
Final production costs for the Final Report; No. copies =			88	
	cost/each	number		
Color Copies	98	33		3,234.0
Printing-binding Reports	75	33		2,475.0
Postage	3	33		99.0
Forecasted final report includes 1000 pages with 20% color sheets				
When a non-trustee organization is used, the form 4A is required.			**Contractual Total**	$5.8

Commodities Costs:	Proposed
Description	FY 2000
Commodities Total	$0.0

FY00

Prepared:

Project Number: 00320Z2
Project Title: SEA: Publishing the Integrated Final Reports and a Program Synthesis
Agency: ADF&G

FORM 3B
Contractual &
Commodities
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

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

FY00

Prepared:

Project Number: 00320Z2
Project Title: SEA: Publishing the Integrated Final Reports and a Program Synthesis
Agency: ADF&G

FORM 3B
Equipment
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$0.0						
Travel		$0.0						
Contractual		$106.4						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$106.4			Estimated FY 2001	Estimated FY 2002		
General Administration		$7.4						
Project Total	$0.0	$113.8						
Full-time Equivalents (FTE)		0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00	Project Number: 00320-Z2 Project Title: SEA: Publishing the Integrated Final Reports and a Program Synthesis Agency: NOAA	FORM 3A TRUSTEE AGENCY SUMMARY

Prepared:

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$19.3						
Travel		$6.1						
Contractual		$59.3						
Commodities		$0.4						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$85.1			Estimated FY 2001	Estimated FY 2002		
Indirect		$21.28						
Project Total	$0.0	$106.4						
Full-time Equivalents (FTE)		0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Prepared:

Project Number: 00320Z-2
Project Title: SEA: Publishing the Integrated Final Reports and a Program Synthesis
Name: Prince William Sound Science Center

FORM 4A
Non-Trustee
SUMMARY

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2000
Jennifer Allen	Synthesis Coordinator & Editor		2.8	6.9		19.3
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.8	6.9	0.0	
					Personnel Total	$19.3

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
					0.0
CDV/Corvallis, Oregon	750.0	1	4	102.0	1,158.0
Great Falls/CDV	750.0	2	10	147.0	2,970.0
Great Falls/Corvallis, Oregon	750.0	1	4	102.0	1,158.0
CDV/Anch	150.0	1	4	160.0	790.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$6.1

FY00

Prepared:

Project Number: 00320-Z2
Project Title: SEA: Publishing the Integrated Final Reports and a Program Synthesis
Name: Prince William Sound Science Center

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs:			Proposed
Description			FY 2000
Postage			
Telephone			1,000.0
Photocopying			
Network Charge@ 100. Per computer month			200.0
Software Licenses			
Dr. W. Pearcy, Fisheries Oceanography guest editor fee			5,000.0
Fisheries Oceanography publication costs (Reduced No. Pages; 850 copies)			52,640.0
Master CD			90.0
Production cc of CD	55 at	$6	330.0
		Contractual Total	$59.3

Commodities Costs:	Proposed
Description	FY 2000
Office Supplies	400.0
Commodities Total	$0.4

FY00

Prepared:

Project Number: 00320-Z2
Project Title: SEA: Publishing the Integrated Final Reports and a Program Synthesis
Name: Prince William Sound Science Center

FORM 4B
Contractual &
Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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	
Prince William Sound Science Center network, workstation, personal computer and associated hardware		

FY00

Project Number: 00320-Z2
Project Title: SEA: Publishing the Integrated Final Reports and a Program Synthesis
Name: Prince William Sound Science Center

FORM 4B
Equipment
DETAIL

Prepared:

Revision 7-8-99
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Pigeon Guillemot Restoration Research at the Alaska SeaLife Center

Project Number:	00327
Restoration Category:	Research
Proposer:	D. Roby/Oregon State Univ.
Lead Trustee Agency:	DOI
Cooperating Agencies:	None
Alaska SeaLife Center:	Yes
New or Continued:	Cont'd
Duration:	3rd yr. 4 yr. project
Cost FY 00:	$192.8
Cost FY 01:	$93.0
Cost FY 02:	$0.0
Geographic Area:	Alaska SeaLife Center, and adjoining areas of Resurrection Bay
Injured Resource/Service:	Pigeon guillemots, other injured seabird resources

ABSTRACT

This project tests the feasibility of restoration techniques for pigeon guillemots (e.g., installation of artificial nest sites, use of social attractants, captive propagation and release). It also includes controlled experiments crucial to two other restoration objectives: (a) development of nondestructive biomarkers of petroleum hydrocarbon contamination in seabirds and (b) understanding how dietary factors (prey species composition, prey size, lipid content, feeding frequency) constrain growth, development, and condition at fledging in guillemots and other fish-eating seabirds.

STUDY HISTORY

The first field season for this study was in 1998. Prior to the 1998 field season, considerable progress was made in setting up the Research Work Order from USGS-BRD to Oregon State University that will fund this project throughout its duration, selecting a graduate student for the project, designing and constructing artificial nest sites, exploration of potential sites for collecting guillemot eggs and young chicks, and obtaining the necessary permits (NEPA, Scientific Collecting) and approvals (IACUC) to conduct the work.

During the 1998 field season a total of 44 guillemot eggs and 2 guillemot chicks were collected from nests in the wild and transported to the SeaLife Center for incubation and/or captive rearing. A total of 23 eggs were hatched (52% hatching success) and a total of 21 chicks were successfully fledged from the roof of the SeaLife Center. Blood samples were collected from chicks at predetermined ages for baseline levels of certain biomarkers. Chicks were raised on one of four types of forage fish: Pacific herring, Pacific sand lance, juvenile walleye pollock, or crescent gunnels. Growth rates were monitored on all chicks.

INTRODUCTION

The Pigeon Guillemot (*Cepphus columba*) population in Prince William Sound has failed to recover from declines that occurred both before and after the *Exxon Valdez* Oil Spill (EVOS). Post-spill studies of Pigeon Guillemot reproductive success have identified three primary factors preventing recovery:
1) In Prince William Sound (Naked and Jackpot islands) and Kachemak Bay, predation on eggs and chicks has been a major source of nesting failure (Hayes 1996, Prichard 1997, Golet 1999).
2) There has been a decline in the proportion of sand lance in the diet at some guillemot colonies in Prince William Sound (e.g., Naked Island) and Kachemak Bay, and the proportion of high-lipid schooling forage fish in the diet has been shown to be a key factor in guillemot reproductive success at both sites. The Alaska Predator Ecosystem Experiment (APEX) Project components F (Factors Limiting Pigeon Guillemot Recovery), G (Seabird Energetics), and M (Seabird/Forage Fish Studies in Lower Cook Inlet) are investigating the relationship between a lack of recovery in guillemot populations injured by the EVOS and the availability and quality of forage fish. A decline in availability of high-lipid forage fishes (sand lance, herring, capelin) in the last two decades may be responsible for lower growth rates, fledging weights, post-fledging survival, and adult recruitment in guiilemot populations within the oil spill area.
3) The Nearshore Vertebrate Predator (NVP) Project (River Otter and Pigeon Guillemot component) tested the hypothesis that exposure to residual oil from the spill continues to limit recovery of Pigeon Guillemots. Pigeon Guillemots feed on a diversity of nearshore demersal fishes and schooling forage fish that use the substrate to avoid predators (e.g., sand lance), prey that were likely injured by EVOS. The approach of the NVP study is to measure certain biomarkers in blood and compare biomarker levels in nestlings from oiled and non-oiled areas. These blood biomarkers still need to be calibrated to known doses of weathered Prudhoe Bay Crude Oil (PBCO) in a controlled, laboratory setting.

The proposed research is being conducted at the Alaska SeaLife Center in Seward and addresses all three of the above limiting factors. Experimental studies using captive subjects are integrated with raising Pigeon Guillemot nestlings in captivity in order to establish free-ranging guillemot breeding colonies in the vicinity of the SeaLife Center. Predator-free nest sites have been built in the vicinity of the SeaLife Center and, in association with the use of decoys and audio playbacks of guillemot calls, are being used to help attract and recruit prospecting guillemots to breed. Guillemot populations are frequently nest-site limited (Storer 1952) and Pigeon Guillemots readily breed in anthropogenic structures, such as docks and breakwalls, at many locations throughout the species' range. Like most seabirds, guillemots are philopatric to their natal location, and cohorts raised in captivity at the SeaLife Center and released there can be expected to return and attempt to breed in the surrounding area. Although guillemots only rarely breed before three years of age, prospecting 2-year-olds that were raised in the first year of this three-year study can be expected to visit the SeaLife Center during the 2000 breeding season.

Providing artificial nest sites has the potential to restore guillemot populations through enhancing both local recruitment of adults and nesting success. Our success in recruiting prospecting adult guillemots to use artificial nest sites and the proportions of captive-reared and immigrant guillemots that utilize artificial nest sites will allow us to test the feasibility of this direct restoration technique for enhancing recovery of guillemot populations in the EVOS area.

The proposed work is intended to result in the establishment of breeding colonies of free-ranging Pigeon Guillemots near the SeaLife Center. By banding immigrants to the colony and young that are raised and released at the SeaLife Center, we can establish a breeding colony comprised of known-age individuals whose breeding history is known. Accessibility of nest sites can be a major obstacle for studies of factors influencing nesting success and demographics of guillemots, and artificial nests sites can provide investigators with unique opportunities. A dockside Black-legged Kittiwake colony in Great Britain has been studied for the past 30 years and provided most of what is known about that species in the northeastern Atlantic (i.e., Coulson 1988). Establishment of Pigeon Guillemot colonies near the SeaLife Center has the potential of providing a similar resource, in addition to providing opportunities for integration with ASLC's public education program.

Besides providing recruits for the breeding colony of free-ranging guillemots to be established at ASLC, raising chicks in captivity will also provide the opportunity to conduct controlled experiments that are relevant to two major issues in Pigeon Guillemot restoration: (1) the effect of prey type, size, quality, and frequency of delivery on nestling growth rates and condition of young at fledging and (2) the utility of biomarkers in blood and excreta as indicators of exposure to crude oil and other environmental contaminants. Research on these two topics can best be conducted using captive subjects whose environment and diet can be carefully controlled to avoid confounding variables so common in natural populations. In the first year of this study (1998), chicks were raised on different diet regimes to determine the effects of the prey type on growth rates. Chicks were fed either high-lipid schooling forage fishes (sand lance, herring), low lipid forage fish (juvenile walleye pollock), or nearshore demersal fishes (crescent gunnel, high cockscomb) on growth rates. These controlled feeding experiments will be continued in FY 2000. The results from this study will complement continuing studies on the role of diet for productivity of nesting guillemots that are part of the APEX Project.

In FY 2000, the third year of the study, some chicks that are raised in captivity will be fed small, sublethal doses of weathered Prudhoe Bay crude oil (PBCO). Subsequent to dosing, samples of blood and excreta will be collected at prescribed intervals for measurement of biomarkers of health status. These results will allow us to define the dose-response relationship between ingested PBCO and each biomarker of exposure. Such results are essential for evaluating the efficacy of particular biomarkers and the utility of these biomarkers for assessing the exposure of free-ranging guillemots to oil.

Of particular value for interpretation of the results of captive feeding trials and crude oil dose-response experiments will be the subsequent release of these subjects and measurements of their return rates in subsequent years. Although it can not be assumed that all young guillemots that are fledged from the ASLC and survive to breeding age will return to breed near ASLC, the return rates of nestlings raised on various diets, plus return rates of oil-dosed and control nestlings, will provide valuable information on the long term effects of prey composition and oil exposure for guillemot fitness.

NEED FOR THE PROJECT

A. Statement of Problem

In the last two decades the Pigeon Guillemot population in Prince William Sound has declined from 15,000 to 5,000 individuals (Laing and Klosiewski 1993). While this decline apparently began prior to the EVOS, an estimated 10-15% of the population in the spill area died as a direct result of the spill. Post-spill censuses have not detected an increase in numbers, suggesting no appreciable recovery has occurred in the aftermath of the spill. Reasons for the lack of recovery are unclear, but may be related to changes in prey resource availability, continuing exposure of guillemots or their prey to oil, or nesting failure due to predation on guillemot eggs and/or nestlings.

Predation on Pigeon Guillemot eggs and chicks was apparently minimal before EVOS, but post-spill studies have frequently recorded high levels of predation from river otters and mink (Hayes 1995). High predation rates could be reducing production of local birds, increasing breeding dispersal (lack of fidelity to a previously used nest site or location) of established breeders, and decreasing the immigration of guillemots from other colonies. While Pigeon Guillemots typically have high fidelity to their breeding site, disturbance and lack of breeding success can increase the rate and distance of breeding dispersal. Populations suffering high levels of disturbance, such as persistent nesting failure due to terrestrial predators, will decline due to a lack of production of new recruits, dispersal of breeding birds, and/or decreased immigration.

Two ongoing EVOS projects have identified potential reasons for a lack of recovery by Pigeon Guillemots in the EVOS area. The APEX Project has identified a major shift in the nearshore ecosystem that has apparently resulted in fewer high-lipid schooling fish, particularly sand lance (*Ammodytes hexapterus*) fed to chicks (Oakley and Kuletz 1994, Golet et al. unpubl. ms.). Pre-spill studies found sand lance, a nearshore schooling fish with relatively high average energy density, to be the dominant prey returned to chicks. Post-spill studies have found gadids and nearshore demersal fish to constitute the majority of the diet. The NVP project has attempted to determine if blood biomarkers can be used to monitor level of exposure to oil and if blood from individuals in wild populations currently indicates exposure to oil is occurring. Both of these projects have examined wild populations that are exposed to numerous sources of variability that confound the examination of factors affecting chick growth or blood biomarkers.

This study is relevant to EVOS Restoration Work because it is designed to develop direct restoration techniques for Pigeon Guillemots, a species injured by the spill that is failing to recover. Techniques developed during this study will be relevant to restoration of other alcid species. Also, dose-response experiments with guillemot nestlings fed small, sublethal amounts of weathered Prudhoe Bay crude oil will provide crucial validation and calibration results for interpretation of on-going studies of biomarkers as indicators of crude oil exposure. Experimental studies with captive-reared guillemots will also provide a better understanding of how shifts in the diet of guillemots and other seabirds breeding in the EVOS area affects growth, development, fledging condition, and, ultimately, fitness. By monitoring the growth and development of nestlings raised on controlled rations, the relative nutritional quality of various prey can be assessed. Also, fitness tradeoffs between prey size/quality and provisioning rate can be assessed through monitoring of subsequent survival in the wild of captive-reared chicks. Understanding the constraints imposed on guillemots by diet composition, oil exposure, and nest site quality will be crucial for designing management initiatives to enhance productivity in this and other seabird species that are failing to recover from EVOS.

B. Rationale/Link to Restoration

Artificial nest sites have the potential to increase the size of both guillemot breeding colonies and populations. A Black Guillemot colony in arctic Alaska increased from 10 to 225 pairs in 17 years through provision of artificial nest sites (Divoky et al. 1974 and in prep.). In Washington State 27% of the 33 Pigeon Guillemot colonies are in piers or other anthropogenic structures (Speich and Wahl 1989). Establishment of a Pigeon Guillemot colony near the Alaska SeaLife Center will demonstrate the utility of direct restoration in assisting the recovery of Pigeon Guillemot populations in the northern Gulf of Alaska. If artificial nest sites are successful in attracting breeding adults and if successful reproduction ensues, artificial nest sites can be used in Prince William Sound to enhance productivity, recruitment, and immigration, all of which will facilitate recovery. Clusters of artificial nest sites similar to those at the ASLC can be installed near natural colonies that suffer from chronically high nest predation rates. Nests could be placed on pilings or "dolphins" constructed specifically for colony development.

Aside from providing prototypes for artificial colonies in other parts of the EVOS area, a breeding colony of free-ranging guillemots at the ASLC will allow investigators to conduct research on Pigeon Guillemots that would not be possible at natural colonies. Loss of eggs or chicks to predation has been a major source of nest failure in post-spill studies of Pigeon Guillemots in Prince William Sound (Hayes 1995, Golet 1999). In addition, marked adults and returning young will allow an examination of demographics that has not been possible in Prince William Sound studies. A lack of recovery could be due to demographic parameters (e.g., adult survival, subadult survival, immigration/emigration rates) not evident in studies of nesting success or colony censuses. Guillemot demographics are much more easily studied at a colony of artificial nest sites where the banding of chicks and adults entails far fewer problems than at natural colonies. Should the proposed work result in the deployment and use of significant numbers of artificial nest sites in Prince William Sound, investigators will be able to obtain demographic information for that area that could explain the lack of recovery of local populations.

While the colonies of Pigeon Guillemots that we are attempting to established near the ASLC will have the benefit of captive-reared chicks returning to their natal location and assisting in establishment of the colony, immigration is obviously the source of adults founding new colonies. Immigrants can also be the primary source of recruits to established and expanding colonies (Petersen 1981). Unlike many seabirds, guillemots are semi-colonial and able to breed as single pairs as well as in colonies. Prospecting guillemots can be expected to search for nesting opportunities more extensively than more colonial seabirds, which require minimum numbers of conspecifics for successful breeding. Nest sites at ASLC are likely to attract non-breeding prospectors from the approximately 100 pairs of Pigeon Guillemots breeding between Aialik Cape and Cape Resurrection (Nishimoto and Rice 1987), as well as more distant colonies. An expanding colony of Black Guillemots in arctic Alaska drew most of its recruits from colonies more than 400 km distant (Divoky, in prep.).

A Pigeon Guillemot colony could also have the potential of attracting other seabird species to nest in the area of ASLC. Some of these other species may also be recruited by providing nest sites. A Black Guillemot breeding colony that utilized artificial nest sites in arctic Alaska also attracted Horned Puffins (*Fratercula corniculata*), some of which used the artificial nest sites (Divoky 1982 and unpubl.).

The research component of this study will allow evaluation and validation of the use of nondestructive biomarkers (in blood and excreta) to assess the health status of individual guillemots and potential exposure to petroleum hydrocarbons. There is evidence that certain acute phase proteins (i.e., haptoglobin) in blood and porphyrins in excreta are induced by ingestion of sublethal doses of weathered crude oil (Prichard et al. 1997). The results of a dose-response experiment with wild guillemot nestlings in their natural nest sites, however, were ambiguous because of among-site variability in baseline values for biomarkers (Prichard et al. 1997). Also, guillemot nestlings were fed small doses (0.05-0.2 ml) of highly weathered PBCO in that study; and the dose levels were not sufficient to cause even a significant decline in growth rates of nestlings. Finally, blood samples for measuring biomarker levels were not collected until five days post-dosing, when any induction of an acute phase response had already likely peaked. Regardless of all these uncontrolled factors, the serum haptoglobin levels in guillemot chicks fed 0.2 ml of weathered PBCO were significantly different from that of controls. While the use of blood and fecal biomarkers for monitoring oil exposure and general population health of guillemots is promising, more research under controlled, captive conditions is required to validate the techniques and provide a sound basis for interpretation of results from wild guillemots.

There is a definite need for information on the relationship between diet and reproductive success for Pigeon Guillemots, a seabird species that is failing to recover from EVOS at an acceptable rate. Guillemots are the most neritic members of the marine bird family Alcidae (i.e., murres, puffins, and auks), and like the other members of the family, capture prey during pursuit-dives. Pigeon Guillemots prey on a wide variety of fishes, including schooling forage fish (e.g., sand lance, herring, pollock) and subtidal/nearshore demersal fish (e.g., gunnels, blennies, sculpins; Drent 1965, Kuletz 1983). There is strong evidence of a major shift in diet composition of guillemot pairs breeding at Naked Island. Sand lance were the predominant prey fed to young in the late 1970s (Kuletz 1983), but currently sand lance is a minor component of the diet (G. Golet, unpubl. ms.). In contrast, guillemots breeding in Kachemak Bay continued to provision their young predominately with sand lance up through the 1996 breeding season, and sand lance was particularly prevalent in the diet at sites that support high densities of breeding pairs (Prichard 1997). Also, young of breeding pairs that provisioned their nestlings with mostly sand lance had higher growth rates (Prichard 1997, Golet et al. unpubl. ms.). Jackpot Island in southwestern Prince William Sound supports the highest nesting densities of guillemots anywhere in the Sound and growth rates of nestlings are correspondingly high. The high availability of juvenile herring to guillemots nesting at Jackpot Island may be responsible for both the high nesting density and high growth rates. Thus availability of high-quality schooling forage fishes (herring, sand lance) may be crucial for maintaining high nesting densities of guillemots.

C. Location

Pigeon Guillemot nestlings will be raised in captivity at the Alaska SeaLife Center in Seward during FY 00. Guillemot eggs and hatchlings (<10 days post-hatch) will be obtained from source colonies on the Kenai Peninsula, Kodiak Island, non-oiled parts of Prince William Sound, Southeast Alaska, or at other appropriate northern Gulf of Alaska colonies. Impact of these collections on the productivity of source colonies should be negligible, as eggs lost during the first half of incubation are usually replaced during renesting and the majority of guillemot nesting attempts in the NGOA fail to produce fledglings because of high nest predation rates (see annual progress reports for EVOS Trustee Council projects 163F and 163M). All the captive-reared chicks that reach fledging age in good health will be banded and released at the ASLC to assist in efforts to establish local breeding colonies of free-ranging guillemots near ASLC. Artificial nest sites will be maintained near ASLC on an adjacent breakwater and other sites to enhance the prospects for colony establishment. Colonies in Resurrection Bay that may serve as sources of immigrants or may recruit captive-reared guillemots will be censused and checked for banded adults during the third year of the project, 2000. The information obtained from this project will benefit Pigeon Guillemot populations in the Gulf of Alaska, especially Prince William Sound. An understanding of the affect of prey type on chick growth will help explain the role of ecosystem shifts in continuing declines of Pigeon Guillemot populations. Assessing the utility of blood biomarkers for detecting and quantifying exposure to crude oil will benefit efforts to monitor the health status of Pigeon Guillemot populations throughout the spill zone without resorting to lethal sampling procedures.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

All research will be conducted at the Alaska SeaLife Center, which will allow the community in and around Seward to observe progress in the establishment of guillemot colonies in both artificial and natural nest sites. Wild breeding colonies near ASLC have the potential for involving science classes from local schools. The location of colonies will potentially permit easy viewing by the public and allow science teachers to use the colony for instruction about seabird breeding biology and restoration. Science classes could conduct observations on the occurrence and activities of prospecting and breeding guillemots. Some of these (timing of arrival in the spring and sightings of color banded adults) could provide important information for the period when the investigators are not in Seward. Local science teachers can receive annual summaries of information about local colonies (e.g., timing of clutch initiation, breeding success) that can provide the basis for lessons on regional climate change and annual variability in the marine environment. The Seaquest Program of the Chugach School System would be a logical avenue for presenting this material to students.

PROJECT DESIGN

A. Objectives

This research project has three primary objectives listed below. During the third year of the project (FY 00), the emphasis will be on achieving all three objectives.

1. Determine the feasibility of using direct techniques for restoration of Pigeon Guillemots, including:
   a) providing artificial nest sites
   b) use of social attraction, such as decoys and playbacks of vocalizations
   c) release of captive-reared young

2. Determine the response of particular biomarkers of crude oil exposure (acute phase proteins, plasma sodium, fecal porphyrins) to variables of exposure in guillemot nestlings, and the survival of exposed nestlings post-fledging. Exposure variables that will be examined include:
   a) dose of ingested oil
   b) time since ingestion of dose
   c) chick age
   d) chick diet quality and condition

3. Determine the effect of diet variables on growth performance, development, baseline biomarker levels, fledging condition, and post-fledging survival of Pigeon Guillemots, including:
   a) type of forage fish consumed
   b) lipid content of the diet
   c) frequency of feedings

B. Methods

The proposed work will test the following three basic hypotheses, which relate to each of the three primary objectives listed above:

Hypothesis 1. Artificial nest sites, decoys, and playbacks of vocalizations can be used to establish new Pigeon Guillemot breeding colonies and enhance breeding success over that experienced at natural colonies using natural nest sites.

Hypothesis 2. Biomarkers from plasma and excreta of nestling Pigeon Guillemots can be used as indicators of exposure to weathered crude oil in the food supply, and the subsequent survival probabilities of young guillemots post-fledging.

Hypothesis 3. Growth performance, fledgling condition, and post-fledging survival of Pigeon Guillemot nestlings are sensitive to differences in prey type, prey size, feeding frequency, and lipid content of prey.

Methodology employed during the third year of the study (FY 00) will consist of the following:

Objective 1: Testing Feasibility of Direct Restoration Techniques

a. Installation of Artificial Nest Sites and Use of Social Attraction

Pigeon Guillemot nest sites have been constructed and installed at several locations in the vicinity of the Alaska SeaLife Center. Additional nest sites will be provided at each location if the number of breeding birds and prospecting adults exceeds the number of available nest sites. Design of the artificial nest sites was based on the sites developed by Dr. Divoky for Pigeon Guillemots in Puget Sound, with modifications based on studies of nest site characteristics that were associated with nesting success in Kachemak Bay (Prichard 1997). Sites have two entrances with a central nesting cavity. Baffles in the entryways to the nest cavity prevent avian predators from viewing nest contents. Based on the locations of Pigeon Guillemot nest sites associated with docks and piers, it appears that placing the sites beneath an overhang will increase their attractiveness to guillemots prospecting for nest sites. Sites under an overhang apparently have the advantage of decreased avian predation. Sites are large enough to accommodate monitoring devices (such as a closed circuit camera, platform scale, or activity monitor) that may be used in future research.

Guillemot decoys have been made from molds produced by Mad River Decoy in Vermont. A CD player with external speakers is being used to play adult Pigeon Guillemot calls from May to mid August. Because guillemots prospecting for nest sites may make recruitment decisions based on local breeding productivity (Boulinier et al. 1996), from late June to late August the calls of chicks in nest sites are also played during the early morning and evening, when colony attendance can be expected to be highest. Similar combinations of decoys and audio playbacks have been used successfully for other seabird species, including alcids (Kress and Nettleship 1989, Kress 1983), but have never before been used to attract guillemots to nest at new locations.

We will begin systematic observations of artificial nest sites and decoy sets in May. Daily observations will be conducted at the times expected to have maximum colony attendance (0200-0900 and 1600-2000 Alaska Daylight Time, high tides). Initially observations will be recorded every 15 minutes on the number of Pigeon Guillemots visible from the roof of ASLC and their distance from artificial nest sites. Once guillemots begin associating with decoys and nest sites, we will conduct detailed observations on the behavior of prospecting birds. The location and activities of prospectors will be recorded during 15-minute periods. Behavioral observations will be similar to those conducted by Preston (1968) on Black Guillemot social behavior.

b. Monitoring of Pigeon Guillemot Breeding Biology and Demographics

Should breeding occur in the artificial nest sites in 2000, we will obtain information on the breeding biology of birds using the nest sites. To reduce the chances of nest site abandonment, no adults will be captured during 1999, but if successful breeding takes place in 1999, we will attempt to noose breeding adults for banding in 2000. In 2000 the following breeding parameters will be monitored:

- date of clutch initiation
- egg weight and volume
- egg color and pattern
- date of hatching
- weight at hatching
- hatching success
- growth rate (measured every two-four days)
- fledging weight
- fledging age
- fledging success

The observations on breeding chronology and success can be compared with ongoing monitoring of Pigeon Guillemot nesting in Prince William Sound and Kachemak Bay. Additionally the information on egg size and color can be used in future years to assess the potential of using egg characteristics to measure female survival and recruitment.

During the nestling period we will conduct observations on the prey types delivered to chicks. These observations will determine the taxonomic composition of nestling diets at each nest and collectively. These observations will be compared with diet data collected at natural colonies in Prince William Sound and Kachemak Bay (Golet unpubl. ms., Prichard 1997).

c. Captive-rearing of Chicks

Guillemot eggs and chicks will be collected during late June and early July, during the mid- to late incubation period and early chick-rearing period. Eggs and young hatchlings will be collected from nests on the Kenai Peninsula, Kodiak Island, non-oiled portions of Prince William Sound, Southeast Alaska, or other locations in the northern Gulf of Alaska. Collection of eggs will occur late in incubation, when feasible, in order to maximize hatching success. In 1998 we learned that eggs collected later in the incubation period had the highest chances of hatching. Eggs and hatchlings will be transported to the ASLC in electric brooder boxes and incubated in a large cabinet incubator operated by ASLC until they hatch or it becomes clear the eggs are infertile or addled. We will supplement the sample size of guillemot chicks hatched from eggs with guillemot chicks collected from nests shortly after hatching in order to meet target sample sizes for numbers of chicks raised in captivity and released at ASLC. We will not collect chicks older than 10 days post-hatch because chicks translocated later in the nestling period display philopatry to the location of hatching, instead of fledging (Serventy 1967, Fisher 1971).

The source colonies for eggs or hatchling guillemots will be primarily on the Kenai Peninsula, Kodiak Island, Southeast Alaska (near Juneau) and non-oiled portions of Prince William Sound. Collection sites will be selected based on the numbers of breeding pairs at each colony and the accessibility of individual nests. The proposed area where collections will occur has more than an adequate breeding population of Pigeon Guillemots to support the collections we propose without a detectable impact on existing colonies. We will collect a minimum of 60 guillemot eggs or very young chicks during the 2000 breeding season with the goal of successfully raising and releasing at least 40 captive-reared fledglings into the wild at ASLC. These minimum sample sizes are realistic given the numbers of eggs collected and hatched at the SeaLife Center in 1999, and the number of hatchlings collected in FY 99. When two-egg clutches are encountered in the field, we will collect both eggs in the clutch in order to enhance the incidence of clutch replacement at source colonies. Assuming a level of philopatry similar to that observed for Black Guillemots (Divoky, in prep.), 35% of fledging guillemot chicks should ultimately return to ASLC from the 2000 cohort, providing at least14 potential recruits to local breeding colonies. If all surviving captive-reared guillemots recruit at the natal location, a colony of > 20 breeding pairs should be present by 2004, even if the sites do not attract immigrants from other natural colonies before that time.

d. Release of Captive-reared Chicks

Guillemots fledge at night as early as 30 days after hatching, with most fledging after 35 days (Hayes 1995). Fledglings are able to fly at the time of nest departure, are close to adult size, and are independent of parental care after they fledging. When captive-reared chicks reach 32 days of age, they will be moved in their containers to the roof of ASLC. The covers will be removed from the buckets after sunset and chicks provided the opportunity to fledge. To insure that no predation by gulls or other avian predators occurs, project personnel will attend the chicks whenever they are on the roof. Fledglings will be taken to the roof nightly until all have fledged. Fledglings will be banded with a stainless steel U.S. Fish and Wildlife band and a unique combination of color polyvinyl chloride bands to allow individual identification at a distance. The latter will be sealed with an adhesive to reduce band loss.

e. Assessment of Size and Productivity of Pigeon Guillemot Colonies in Resurrection Bay

A census of guillemot colonies in Resurrection Bay and adjacent areas will facilitate understanding of the conditions contributing to the establishment of artificial colonies near ASLC. Immigration constituted the majority of recruits at a colony of Black Guillemots in arctic Alaska that was enhanced using artificial nest sites, and Pigeon Guillemots fledging from local natural colonies in Resurrection Bay that have yet to breed can be expected to prospect the sites near ASLC. To assess the size of these potential source populations and their annual productivity we will attempt to census as many local colonies as possible in 2000 and, when possible, determine breeding productivity. If Pigeon Guillemot nests at these colonies are accessible, we will band nestlings. Resightings of these guillemots at ASLC will provide information on dispersal distance for this species. Inter-colony visits are common for pre-breeding alcids (Harris 1983, Kress and Nettleship 1989), and in 2000 we will search these colonies for banded individuals that were raised in captivity at ASLC in 1998 and 1999.

Objective 2. Validation and Calibration of Nondestructive Biomarkers for Monitoring the Health and Exposure to Oil of Guillemots

a. Measurement of Certain Blood Biomarkers of Petroleum Hydrocarbon Exposure

In the third year of this study (FY 00), research on blood biomarkers of oil exposure will include controlled dose-response experiments with weathered Prudhoe Bay Crude Oil (PBCO). We will also determine the time course of biomarker response to ingestion of PBCO, including the time post-ingestion when biomarker induction is no longer detectable. At 20, 25, and 30 days post-hatch, we will feed guillemot chicks small, sublethal doses of weathered PBCO in number 2 gelcaps that are inserted into the abdominal cavity of a fish that is then fed to the nestling. Eight guillemot nestlings raised on herring (see below) will be assigned to each of the following oil ingestion treatments: control, 0.5 ml of weathered PBCO, and 1.0 ml of weathered PBCO. Control chicks will receive 1 ml of corn oil in a number 2 gelcap inserted in a food fish. We know from previous experiments (Prichard et al. 1997) that a dose of 0.2 ml of weathered PBCO ingested three times during the latter part of the nestling development period does not have a significant effect on growth of Pigeon Guillemots. Consequently, these doses are designed to produce slight effect on post-natal growth.

Just before and following ingestion of the oil dose, we will collect 1 ml of blood in heparinized vials by puncturing the jugular vein. Blood samples will be collected at 0 h, 12 h, 24 h, and 48 h post-ingestion of oil. Previous experiments (Prichard 1997) indicate that there is no significant difference in most blood biomarker levels five days after oil dosing, so this time course of blood samples is designed to reveal the time course of biomarker induction from crude oil ingestion. Blood samples will be kept cool and centrifuged at 3,000 rpm for 20 minutes. Plasma will then be removed with a pipette and stored in snap-top plastic vials at -20°C for laboratory analysis at the University of California Davis. In the lab, we will measure haptoglobin and other acute phase protein levels in plasma samples in order to determine dose-response and time course of the response. Assays for blood biomarkers will be conducted in the laboratory of Dr. Scott Neuman at UC Davis. Blood biomarker levels will be compared among the control chicks raised on the three diets (see below) to assess the role of diet in determining baseline biomarker levels, relative to induction caused by ingestion of PBCO.

b. Measurement of Biomarkers in Excreta

In addition to collection of blood samples, samples of excreta will be collected over 24-h intervals each day after the initial dosing of PBCO in order to measure fecal porphyrin levels and determine dose-response and time course of response. As with blood biomarkers, responses in fecal porphyrin levels will be compared among the three diet groups. Measurements of fecal porphyrins in excreta will be conducted in the laboratory of Dr. Larry Duffy at the University of Alaska Fairbanks.

Objective 3. Captive Feeding Trials to Assess the Relationship between Diet and Postnatal Development in Guillemots

a. Comparison of Guillemot Growth Performance on Diets of High-lipid or Low-lipid Schooling Forage Fish

In FY 00, 8-12 guillemot chicks will be raised on each of three diets: (1) 180 g of herring per day, (2) 180 g of sand lance per day, or (3) 180 g of juvenile walleye pollock per day. All of these prey species are major components of guillemot chick diets at certain sites and the three species are representative of the two very different lipid levels in guillemot prey. These daily rations are designed so as to provide a variety of caloric and lipid consumption rates that are within the normal range experienced by guillemot nestlings, but biomass consumption rates would be the same for each diet group. Herring and sand lance are representative of high-lipid forage fishes with relatively high energy densities. Juvenile walleye pollock are representative of low-lipid forage fishes with relatively low energy densities. Each chick will be kept in a separate cage so that food consumption can be monitored individually. The daily rations will be provided to most chicks in four daily feedings of 45 g each at about 10:00, 13:00, 16:00, and 19:00 ADT.

Chicks will be fed a mixed diet of herring, sand lance, and pollock *ad libitum* until they are 10 days old. Then they will be switched to their respective diets until they are 30 days old. Between 30 days and fledging they will be fed *ad libitum* again, but only the type of forage fish that they were fed from 10-30 days post-hatch. Younger chicks (10-15 days post-hatch) will not be able to consume 180 g/day of their respective diets, especially those on high-lipid diets. Consequently, we will feed chicks 120 g/day when they are 10-11 days old, 140 g/day at 12-13 days old, 160 g/day at 14-15 days old, and 180/day thereafter. Each day prior to the first feeding the body mass, wing length, and outer primary length of each chick will be measured until each captive-reared chick fledges into the wild, at about 35-40 days post-hatch. Return rates of sub-adults in the fourth year of this study will allow us to assess the role of pre-fledging nutrition and fledging mass on subsequent post-fledging survival.

CY 2001

In 2001 none of the direct restoration activities listed above for 2000 will be conducted, but after 2000 we will attempt to locate guillemots that were raised at the Alaska SeaLife Center at regional colonies during our surveys.

Approval of the field protocols for work with live birds described in this DPD have been obtained from the Institutional Animal Care and Use Committee at Oregon State University and from ASLC. Any take of eggs or incidental/unintentional take of nestling or adult guillemots will be covered by relevant Federal and State Scientific Collecting permits. All fledgling, captive-reared guillemots released to the wild will be banded with USFWS stainless steel leg bands and polyvinyl colored leg bands under a Master Station banding permit held by the Oregon Cooperative Fish and Wildlife Research Unit.

C. Contracts and Other Agency Assistance

Laboratory analyses of the biochemical composition and energy content of forage fishes fed to captive guillemots and the proximate composition of chick carcasses will be conducted in the laboratory of the PI at Oregon State University.

Analyses of biomarkers in blood plasma and fecal samples will be conducted in the labs of Dr. Scott Neuman at the University of California Davis and of Dr. Lawrence K. Duffy at the University of Alaska Fairbanks, where the expertise is available to perform these tasks.

SCHEDULE

A. Measurable Project Tasks for FY 00 (February 1, 2000 - January 31, 2001

May 1 - May 15: Install artificial nest sites, decoys, and playback sound equipment at SeaLife Center.

May 15 - September 10: Collect field data on guillemot use of artificial nest sites, raise guillemot nestlings in captivity, conduct captive rearing experiments, and release captive-reared fledglings.

Sept. 10 - Dec. 31: Enter, analyze, and interpret field data and data collected from captive-reared chicks. Conduct laboratory analyses of plasma samples, diet samples, and chick carcass samples.

January 1 - 14:Prepare for Annual Restoration Workshop

January 15 - 24: Attend Annual Restoration Workshop and present FY 00 results to peer reviewers.

Jan. 24 - April 14: Prepare 2000 annual report of findings.

April 15: Submit annual report (FY 00 findings)
Submit FY 01 DPD to Trustee Council

B. Project Milestones and Endpoints

FY 00

May 15, 2000 — Installation of artificial nest sites, decoys, and audio equipment near the Alaska SeaLife Center

September 10, 2000 — Completion of third and final field season, release of third cohort of captive-reared nestlings, collection of blood and fecal biomarker samples for dose-response experiment, completion of captive-feeding trials comparing nestling growth performance on high lipid and low-lipid schooling forage fishes.

April 15, 2000 — Completion of third annual report of findings

FY 01

June 30, 2001: — Completion of M.S. thesis

September 30, 2001 — Completion of Objectives 2 and 3 and submission of manuscripts addressing these objectives

C. Completion Date

The anticipated completion of this project will be early in FY 02, at the end of calendar year 2001. This will allow adequate time to complete data analysis, thesis preparation by the Masters student, and manuscript preparation and submission following the last field season in 2000 and completion of laboratory analysis early in 2001.

PUBLICATIONS AND PROJECT REPORTS

The following publications are projected for this research project (this is a rough projection and by no means complete):

An annual report for the third year of this project will be submitted by 15 April 2001. The final report for this project will be submitted 15 December 2001. At least three manuscripts will be generated from this research, and all will be published in the peer-reviewed scientific literature. Each of these three manuscripts will address one of the three major objectives/hypotheses of this study: (1) guillemot colony establishment as a direct restoration technique, (2) biomarkers as a means of assessing exposure of guillemots to crude oil, and (3) diet as a factor in nestling growth and post-fledging survival. A portion of the final report will be excerpted from the thesis of the M.S. student on this project. This student will be strongly encouraged and directly assisted by the PI to submit for publication in the peer-reviewed scientific literature the results from this research.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The research described in this proposal takes advantage of the new research facilities and potential represented by the Alaska SeaLife Center and dove-tails nicely with continuing research as part of the APEX and NVP projects that assesses factors limiting recovery of Pigeon Guillemot populations damaged by EVOS. It is also relevant to efforts toward developing seabird models as upper trophic level sentinels of oil pollution in nearshore ecosystems. The proposed research approach utilizes growth performance, fledgling body condition, and blood and fecal biomarkers to assess the health status of guillemot nestling exposed to oil and raised on different diet rations. These data are essential for developing techniques for long term monitoring of the health and status of guillemot populations in the EVOS area.

Studies of foraging, reproduction, and population recovery following the EVOS are on-going for pigeon guillemots. This proposal complements and enhances other studies on pigeon guillemots, without duplication of effort. The PI on the present proposal has been and will continue to work closely with David Irons and Greg Golet (PIs on APEX Component 00163 F "Factors Affecting Recovery of PWS Pigeon Guillemot Populations"), Dave McGuire (Co-PI on NVP studies of biomarkers of oil exposure in guillemot nestlings), and John Piatt (PI on APEX Components 00163 M "Lower Cook Inlet Forage Fish Studies" and 99163 N "Black-legged Kittiwake Feeding Experiment") in developing protocols for collecting data.

PRINCIPAL INVESTIGATOR

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The PI has extensive experience with studies of the reproductive biology of high latitude seabirds and the relationship between diet composition and productivity. He is currently the PI of the Seabird Energetics component (Component G) of the APEX Project and Co-PI of the Diet Quality and Chick Growth component (Component N) of the APEX Project. He has been involved in research on the factors constraining recovery of Pigeon Guillemots in the EVOS area for the last four years.

OTHER KEY PERSONNEL

Revisic 7-8-99
approved TC 8-9-99

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$0.0						
Travel		$0.0						
Contractual	$150.1	$161.1						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$150.1	$161.1			Estimated FY 2001	Estimated FY 2002		
General Administration		$11.3						
Project Total	$160.6	$172.4			$93.6			
Full-time Equivalents (FTE)	1.3	1.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00 costs are higher than were estimated. The difference is mostly in higher transportation costs within Alaska to collect guillemot eggs and chicks for rearing back at the SeaLife Center.

Not included in this budget are Bench Fees for the Alaska SeaLife Center, currently estimated at $18,874.

Project Total: $ 172.4
+ 20.4 ASLC Bench fees
$ 192.8

FY00

Prepared: 7/8/99

Project Number: 00327
Project Title: Pigeon Guillemot Restoration Research at the Alaska SeaLife Center
Agency: DOI: U.S. Geological Survey

FORM 3A
TRUSTEE
AGENCY
SUMMARY

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

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
						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 2000
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

FY00

Project Number: 00327
Project Title: Pigeon Guillemot Restoration Research at the Alaska Sealife Center
Agency: DOI: U.S. Geological Survey

FORM 3B
Personnel
& Travel
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed
Description	FY 2000
4A Linkage	~~160.6~~ 161.1
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	~~$160.6~~ 161.1

Commodities Costs:	Proposed
Description	FY 2000
Commodities Total	$0.0

FY00

Prepared: 7/8/99

Project Number: 00327
Project Title: Pigeon Guillemot Restoration Research at the Alaska Sealife Center
Agency: DOI: U.S. Geological Survey

FORM 3B
Contractual &
Commodities
DETAIL

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

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

FY00

Project Number: 00327
Project Title: Pigeon Guillemot Restoration Research at the Alaska Sealife Center
Agency: DOI: U.S. Geological Survey

FORM 3B
Equipment
DETAIL

Prepared: 7/8/99

4/15 changes

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$33.3						
Travel		$15.4						
Contractual		$62.8						
Commodities		$14.9						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$126.4			Estimated FY 2001	Estimated FY 2002		
Indirect		$34.7						
Project Total	$0.0	$161.1						
Full-time Equivalents (FTE)		1.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

42.5

Indirect rate for OSU in FY00 is 43% of Modified Total Direct Cost (MTDC=Direct cost- assistanceship and equipment) on-campus research rate and 26% of MTDC off-campus research rate.

Indirect rate: $9195 + $25,495 = $34,690

1. FY00 On-Campus direct costs=$27,305, which includes office salaries, benefits, meeting travel, office support. FY00 Modified direct costs (less tuition, equipment)= $21383

43% of $21383= $9195

2. FY00 Off-campus direct costs= $98,059, which includes field salaries, benefits, field travel, and field housing. FY00 Modified direct costs (less tuition, equipment)= $98,059

26% of $98059= $25,495

Not included in this budget are bench fees for the Alaska SeaLife Center, which are currently estimated at $18,874.06.

FY00

Prepared: 7/8/99

Project Number: 00327
Project Title: Pigeon Guillemot Restoration Research at the Alaska Sealife Center
Agency: DOI: U.S. Geological Survey

FORM 4A
Non-Trustee
SUMMARY

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

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 2000
graduate research assistant			12.0	2.3		27.6
research assistant, field			3.0	1.9		5.7
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		15.0	4.2	0.0	
					Personnel Total	$33.3

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Corvallis, OR to Seward, AK	0.7	5			3.5
Seward, AK to field sites for egg collection	0.5	16	30	0.1	11.0
					0.0
presntation at EVOS Restoration Workshop	0.6	1	3	0.1	0.9
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$15.4

FY00

Project Number: 00327
Project Title: Pigeon Guillemot Restoration Research at the Alaska Sealife Center
Agency: DOI: U.S. Geological Survey

FORM 4B
Personnel
& Travel
DETAIL

P 'ed: 7/8/99

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

Contractual Costs:	Proposed
Description	FY 2000
Personal Services Contract to George Divoky	35.0
Housing in Seward for 3 persons (4 mo @75$/day)	9.9
duplication/computer fees	1.2
lab analyses of blood and excreta samples for biomarkers (L. Duffy, UAF)	10.0
samples shipping	1.0
publication- reports and visual aids	1.5
vehicle rental Anchorage to Seward	1.1
field equipment maintenance	1.3
phone services- long distance charges	1.8
Contractual Total	$62.8

Commodities Costs:	Proposed
Description	FY 2000
cages for chicks raised in captivity	0.5
nest boxes, articial nest sites	1.7
decoys, playbacks, other social attractants	1.6
egg collecting equipment	0.6
incubators	0.3
blood sample collection supplies	2.5
food for personnel at Seward (3 persons, 16 wk@$200/wk)	4.5
Ohaus top-loading balance, battery-powered	2.2
food for chicks	0.4
bands and banding supplies	0.6
miscellaneous supplies for captive rearing	
Commodities Total	$14.9

FY00

Prepared: 7/8/99

Project Number: 00327
Project Title: Pigeon Guillemot Restoration Research at the Alaska Sealife Center
Agency: DOI: U.S. Geological Survey

FORM 4B
Contractual &
Commodities
DETAIL

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	

FY00	Project Number: 00327 Project Title: Pigeon Guillemot Restoration Research at the Alaska Sealife Center Agency: DOI: U.S. Geological Survey	FORM 4B Equipment DETAIL

Prepared: 7/8/99

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$0.0						
Travel		$0.0						
Contractual		$19.1						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$19.1			Estimated FY 2001	Estimated FY 2002		
General Administration		$1.3						
Project Total	$0.0	$20.4						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Prepared:

Project Number: 00327
Project Title: Pigeon Guillemot Research -- ASLC Bench Fee Component
Agency: DOI-USGS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Approved TC 8-9-99

Mass-Balance Model of Trophic Fluxes in Prince William Sound

Project Number:	00330-CLO
Restoration Category:	Research
Proposer:	D. Pauly/UBC
Lead Trustee Agency:	NOAA
Cooperating Agencies:	None
Alaska SeaLife Center:	No
New or Continued:	Cont'd
Duration:	3rd yr. 3 yr. project
Cost FY 00:	$25.3
Cost FY 01:	$0.0
Cost FY 02:	$0.0
Geographic Area:	Prince William Sound
Injured Resource/Service:	All

ABSTRACT

This project will provide an additional year of funding for Project /330, under which a food-web model of Prince William Sound was constructed and initially disseminated. The food web model forms the core of a prototype CD-ROM, which also includes food web models from three other aquatic ecosystems of Alaska, user-friendly databases on the biology and local/traditional knowledge of the marine organisms of Prince William Sound, and links to related information and resource agencies. In FY 00, this project will (a) produce a final version of the CD-ROM and distribute it to resource managers, schools, communities, and the general public, (b) provide hands-on guidance and education on food-web based management approaches to resource managers and other potential users, and (c) publish several articles in peer reviewed scientific journals.

INTRODUCTION

The purpose of this project, *Mass Balance Model of Trophic Fluxes in Prince William Sound* (BAA-330), is to synthesize ecosystem information collected since the 1989 EVOS. A computer model of the PWS food web was constructed with empirically-based estimates resulting from the EVOS research program. The purpose of constructing this model was to address system-wide questions, build a cohesive picture of the structure and flows of the biotic portion of the ecosystem, and enable ecosystem-based assessment and management of the natural resources of PWS. The model was constructed with the widely-used Ecopath software (Christensen and Pauly 1992a, b, 1995, 1998, Pauly and Christensen 1993, Pauly and Christensen 1995, and other authors in Christensen and Pauly 1996). The model has undergone refinement, and it has been presented to scientists and resource managers and disseminated to a broader audience of educators and the general public in Alaska. The following lists summarize our accomplishments:

Completed Objectives

- Prepared and held a one-week model specification workshop;
- Built a food web model of the interactions of the APEX community members;
- Built a food web model of the interactions of the NVP community members;
- Built a food web model of the interactions of the SEA community members;
- Integrated the three food webs into two, large-scale models of the interactions of the communities;
- Interacted with experts and modify Ecopath mass-balance model until consensus on trophic interactions in PWS and adjacent waters is reached;
- Entered biological information, local names in local languages, and local knowledge (so far published) on PWS region fishes and other Alaskan fishes into FishBase;
- Linked the Ecosim module of the PWS model with an existing model of PWS capable of predicting primary production, and thus drive the trophic interactions in Ecosim;
- Prepared a CD-ROM with Ecopath/Ecosim model(s) of PWS, and a database on the fishes of the PWS region;
- Presented the project and its products at every opportunity, especially at conferences and in the primary literature.
- Enabled the models to be run in a spatially-explicit manner using Ecospace by expressing spatial distributions of organisms.

Objectives still in preparation

- Prepare and hold a workshop to present and disseminate the CD ROM product, and teach its use;
- Modify PWS Ecopath model such that seasonal changes are explicitly considered when establishing mass balance;

Objective deleted during FY99 contract refinement

- Use essentially the same method to construct an Ecopath model of the Kenai Shelf and the Outer Cook Inlet;

Project Milestones and Endpoints for FY99 (progress to date)

Nov. 1998:	Incorporation of explicit seasonally into PWS Ecopath Model and submission of scientific paper on subject **(Martell et al., in prep.);**
Jan. 1999:	*Holding of Model Specification Workshop* **(task deleted; see above);**
Mar. 1999:	Presentation of results at EVOS 10 year legacy conference **(completed);**
May. 1999:	*Publication of Shelf model report* **(task deleted; see above);**
Jun. 1999:	Submittal of scientific papers documenting key features and behavior of trophic mass-balance models including Ecospace paper **(Okey and Pauly, in press.; Okey et al., in prep.; Martell et al., in prep.; Hulbert et al. in prep.; Purcell et al. in prep.;** ***also see*** **Okey and Pauly 1998, 1999);**
Sep. 1999:	Final dissemination of project results and products

The overall project is on schedule, even though one task (seasonal model) was shifted from November 1998 to summer 1999. In fact, this project will likely result in several more scientific papers than were originally expected (e.g., see list above).

By working with the various experts, we achieved a broad and inclusive ecosystem synthesis of the larger Prince William Sound and insights into the changes within it. This broad participation, and the collaborative process complimented existing EVOS research and provided ecosystem-level insights into both the structure and function of PWS and the effects of EVOS and other perturbations. The Prince William Sound Ecopath model is described in detail by the various contributors in Okey and Pauly (1998 and 1999) and the collaborative approach used to create it, as well as some epistemological implications of this approach, are described in Okey and Pauly (in press.).

NEED FOR THE PROJECT

A. Statement of Problem

See the FY99 proposal for a statement on the need and usefulness of an integrated, ecological approach involving Ecopath modelling. This section describes the need for the three proposed closeout tasks listed under Objectives in the Project Design section.

CD ROM of Alaska's Aquatic Ecosystems. – The initial success of the prototype CD ROM we distributed in Anchorage and Seward during the past month lends credence to the notion that such a CD ROM is an ideal vehicle with which to disseminate the results of this synthesis of EVOS-generated ecosystem information. We received very positive feedback from attendees of the Legacy of an Oil Spill Symposium, from researchers at the Alaska Sealife Center (where the acting director of education is interested in building an interactive kiosk using the PWS model where visitors can perform simulations; Jim Pfeiffenberger, Alaska Sealife Center, personal communication), and from representatives of public schools (Jennifer Childress, Chugach School District, personal communication), public trustee agencies (Glen Hart, Kenai Fjords National Park, personal communication), private educational providers (Leslie Hines, Kenai Fjords Tours, personal communication), resource management agencies (Joe Sullivan, Alaska Department of Fish and Game, personal communication), native educational and research organizations (Robert Patrick, Aleutian / Pribilof Islands Association, personal communication), an interagency library (Carrie Holba, ARLIS library, personal communication). These are a few examples of cases in which this CD ROM is being considered for use. Furthermore, program developers of the native organization Chugachmiut consider this CD ROM to be ideal for their educational programs (Sandy Wasilli, Chugachmiut, personal communication), and they will begin using it right away, even before the final version of the CD ROM is available.

Production of the prototype CD ROM required the full funding budgeted for this item in FY99. We are already receiving feedback that will guide us through refinements to produce an excellent product, and it appears that it would be widely used given additional funding to enhance the product for research and educational purposes. We believe that we and the EVOS trustees have an excellent opportunity to bring some synthesized EVOS results together with students, communities, and resource managers and planners.

Guidance for resource managers and other users. – The opportunity presented by the results of this ecosystem synthesis program will be realized through the use of the Prince William Sound model in management and educational situations, whether or not the CD ROM is the main vehicle for dissemination. The PWS model and the accompanying Ecopath/Ecosim/Ecospace software provides a useful tool for ecosystem-based management that compliments the toolbox currently used by fishery managers. However, inertia and skepticism will likely prevail until managers become familiar with the potential uses of the approach (Mundy and Gunther 1999, and Philip Mundy, Fisheries and Aquatic Sciences, pers. comm.). A number of individuals have been shown this approach in person and at the workshops held over the previous year.

The objective of preparing and holding a workshop to present and disseminate the CD ROM product and teach its use (objective 11: EVOS restoration proposal 99330) has been partially accomplished through four venues: the 16th Lowell Wakefield Symposium, the Legacy of an Oil Spill Symposium, one-on-one training sessions with interested individuals, and the 5 October 1998 workshop in Anchorage (Okey and Pauly 1998, 1999). Additional workshops for resource managers would provide additional opportunities for agencies to adopt this approach as a compliment to managing exploitation of the living resources in their trust. Although it is a challenging task to persuade managers to adopt new methods, it is worthwhile to provide guidance and educational outreach on the Ecopath approach (Phillip Mundy, Fisheries and Aquatic Sciences, pers. comm.). This is especially true given widespread calls for instituting approaches for ecosystem-based management (NMFS 1999; Keller, in press.).

A budgetary oversight was made by the project coordinator for 99330 (Thomas Okey) in failing to propose travel costs for this objective in the FY99 budget. Furthermore, it is unlikely that left-over funds from 99330 will be available for this task based on an up-to-date analysis (Ann Tautz, UBC Fisheries Centre Administrator, pers. comm., 9 April 1999). Options to remedy this situation include addition of the travel costs for a workshop in an FY00 budget (see attached budget), and utilization of funds from EVOS synthesis project 300 (Andy Gunther, Applied Marine Sciences, pers. comm., 12 April 1999). Considering the interest that has developed in the CD ROM product, including the PWS Ecopath model, within certain sectors of the educational and NGO communities (see above), it is possible, and may be worthwhile, to conduct a workshop tailored to these communities in addition to the workshop for the resource management communities. Use of the CD ROM and model by these public-user sectors has the potential to influence rates of acceptance by resource management agencies.

Manuscript preparation and publication. – Two publications have already resulted from this synthesis project (Okey and Pauly 1998, and In press). Several more publications are in preparation, and others have been conceptualized (see Publications and Reports section below). This project has resulted in good opportunities for publications by contributors to the model because of insights revealed through this approach to ecosystem synthesis. However, these opportunities will be under-exploited without closeout funds for project staff to catalyze publication ideas and continue to guide this successful collaborative process. We are aware that the trustee council may contribute 1.5 months of personnel time per manuscript plus $1,000 in page costs per project in order to ensure that information is disseminated. However, we are not requesting funding explicitly for this purpose at this time, in order to keep our current request small, and with the assumption that we will be able to lend some focus to these manuscripts given the closeout funding requested herein.

B. Rationale / Link to Restoration

See the FY99 proposal for a general discussion on rational for applying a collaborative version of the Ecopath approach in the Prince William Sound setting. The rational for the current request is to ensure that results are optimally presented and disseminated.

C. Location

The area covered by the Ecopath model is Prince William Sound. The CD ROM of Alaska's Aquatic Ecosystems includes Ecopath models of the Bering Sea, the Alaska Gyre, and Lake Becharof in addition to Prince William Sound. Other resources on the CD ROM, such as Alaska Fishbase, links to other programs, and the Alutiiq dictionary, cover broader areas of Alaska. Distribution of the final CD ROM will be focused on the south-central region of Alaska.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Native organizations of the Prince William Sound Region such as Chugachmiut are very interested in using the CD ROMs in their educational programs (Sandy Wasilli, personal communication; also see Statement of Problem above). These and other organizations are particularly interested in the TEK resources that have been included on the CD ROM. They are not only interested in using our product, but they have interest in making further contributions to it as we move towards the final version. School teachers and educational program administrators have also expressed interest in this product for their science education programs. We believe that this analytical tool (the PWS Ecopath model) and the accompanying CD ROM can ultimately result in communities having a more direct involvement in managing exploitation of natural resources within state and federal science and management structures, as this approach provides a functional conduit for multi-directional flows of ecosystem knowledge.

PROJECT DESIGN

A. Objectives

Three closeout tasks are proposed for this final period:

1. Produce a final CD ROM product for the public domain including resource managers and educational purposes. Refinements will be based on feedback from the completed distribution of the prototype CD ROM;
2. Provide hands-on guidance and education on the Ecopath approach to resource managers and other potential users (implementing objective 11 identified in 99330); and
3. Publish several articles in peer-reviewed scientific journals and reports, which are currently planned, in preparation, in review, or in press.

B. Methods

Refer to our FY98 and FY99 project proposals for specific methodologies of developing an ECOPATH model. The following paragraphs focus on the basic methods of accomplishing the closeout tasks specified in the introduction section of the current proposal.

CD ROM of Alaska's Aquatic Ecosystems - The prototype CD-ROM, *Alaska's Aquatic Ecosystems,* has been produced and was distributed to resource managers, researchers, educators, and community organizations over the last month (see Introduction). It is a vehicle for much of the work in this project including the working PWS ECOPATH model including ECOSIM and ECOSPACE, databases of Alaskan fishes, a native language dictionary of terms related to the PWS ecosystem, and other related resources. This CD-ROM was completed in time for the 10^{th} annual EVOS workshop as proposed with all the planned components (see FY99 proposal and attached CD ROM).

Production of a final CD ROM product will be accomplished by incorporating feedback from the initial round of CD ROM distribution. We have already begun receiving feedback on the prototype version and we are looking forward to building a product that will be even easier to use, and one that is enhanced with more photographs, videos, web resources, and educational features. This will involve design refinements and active networking in addition to incorporation of feedback. A student intern will be employed for two months to gather and organize the information and electronic components to be included on the final CD ROM, under supervision. A computer media production specialist will then be employed for two months to conduct final construction and refinements to the prototype CD ROM. This is a similar process to that used for construction of the prototype version.

The University of Alaska Sea Grant has expressed interest in helping to distribute the final CD ROM (Brenda Baxter, pers. comm., February 1999), and the EVOS restoration office could also serve as a conduit for distribution to investigators, agencies, and other interested parties through the restoration newsletter (Stan Senner, pers. comm., 9 April 1999). Opportunistic exploratory research on the interest of school districts and educational organizations would also be conducted.

Guidance for resource managers and other users – There will be opportunities to organize a workshop for the purpose of introducing professional resource managers to the Prince William

Sound model and the Ecopath approach. This may lead to the adoption this tool by managers who wish to compliment their assessment and management methods with an approach to ecosystem-based management. Potential participating agencies and individuals will be contacted, and a training workshop will be held during the fall or winter of 1999 / 2000. Both the PI and the project coordinator will conduct this workshop, with the cooperation of other interested program personnel. (e.g., Philip Mundy, Andy Gunther, etc.). Certain funding alternatives (see Statement of Problem) may enable such a workshop to be conducted during summer of 1999, however, this will depend on the travel schedules of individuals involved.

Manuscript preparation and publication – Project staff will continue working collaboratively with model contributors to finish manuscripts that have been started, and to identify other insights about Prince William Sound revealed by the model, which are worth pursuing as publications. The UBC project staff will provide organizational leadership for manuscripts in cases where contributing researchers have limited time.

SCHEDULE

A. Measurable Project tasks for FY 00

October 1999:	Produce and distribute final CD ROM with PWS model, etc.
Fall/Winter 1999:	Training workshop for interested agency(ies)
Summer 1999 / Summer 2000:	Submittal and publication of manuscripts

B. Project Milestones and Endpoints

Closeout Milestones (in addition to required annual reports):

October 1999:	Produce and distribute final CD ROM with PWS model, etc.
Fall/Winter 1999:	<u>Possible</u> training workshop for interested agency(ies)
July 1999:	Submission of: Okey et al. (in prep) to Ecological Applications
August 1999:	Submission of: Martell et al. (in prep) to Ecological Modeling
November 1999:	Submission of: Hulbert et al. (in prep)
February 1999:	Submission of: Purcell et al. (in prep)

C. Completion Date

Most tasks will be complete before the end of 1999, but we expect that some manuscripts will not be submitted until summer of the year 2000.

PUBLICATIONS AND REPORTS

Hulbert, L., K. Y. Aydin, B. A. Wright, and T. A. Okey. In prep. Ecological implications of increasing shark populations in PWS: simulations using an Ecopath model. Target Journal: ?

Martell, S., T. A. Okey, C. J. Walters, T. Pitcher and D. Pauly. In prep. A seasonally-explicit model of Prince William Sound, Alaska. Target Journal: Ecological Modelling

Okey, T. A. and D. Pauly, (eds.). 1998. A Trophic Mass-Balance Model of Alaska's Prince William Sound Ecosystem, for the Post-Spill Period 1994-1996. Fisheries Centre Research Report 6(4), University of British Columbia, Vancouver, Canada. 144 p.

Okey, T. A. and D. Pauly, (eds.). 1999. A Trophic Mass-Balance Model of Alaska's Prince William Sound Ecosystem, for the Post-Spill Period 1994-1996. Exxon Valdex Oil Spill Restoration Project Annual Report (Restoration Project 98330), Fisheries Centre, University of British Columbia, Vancouver, Canada. 144 p.

Okey, T. A. and D. Pauly. In press. A mass-balanced model of trophic flows in Prince William Sound: decompartmentalizing ecosystem knowledge. *In:* S. Keller (ed.), Ecosystem Approaches for Fisheries Management, University of Alaska Sea Grant, AK-SG-99-01, Fairbanks.

Okey, T. A., T. A. Dean, T. Cooney, R. J. Foy, J. Bodkin, and D. Pauly. In prep. Trophic cascades in the Prince William Sound Ecopath model: revelations or artifacts? Target journal: Ecological Applications

Purcell, J. E. and T. A. Okey. In prep. Simulations of zooplanktivore populations using an Ecopath model: forage fish versus jellyfish in Prince William Sound, Alaska. Target journal: Marine Ecology Progress Series

PROFESSIONAL CONFERENCES

The results of this ongoing project have been presented at the following symposia:

Legacy of an Oil Spill Symposium: 10 years after the Exxon Valdez. 1999. "The food web of Prince William Sound: an Ecopath toward ecosystem-based management."

16th Lowell Wakefield Fisheries Symposium; Ecosystem Considerations in Fisheries Management. 1998. "A mass-balance model of trophic flows in Prince William Sound"

In addition to the presentations listed above, several workshops were conducted during the course of the work (see previous proposals) and additional training workshop(s) are planned in the current proposal. Presentations of this work at additional professional conferences is likely, as publications continue to spin off from this project. However, no funding is currently requested for this purpose.

COORDINATION AND INTEGRATION OF RESTORATION EFFORTS

The aim of the proposed work is to synthesize data from projects funded by the Trustee council and to disseminate results to resource managers, and for educational purposes. The PWS Ecopath model resulted from a broad collaborative effort across numerous agencies (Okey and Pauly 1998, 1999, in press).

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

We were successful in producing a refined Ecopath model of PWS (Okey and Pauly 1998, 1999, in press) and a prototype CD ROM for distribution of the model and software to interested and appropriate parties. Funds are needed to carry this work through to a successful completion by providing the means to disseminate the results of the project including a final version of the CD ROM and publications in peer-reviewed scientific journals.

PROPOSED PRINCIPAL INVESTIGATOR

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PRINCIPAL INVESTIGATOR

Dr. Daniel Pauly - The key qualifications of Dr. Pauly are having initiated, while still at ICLARM, Manila, Philippines, the activities which led to the emergence of the Ecopath approach and software, and of FishBase, and to have authored a large number of primary literature publications documenting these. Further, he has organized several workshops (including one in the Pacific Northwest) and training courses at which the Ecopath approach was taught and used.

OTHER KEY PERSONNEL

Thomas A. Okey, M.S., Project Coordinator / Marine Ecologist, Fisheries Centre, UBC, who will coordinate the development and distribution of the final CD ROM, the Ecopath training sessions for interested agencies, and resulting papers and reports.

Cindy Young, Multi-media Production Specialist, Department of Zoology, UBC, who produced the prototype CD ROM and will produce the final version.

Revision -30-99
Approved TC 8-9-99

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

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$0.0						
Travel		$0.0						
Contractual		$23.6						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$23.6			Estimated FY 2001	Estimated FY 2002		
General Administration		$1.7						
Project Total	$0.0	$25.3						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Prepared:

Project Number: 00330-BAA
Project Title: Mass Balance Model of Trophic Fluxes
Agency: NOAA

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Revision -30-99

FY 00 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000
Personnel	$89,500	$16,780
Travel	$10,090	$0
Contractual	$15,000	$1,831
Commodities	$0	$0
Equipment	$400	$0
Subtotal	$114,990	$18,611
Indirect	$25,011	$5,034
Project Total	$140,001	$23,645
Full-time Equivalents (FTE)	21.1	6.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

	Estimated FY 2001	Estimated FY 2002	Estimated FY 2003		
	$0.0	$0.0	$0.0		

Dollar amounts are shown in thousands of dollars.

Comments:

Indirect costs are for UBC Fisheries Centre, standard UBC contract overheads and cover general services, administration, space and buildings, computer facilities, basic office supplies and communications. They are calculated at the standard UBC contract rates for ' non-commercial government and NGOs' of 30% of the cost of personnel and 2% or travel costs.

NOAA general administration costs of 7% of the total ($1,655) are not itemized in this budget, and should be added to obtain the full cost to the EVOS trustee council ($25,300).

FY 00

Revised: 30 June 1999

Project Number: 330
Project Title: Closeout of Mass-Balance Model of Trophic Fluxes in Prince William Sound
Name: Fisheries Centre UBC

FORM 4A
Non-Trustee
SUMMARY

FY 00 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Personnel Costs:				Months	Monthly		Proposed
	Name	Position Description		Budgeted	Costs	Overtime	FY 1999
[redacted]	Dr. Daniel Pauly	PI - UBC Fisheries Centre	[redacted]	0.4	7500		3,000
	Mr. Thomas A. Okey	Project Coordinator- UBC Fisheries Centre		1.9	4200		7,980
	Ms. Cindy Young	Computer Media Production Specialist		1.9	2000		3,800
	Ms. Amy Poon	graduate student - Pauly		2.0	1000		2,000
							0
							0
							0
							0
							0
							0
							0
							0
		Subtotal	[redacted]	6.2	14700.0	0.0	[redacted]
						Personnel Total	16,780

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FY 1999
[redacted]						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
					Travel Total	0

FY 00

Revised: 30 June 1999

Project Number: 330
Project Title: Closeout of Mass-Balance Model of Trophic Fluxes in Prince William Sound
Name: Fisheries Centre UBC

FORM 4B
Personnel
& Travel
DETAIL

FY 00 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

Contractual Costs:	Proposed
Description	FY 1999
Production of final CD-Rom, Alaska's Aquatic Ecosystems	
Production of 1000 CD ROMs with silkscreen design	891
Four color CD booklet and tray card	165
Four color film	132
Shipping from printers	165
Digitizing video and slides	198
Cost of art production (partially included in Ms. Young's salary)	148
Distribution Costs	132
	0
	0
	0
Contractual Total	1,831

Commodities Costs:	Proposed
Description	FY 1999
Commodities Total	$0.0

FY 00

Revised: 30 June 1999

Project Number: 330
Project Title: Closeout of Mass-Balance Model of Trophic Fluxes in Prince William Sound
Name: Fisheries Centre UBC

FORM 4B
Contractual &
Commodities
DETAIL

FY 00 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1999 - September 30, 2000

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.	**New Equipment Total**		$0.0

Existing Equipment Usage: Description	Number of Units	

FY 00	Project Number: 330 Project Title: Closeout of Mass-Balance Model of Trophic Fluxes in Prince William Sound Name: Fisheries Centre UBC	FORM 4B Equipment DETAIL

Revised: 30 June 1999

00338

approved TC 8-9-99

Survival of Adult Murres and Kittiwakes in Relation to Forage Fish Abundance

Project Number:	00338
Restoration Category:	Research
Proposed By:	U.S. Geological Survey (PI- John F. Piatt)
Lead Trustee Agency:	DOI-BRD
Cooperating Agencies:	DOI-FWS
Alaska SeaLife Center	no
Duration:	3rd year, 4-year project
Cost FY 00:	$59,700
Cost FY 01	$46,400 (data analysis, reporting)
Cost FY 02	$0
Geographic Area:	Cook Inlet, Gulf of Alaska
Injured Resource:	Multiple resources

ABSTRACT

Some seabird populations damaged by the *Exxon Valdez* oil spill 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 banding and resighting to quantify the survival of adult common murres and black-legged kittiwakes.

INTRODUCTION

Some seabird populations in the Gulf of Alaska have undergone marked fluctuations during the past few decades (Hatch and Piatt 1995; Piatt and Anderson 1996), including periods of decline or non-recovery. Ultimately, the ability of injured or declining seabird populations to recover depends on: 1) breeding success, or productivity; 2) fledgling survival and subsequent recruitment; and 3) overwinter survival of adults (Harris and Wanless 1988). Without concurrent measurement of at least two of these three parameters, it is difficult to determine which factor is most limiting to a population's recovery.

Mechanisms that regulate seabird populations by influencing productivity, recruitment, and adult survival are poorly understood, but food supply is clearly important (Cairns 1992). Studies sponsored by the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) in 1995-99 (APEX, Restoration Project 00163) have shown linkages between food supply and population fluctuations. Exactly which parameters of reproductive strategy are driven by food supply, and so drive population fluctuations, remain unclear. To date, APEX has focused on forage fish availability and its relationship to energy expenditure and productivity.

We propose to determine the overwinter survival of adult common murres (*Uria aalge*) and black-legged kittiwakes (*Rissa tridactyla*) using established banding and resighting techniques at two of the colonies (Fig. 1) currently being investigated by APEX. Results of past work show clear differences in prey availability between the two colonies, with forage fish being scarce around Chisik Island and abundant around Gull Island. Both seabird species must work significantly harder at Chisik to provide food to their chicks (Fig. 2). This difference appears to be manifested in sharply reduced kittiwake production at Chisik Island (Fig. 2). Observing that kittiwake populations have been steadily declining at Chisik while increasing at Gull (Fig. 3), one might be tempted to conclude that weak productivity and recruitment are driving the Chisik kittiwake population declines. However, while murres (at least in recent years) have been similarly productive at Chisik and Gull (Fig. 2; J.F. Piatt unpubl. 1997 data), the Chisik Island murre population has historically declined at an even greater rate than the kittiwake population.

From these data we conclude that the murre population decline at Chisik Island and concurrent increase at Gull Island may be attributable to differences in adult survival rates. Measurement of survival rates, in coordination with APEX's focus on food supply, energy expenditure and colony productivity, should help to more completely resolve the mechanisms underlying seabird population fluctuations, particularly for those species such as murres that are able to buffer against periods of food shortage by increasing foraging effort (Burger and Piatt 1990; Irons 1992).

Our continued research will measure adult survival of both murres and kittiwakes at Chisik and Gull Islands. We will use conventional banding/resighting methods to establish both species' adult survival rates. Working in collaboration with the Cook Inlet Seabird and Forage Fish Studies (CISeaFFS) component of the APEX project, we will compare survival between colonies in relation to foraging stress, breeding success, and forage fish abundance. Foraging stress from breeding effort is probably a major contributor to adult overwinter mortality (Golet et al. 1998). Our work will enhance understanding of the relationships among survival, reproduction, and foraging energy expenditure in kittiwakes and murres in lower Cook Inlet. In a broader context, our research will clarify the mechanisms and limiting parameters underlying natural population declines or the failure of injured populations to recover.

NEED FOR THE PROJECT

A. Statement of the Problem

Research has provided few clear examples of how seabird population biology is affected by changes in prey availability (Hunt et al. 1991). Consequently, it has been difficult to understand the non-recovery of some EVOS-damaged seabird populations because natural changes in forage fish stocks may have also contributed to their decline. The picture is further complicated by our inability to pinpoint which aspect of population biology ultimately drives population fluctuations. To determine the cause of population declines or non-recovery, the population's productivity, recruitment, and adult survival should be measured concurrent with evaluation of available food supply (Cairns 1992).

Current EVOSTC-funded work (APEX, Restoration Project 00163M) measures productivity and foraging differences of seabirds in response to fluctuating prey availability. Preliminary results from research conducted in lower Cook Inlet show some correspondence between productivity and forage fish availability to breeders. There is no correspondence, however, in species such as the murre which are able to increase foraging effort in response to decreasing forage fish abundance (Burger and Piatt 1990, Zador and Piatt 1999). Differences in recruitment and/or adult survival are thus implicated as important determinants of population fluctuations. Yet their relative importance has not been established by EVOSTC researchers, despite past work which has shown that variation in either recruitment or adult survival could obscure or even offset population fluctuations apparently driven by productivity differences (Hudson 1985).

Since murres and kittiwakes do not commence breeding until they are several years old (Hudson 1985; Aebischer and Coulson 1990), it is not feasible to measure recruitment in Cook Inlet seabird populations within the time frame required by EVOSTC funding. Measurement of adult overwinter survival has not yet been studied within a complete ecological framework, and has been identified by APEX reviewers as an important topic for expanded research in pursuit of understanding population fluctuations and recovery.

B. Rationale

Population changes are continually being driven by natural ecosystem changes, and are occasionally driven by anthropogenic perturbations such as the *Exxon Valdez* oil spill. In order to separate natural population fluctuations from anthropogenic population changes, we must have a complete understanding not only of the factors which drive population changes (e.g. change in prey availability) but also of the population biology parameter which is most altered by those driving forces. Annual productivity in relation to varying prey availability is currently being studied, but cannot explain all observed population trends. It is not feasible to measure chick survival and recruitment. Therefore, to assess the potential for recovery of seabirds affected by the spill by pinpointing the cause of population trends, a study of adult survival and its relationship to prey availability is required.

In collaboration with the ecosystem-based study of seabird foraging conditions and breeding biology currently being conducted by APEX in lower Cook Inlet (Restoration Project 00163M), we have a unique opportunity to assess not only the role of adult survival in seabird population fluctuations, but also the suspected linkage between foraging effort during the breeding season and adult overwinter survival. By choosing species with different long-term breeding strategies (kittiwakes maintain investment in reproduction at relatively constant [high] levels despite variation in food supply; murres adjust reproductive effort in relation to prey availability by altering buffer or "loafing" time) we will address questions raised by ongoing APEX work that shows linkage between prey availability and population fluctuation in some species (kittiwake) but only implies a linkage in others (murre). Refined understanding of foraging effort in relation to food supply will further our understanding of the costs of breeding in murres and kittiwakes. Stress induced by increased foraging effort in response to poor foraging conditions (Kitaysky et al. 1999a) may explain variation in adult survival.

C. Location

The proposed research will be undertaken in lower Cook Inlet, Alaska. The project's benefits will be realized throughout the EVOS area, in the form of enhanced understanding of seabird population trends and recovery mechanisms. Homer, Alaska is the only community that may be directly affected by the proposed research (as detailed below).

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

Gull Island in Kachemak Bay is owned by the Seldovia Native Association (SNA). Limited subsistence use occurs during summer, with occasional egging and harvesting of juvenile birds (Fred Elvsaas, pers. comm.). It is also a major tourist attraction for visitors to Homer. Permission to work on and around the island has been obtained under the provision that annual reports of findings be made available to the SNA. We inform the local tour boat operators about our activities so that our presence at the island can be explained to visiting tourists. Chisik Island is managed by the Alaska Maritime National Wildlife Refuge, and we will employ charter vessels from Homer to support field work there. Chisik Island supports a small, seasonal fishing community and we will inform the summer residents about the nature and purpose of our activities. Whenever possible, equipment and other resources will be acquired locally.

PROJECT DESIGN

A. Objectives

1. To determine adult common murre and black-legged kittiwake overwinter survival rates, using conventional banding and resighting methods.

2. To relate differences in common murre and black-legged kittiwake overwinter survival to differences in prey availability, foraging effort and physiological stress during the breeding season.

3. To relate differences in common murre and black-legged kittiwake overwinter survival to differences in breeding success.

Background

To test our primary hypothesis- that adult common murre and black-legged kittiwake overwinter survival is related to prey availability and foraging stress during summer- we need to obtain measures of overwinter survival concurrent with measures of prey abundance and distribution. Data on prey (forage fish) abundance and distribution will be obtained via coordinated efforts with EVOSTC-funded projects 00163M (APEX) and 99306 (Sand Lance Ecology). Measures of physiological stress are being obtained in coordination with the EVOSTC-funded project 99479 (Effects of Food Stress on Survival and Reproductive Performance of Seabirds).

We will conduct the proposed research at Chisik and Gull Islands, lower Cook Inlet (Fig. 1). Chisik Island has relatively low prey availability within typical murre/kittiwake foraging ranges, while Gull Island has high prey availability (J. Piatt, unpubl. data). The Chisik Island populations of both murres and kittiwakes have shown steady declines over the past two decades, in contrast to the Gull Island populations which are expanding (Fig. 3). Ongoing APEX work has shown a significant relationship between breeding success and foraging effort for kittiwakes, but not for murres (Fig. 2). Both species show increased foraging effort with decreased prey availability, but it appears that murres have a greater range of foraging effort within which they can still successfully produce chicks, as indicated by past studies (Burger and Piatt 1990, Zador and Piatt 1999). This raises the question: Is there a delayed or hidden cost to successful breeders that have had to "work harder" to raise their chicks? One way such a cost may be expressed is in decreased annual adult survival.

Measurement of survival:

Adult overwinter survival in seabirds has typically been measured by intensive banding and resighting programs (Harris and Wanless 1988; Aebischer and Coulson 1990; Hatchwell and Birkhead 1991; Hatch et al. 1993; Sydeman 1993, Erikstad et al. 1995). A suite of potential confounding factors (loss of bands, emigration, intracolony movement, observer failure to see marked birds) complicate survival estimates based on banding and resighting (Harris and Wanless 1988; Hatch et al. 1993). Models have been developed which account for some of these problems (Pollock et al. 1990); overcoming the remaining uncertainties depends directly on the amount of personnel effort that can be dedicated to banding and resighting work. Intensive effort will be required to resight banded birds, especially during the pre- egg-laying stage for kittiwakes (May) and murres (June). Adult common murres are particularly difficult to resight, due to the murre's compact body posture while at the nest site.

Measurement of foraging effort and physiological stress:

Increased foraging effort may be the most important contributor to reduction in adult seabird survival (Golet et al. 1998), illustrating the trade-off between yearly reproductive output and longevity. The CISeaFFS study is currently measuring murre and kittiwake foraging effort (in terms of bird-hours spent away from the colony) using a series of 6-8 all-day nest watches spread throughout the incubation and chick-rearing periods. All-day watches give information on nest-site attendance (a measure of 'loafing time'[Zador and Piatt 1999], foraging trip duration, and chick provisioning rate. For example, during four years (1995-1998) of study we have observed that average foraging trips are more than 50% longer at Chisik Island than Gull Island (murres: 190 vs. 122 min; kittiwakes 254 vs. 166 min; respectively).

All of the birds captured for banding are also sampled for levels of corticosteroid stress hormones in the blood. We have already found a strong relationship between stress hormone levels and food (energy) intake (Kitaysky et al. 1999b) in growing chicks, and differences in baseline levels of stress hormones between the 'food-rich' colony at Gull Island and the 'food-poor' colony at Chisik Island (Kitaysky et al. 1999a). We will continue to analyze baseline corticosteroid levels in all birds banded for the survival study, and will eventually be able to relate survival to stress in individual birds, as well as between colonies.

B. Methods

Resighting efforts to search for birds banded during FY98 and FY99 will commence in May and June 2000. Initial effort will focus on nest-sites at which birds were banded during previous years. Search coverage will then be expanded to include all visible nests, in order to document any intracolony movement. Coverage will also include roosting rocks and other gathering areas, to look for birds that may skip breeding in the year following banding, but continue to attend the colony. Resighted birds' position in the colony will be noted on archival plot photos or sketches.

Sample Size and Survival Statistics: Assuming a binomial distribution (sample unit being an individual adult, with survival being a yes or no), a power analysis of sample size in a two by two table predicts that a sample size of 47 marked birds per island would resolve a 6% difference in survival between colonies with acceptable statistical power and confidence (Table 1). To double the resolution (3%) would require a sample size nearly five times greater. However, a sample size of 185 is predicted to resolve a 4% difference with strong power and significance at the 0.05 level. Previous studies have reported murre survival rates ranging from 87% to 98%, measured at stable colonies (Hudson 1985, Sydeman 1993). Given that our study colonies represent relative extremes of population expansion and decline, it is not unreasonable to expect their survival rates to also be at the extreme ends of the normal range. Therefore, detection of a 4% difference with statistical significance should adequately address our primary hypothesis. To allow for a small percentage of known band loss, our goal is to individually mark a minimum of 200 birds of each species at each colony..

Need for additional year of banding fieldwork: We originally scheduled completion of banding fieldwork in the summer of FY98, and projected FY99 costs based only on resighting during summer 1999 fieldwork. FY00 costs were projected to include only data analysis and writeup. But we were unable to complete our banding objectives during FY98 fieldwork (as detailed in the Restoration Project Annual Report). One of the local effects of 1998's El Niño perturbation was markedly reduced attendance at our study colonies by both kittiwakes and murres. Furthermore, birds that did attend were unusually flighty and nervous, making them especially difficult to catch. Mainly due to these uncontrollable factors, we were not able to complete our target sample sizes of 200 marked birds of each species at each colony (Table 1, Table 2).

Furthermore, it has come to our attention that precise survival estimates based on banding are ideally generated by multi-year studies because long-lived seabirds often skip one or more years of attempts at breeding (Erikstad et al. 1995, Golet et al. 1998). Because of this, and also because returning birds are not always sighted in every year they come back to a colony (a function of observer effort and nest-site fidelity), it is desirable to have at least four years of re-sighting data for robust analyses of survival data (Pollock et al. 1990, Lebreton et al. 1992; W. Sydeman, pers. comm.).

We are therefore proposing an additional year of banding during summer 1999, necessitating an additional year of resighting fieldwork during summer 2000. The data analysis and writeup are projected into FY01, instead of FY00 as previously proposed. This extra year would boost our sample sizes into an optimal range, and allow for three years of resighting effort. This would also allow us to continue coordination of survival studies with the study of physiological stress (EVOSTC Project 99479), which has continued funding for field work in FY00 and FY01.

Cooperating Agencies, Contracts, and Other Agency Assistance

Personal Services contracts may be used for statistical consultation and programming assistance.

SCHEDULE

A..Measurable Project Tasks for FY 00

Oct. 1-Jan. 31:	Evaluate results of FY99 work
Feb. 1-April 15:	Arrange resighting logistics
March:	Attend EVOS Symposium
April 15:	Submit Annual Report (FY99 findings)
April 16-June 30:	Conduct field work
Sept. 11-Sept. 30:	Compile resighting results; begin data analysis

B. Project Milestones and Endpoints

Dec. 31, FY 00:	Preliminary data analysis will be completed
April 15, FY 00:	Submit annual report (FY 99 findings)
June 30, FY 00:	Resighting fieldwork will be completed
April 15, FY 01:	Submit annual report (FY 00 findings)
Sept. 30, FY 01:	Preparation of research results for publication in peer-reviewed journals will be completed
April 15, FY 02:	Submit final report (FY 01 findings) Manuscripts will be submitted for publication

C. Completion Date

Our proposed research takes advantage of a natural comparative system (failing vs. thriving colonies) to reduce the time required to test the hypothesis that increased energy expenditure and stress during the breeding season will decrease adult survival. We propose three field seasons (FY98, FY99, and FY00) to ensure an adequate sample size and to allow for modification of project design based on initial results. The third field season is necessary due to the aberrant breeding season in 1998, as explained above in Methods. The project will be completed by the end of FY01, which is planned as a close-out year during which no new research will be undertaken. Efforts in FY01 will focus on publication of research results in peer-reviewed journals.

PUBLICATIONS AND REPORTS

The second planned product of the proposed research will be the annual report detailing FY99 findings, due on April 15, 2000. Publication of project results in peer-reviewed journals will be pursued as soon as scientifically appropriate and logistically possible.

PROFESSIONAL CONFERENCES

Results of this project will be presented during FY01 at the Annual Meeting of the Pacific Seabird Group, or at other professional meetings where appropriate.

NORMAL AGENCY MANAGEMENT

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

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

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

Logistic support from the USFWS and AMNWR will include vessel use, storage facilities, laboratory space, computer usage, and communications. Field sites and research platforms will be shared with the EVOSTC-funded APEX and sand lance projects.

EXPLANATION OF CHANGES IN CONTINUING PROJECT

The design of the proposed work has not changed. As explained above in 'Methods', however, we did not meet our target goal of banded birds in FY98 owing largely to El Niño effects on bird attendance. Therefore we are asking to extend the project for one year so that we can band adequate numbers of birds for statistical confidence in the survival results.

PRINCIPAL INVESTIGATOR

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PRINCIPAL INVESTIGATOR

Dr. John F. Piatt, Research Biologist (GS-13) with the Alaska Science Center, Biological Resources Division, USGS in Anchorage. Obtained a Ph.D. in Marine Biology from Memorial University of Newfoundland in 1987 (dissertation on seabird-forage fish interactions). Since 1987, studied seabirds at colonies and at sea in Gulf of Alaska, Aleutians, Bering and Chukchi seas. Author on 75 peer-reviewed scientific publications about seabirds, fish, marine mammals, and effects of oil pollution on marine birds. Responsible for coordination and oversight of the proposed research.

PROJECT LEADER

Thomas I. Van Pelt, MSc. student at the University of Glasgow, Scotland, and current employee (GS-9) of the Alaska Biological Science Center. Over seven years of experience working in Gulf of Alaska and Aleutian marine ecosystems. Responsible for project design, logistics, data analysis, and preparation of manuscripts and reports.

OTHER KEY PERSONNEL

Ann Harding and Mike Shultz (USGS/BRD staff involved with APEX project) will share responsibility for fieldwork, data management and analysis, and manuscript preparation.

COLLABORATORS

Dr. David B. Irons, Migratory Bird Management, USFWS. Extensive experience with seabird survival studies in Prince William Sound. Will collaborate on project design, and provide technical guidance.

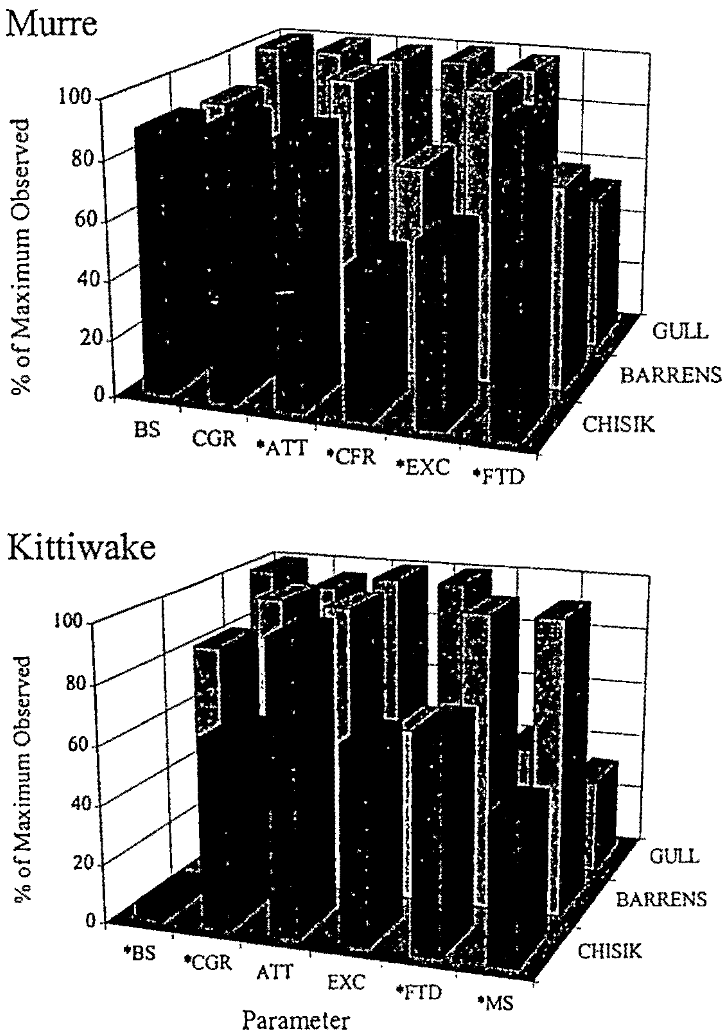
Table 1. Power analysis of sample size (in a two by two table). One minus beta is power; a power of <0.50 is typical in survival estimations. One minus alpha is the confidence interval. Ps and Pe are estimated survival fractions at two hypothetical colonies. Thus, with a sample size of 47 (banded birds per colony), we would expect to resolve a 6% difference (Ps minus Pe) with a power of 0.51 and 90% confidence intervals. With a sample size of 185, we would expect to resolve a 4% difference with a power of 0.75 and 95% confidence intervals. In general, as sample size doubles, variance is halved (Heisey and Fuller, 1985). Resolution of differences <4% demands unacceptably large sample sizes.

alpha	Zalpha	beta	Zbeta	Ps	Pe	n =
0.10	1.18	0.25	0.68	0.92	0.89	352
0.10	1.18	0.49	0.01	0.92	0.89	226
0.05	1.65	0.25	0.68	0.95	0.91	185
0.05	1.65	0.25	0.68	0.95	0.90	125
0.10	1.18	0.25	0.68	0.95	0.90	100
0.10	1.18	0.49	0.01	0.94	0.89	72
0.10	1.18	0.49	0.01	0.95	0.89	47

Table 2. Progress of banding work related to EVOS Restoration Project 00338 "Survival of adult murres and kittiwakes in relation to forage fish abundance". Table shows number of birds banded by year, location, and species.

Year	Gull Island		Chisik Island	
	Murre	Kittiwake	Murre	Kittiwake
1996	0	9	0	0
1997	30	40	132	69
1998	101	108	56	71
Total	**131**	**157**	**188**	**140**

Figure 1. Study area in lower Cook Inlet. Colonies proposed for study of adult survival are located on Chisik and Gull Islands.



Parameters: BS- Breeding Success, CGR- Chick Growth Rate, ATT- Attendance by Adults, CFR- Chick Feeding rate, EXC- Exchange Rate of Brooding Adults, FTD- Foraging Time Duration, MS- Mean Meal Size. Asterisk (*) indicates significant difference in parameter values between colonies.

Figure 2. Variation in reproductive and behavioral parameters of seabirds at Chisik, Gull, and Barren Island colonies in 1996. Note high and similar breeding success of murres at Gull and Chisik, hypothetically made possible by increased foraging effort of Chisik murres. Chisik kittiwakes were apparently unable to compensate, and therefore failed to produce chicks.

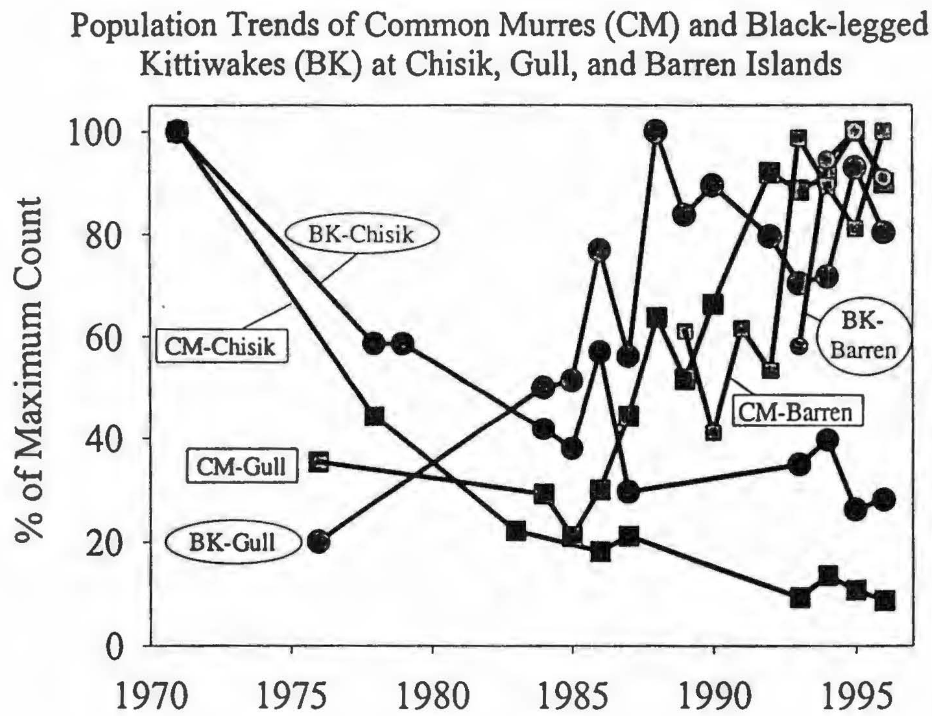


Figure 3. Population trends of murres and kittiwakes showing declines at Chisik Island and increases at Gull Island.

Approved TC 8-9-99

2000 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Budget Category:	Authorized FY 1999	Proposed FY 2000						
Personnel		$39.7						
Travel		$2.7						
Contractual		$8.0						
Commodities		$2.8						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$53.2			Estimated FY 2001	Estimated FY 2002		
General Administration		$6.5						
Project Total	$0.0	$59.7			$46.4	$0.0		
Full-time Equivalents (FTE)		1.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY00

Prepared: 4/13/99

Project Number: 00338
Project Title: Survival of Adult Murres and Kittiwakes
Agency: U.S. Geological Survey

FORM 3A
TRUSTEE
AGENCY
SUMMARY

2000 EXXON VALDEZ TRUST__ COUNCIL PROJECT BUDGET

October 1, 1999 - September 30, 2000

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FY 2000
Thomas Van Pelt	Wildlife Biologist	GS-9	9.0	3.8		34.2
Vacant	Biotech	GS-5	2.5	2.2		5.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal	[redacted]	11.5	6.0	0.0	[redacted]
					Personnel Total	$39.7

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FY 2000
Anc/Hom/Anc	0.2	6	0	0.0	1.2
RT airfare to attend workshop on statistical techniques	0.8	1	7	0.1	1.5
for mark-recapture survival analyses					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.7

FY00

Prepared:

Project Number: 00338
Project Title: Survival of Adult Murres and Kittiwakes
Agency: U.S. Geological Survey

FORM 3B
Personnel
& Travel
DETAIL

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

Contractual Costs:	Proposed
Description	FY 2000
Air charter Homer-Chisik; 6 trips @ $500/trip	3.0
Boat charter (Camp support; Homer-Chisik; 2 trips @ 1500/trip)	3.0
Attendance at workshop on statistical techniques for survival analyses	1.0
Safety training	1.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$8.0

Commodities Costs:	Proposed
Description	FY 2000
Fuel and lubricants (resighting from water, 15d per colony @ 10 gal/day @ $3.00/gal)	1.0
Misc. supplies	1.8
Commodities Total	$2.8

FY00

Prepared:

Project Number: 00338
Project Title: Survival of Adult Murres and Kittiwakes
Agency: U.S. Geological Survey

FORM 3B
Contractual &
Commodities
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			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
Boston Whaler (camp and personnel support; @ $75K)	1	FWS
Laptop computer (data management, per island, @ 2 x $1.5K)	2	USGS
Zodiac inflatables and motors (resighting from water; camp support, @ 2 x $ 9K)	2	USGS
Telescopes (resighting; @ 2 x $1K)	2	USGS
Tripods (resighting; @ 2 x $0.2K)	2	USGS
Binoculars (resighting; @ 4 x $0.5K)	4	USGS

FY00

Prepared:

Project Number: 00338
Project Title: Survival of Adult Murres and Kittiwakes
Agency: U.S. Geological Survey

FORM 3B
Equipment
DETAIL

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

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 2000
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			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
Boston Whaler (camp and personnel support; @ $75K)	1	FWS
Laptop computer (data management, per island, @ 2 x $1.5K)	2	USGS
Zodiac inflatables and motors (resighting from water; camp support, @ 2 x $ 9K)	2	USGS
Telescopes (resighting; @ 2 x $1K)	2	USGS
Tripods (resighting; @ 2 x $0.2K)	2	USGS
Binoculars (resighting; @ 4 x $0.5K)	4	USGS

FY00

Prepared:

Project Number: 00338
Project Title: Survival of Adult Murres and Kittiwakes
Agency: U.S. Geological Survey

FORM 3B
Equipment
DETAIL