19.5.2

Port Dick Creek Tributary and Development Project.

Project Number: 97139-A2

Restoration Category: General Restoration.

Proposer: Alaska Department of Fish and Game.

Lead Trustee Agency: United States Forest Service.

Cooperating Agency: United States Forest Service, Alaska Department of Natural Resources an the Alaska Department of Fish and Game.

Alaska Sea Life Center:

Duration: 2nd year, 5 year project.

Cost FY 97: $82,700 (Includes streambed stability monitoring)

Cost FY 98: $49,700

Cost FY 99: $39,700

Cost FY 00: $32,000

Geographic Area: West Arm Port Dick Bay, Outer Gulf Coast of Southern Kenai Peninsula.

Injured Resource/Service: Pink and Chum Salmon.

ABSTRACT

This ongoing restoration project has resulted in the identification and feasibility analysis for the restoration of pink and chum salmon spawning habitat within a tributary system of Port Dick Creek. The major project goal involves the restoration of the native Port Dick Creek salmon stocks which had been exposed to moderate to heavy oiling during the 1989 *Exxon Valdez* Oil Spill. Actual restoration of the spawning habitat will or will have taken place in June, 1996. If the natural colonization rates are not adequate to fully seed the newly restored spawning habitat, on-site fish culture techniques will be incorporated using the native Port Dick pink and chum salmon stocks to maintain genetic integrity. Water temperature, water level, salinity and stream velocity will be monitored as these parameters are well correlated in the literature with egg survival, spawning success, egg fertilization and suitable spawning substrate. Additional post construction substrate monitoring is proposed. These activities as well as evaluation studies will be conducted annually from 1996 to 2000.

INTRODUCTION

The area of Lower Cook Inlet (LCI) along the southern Kenai Peninsula has a significant number of estuarine and intertidal nursery areas important to pink and chum salmon production. The harvest of pink and chum salmon returns to the area provide a significant contribution to the southern Kenai Peninsula economy. The goal of this oil spill restoration survey involved the identification of *Exxon Valdez* Oil Spill impacted areas and the determination of the optimal methods of restoration in terms of habitat rehabilitation and fish enhancement methods.

The restoration surveys were initiated in FY/91 and FY/92, resulting in the final selection of Port Dick Creek, on the Outer Gulf Coastal area of the Kenai Peninsula (Figure 1). This system was chosen because it is considered one of the most important pink and chum salmon production streams in the LCI area and it was moderately to heavily oiled by the *Exxon Valdez* Oil Spill (ADF&G 1993). A potential spawning habitat restoration analysis at this site was initiated in FY/91 and continued through to the spring of 1993 and again in 1995.

The selected intermittent tributary or channel of Port Dick Creek has historically supported a run of pink and chum salmon. However, since 1964 the channel site has filled in, apparently the result of the combined effects of the earthquake and periodic high surface runoff. The proposed tributary site selected merges with the main stem of Port Dick Creek, before flowing into the estuarine area of the West Arm of Port Dick Bay (Figure 2). The lower 150 m of tributary has been selected for this spawning habitat restoration project. The existing tributary currently has a major water source including a small lake at the 300 m elevation (Figure 2). In some years during the spring and summer months, the tributary water depth is enough to attract spawning salmon. However, as the season progresses the water level declines below the 60-90 cm of deposited gravel (ADF&G 1992/93). Restoration of the spawning habitat will be conducted in June 1996. In order to increase the colonization rate for the restored habitat, on-site fish culture techniques will be incorporated using native Port Dick Pink and Chum salmon stocks to maintain genetic integrity.

Monitoring and analyses of hydrologic data have been demonstrated to correlate to egg-fry survival rates in all salmon species. Complete recovery from the EVOS may not occur for decades, and to fully differentiate the effect of the oil spill injuries on the ecosystem it is necessary to perform basic hydrologic measurements and analyses.

Also important in this salmon rehabilitation project is the need to evaluate and adjust the spawning channel to optimal salmon fry rearing habitat. Bedload transport could play an important role in this evaluation. Monitoring bedload transport in an excavated channel includes accounting for sediment accumulation, quantifying the amount and depth of streambed flux and effects of channel discharge on gravel/cobble transport. These data are inherently important for evaluating spawning gravel habitat.

This proposal reduces the cost of long term monitoring by use of high quality sensors and larger capacity datalogging equipment. The benefits of obtaining basic hydrologic and sedimentologic data can range from moderately helpful to extremely important. CGS is experienced in long term

remote hydrologic datalogging applications, data reduction and interpretation. CGS has agreed to make the analyses responsibilities with ADF&G a joint effort.

NEED FOR THE PROJECT

A. Statement of Problem

The targeted resource is the wild pink and chum salmon stocks of Port Dick Creek, in the West Arm of Port Dick Bay. Benefits realized from the spawning channel will accelerate the recovery of the currently depressed wild pink and chum salmon stocks of Port Dick Creek. The LCI area commercial fisheries would benefit from the increased salmon production at Port Dick Creek. The exvessel value of harvested pink and chum salmon would also serve as a base for the economic multiplier effect in the community through processing and other fishery related services.

Success of the proposed spawning channel construction project depends on a wide variety of physical parameters. Without adequate monitoring of temperature, water level and in some cases salinity it would be difficult to compare fry survival rates to the expanded and changed spawning habitat during the monitoring period, for example. During the design and construction planning stage of the spawning channels it became apparent that bedload transport is also an important and compatible system that should be monitored. Long term shifting of the spawning channel gravel would be expected to occur partially as a result of the channel construction.

The proposed spawning channel will also need to be evaluated quantitatively based on long term hydrologic and sedimentologic monitoring to determine the quality of salmon-rearing habitat.

B. Rationale/Link to Restoration

Although no damage assessment surveys were funded or conducted in the outer Gulf Coastal areas of the Kenai Peninsula of Lower Cook Inlet, studies in Prince William Sound area indicate differences in pink salmon egg mortality as well as growth in the early marine life stage (Willette 1994). These results should be considered applicable as potential impacts on pink and chum stocks in the oil impacted areas of the outer Kenai Peninsula. The proposed restoration of the formally used tributaries at Port Dick Creek will restore to former levels the production of wild pink and chum salmon. The additional spawning habitat created would increase egg to fry survivals by expanding stable habitat.

While the benefit-cost ratio is an important aspect, we also believe that this analysis should not be the only criteria used to evaluate the significance of the Port Dick Spawning Channel project. Restoration of these currently depressed wild pink and chum salmon stocks in the EVOS oiled Port Dick Creek should be considered as the primary reason for this effort. It is difficult to assign a monetary value to the restoration of natural resources as the intrinsic value of wild salmon stocks cannot easily be measured.

The ultimate goal of this project is to restore the wild pink and chum salmon stocks of Port Dick Creek. The major hypothesis relates to the theory that the major survival problem occurs during the instream incubation and residence period for both chum and pink salmon. It is theorized that survival problems are caused by the unstable nature of the spawning habitat within the mainstream of Port Dick Creek. It is important to evaluate the success of the proposed spawning channel in light of the physical parameters that have significant effects on salmon habitat.

In order to achieve the goal of restoration of the wild stocks, several objectives have been identified including the construction and monitoring of a stable spawning channel and initiating colonization of the new system by eyed egg planting operations. Several parameters must be monitored to evaluate the success of the project.

For example, the chum and pink salmon life history are similar, in that the females of each species migrate upstream to spawn in the summer and fall. They create a gravel cavity and deposit their eggs. The eggs reside in the gravel substrate until fry emergence in the spring. Clearly the stability of the gravel substrate is an important habitat component that should be monitored in light of the changed post construction streambed hydraulic parameters (streambed slope, meander curvature, placement of riffles and point bars).

Due to the fact that salmon fry emergence occurs in the spring and a salmon run occurs in the summer, it is apparent that the salmon life cycle essentially requires year-round hydrologic monitoring to properly evaluate the spawning channel project. Long term data need not include water velocity between late November and February (at least a partially frozen channel at these times of year). Other adjustments in the collection of these data, such as specific locations of the sensors and sampling intervals are inevitable.

C. Location

Port Dick Creek is located on the Outer Gulf Coast of the Kenai Peninsula on the exposed coastline of the Gulf of Alaska (Figure 1). The area is characterized and influenced by the warming effect of the maritime currents of the North Gulf Coast, and annual rainfall can exceed 60 inches (ADNR 1994). The predominate vegetation type of the Port Dick Creek drainage is Sitka Spruce and Western Hemlock forest and is considered climax. Sitka Spruce commonly reach a diameter of 24 inches. The creek corridor is narrow (less than 250m) with adjacent slopes in excess of 30% grade. Port Dick Creek is a fresh water creek with the headwaters originating 2 miles to the west of tide water. The soil at the project site is alluvial being poorly drained and low in organic matter.

COMMUNITY INVOLVEMENT

The U.S. Forest Service is the lead federal agency assigned to review this Environmental Assessment (EA) and to make a decision based on the analysis. The Alaska Department of Fish and Game is the cooperating state agency writing the Environmental Assessment.

A scoping meeting was held in Anchorage at the Alaska Department of Fish and Game Office, 333 Raspberry Road on June 19, 1995. ADF&G (Commercial Fisheries Management and Development Division) communicated with the U.S. Forest Service and ADF&G (Habitat and Restoration Division).

This project was reviewed by the *Exxon Valdez* Trustee Council (TC) in April 1995 and approved the project pending federal NEPA requirements be satisfied prior to further funding. State of Alaska members on the Trustee Council include the Attorney General, and the Commissioners of ADF&G and the Department of Environmental Conservation (DEC). Federal agency members include representatives of the U.S. Departments of the Interior and Agriculture and the National Oceanographic and Atmospheric Administration (NOAA). As part of the review process, the EVOS Trustee Council Public Advisory Group (PAG) reviewed this salmon instream habitat and stock restoration project in 1994 and 1995 prior to preparing recommendations to the Trustee Council. The PAG unanimously approved this type of project in 1994. In 1995, the PAG made no motion to approve or disapprove this project, however the project has received strong public support. In addition, conclusions from the Trustee Council Wild Stock Supplementation Workshop in January 1995 also supported this project. Questions concerning goals, linkage to injury and benefit/cost were addressed and incorporated into the proposal.

A public hearing on the proposed Port Dick Restoration project was held in Homer in April, 1995 by the Oil Spill Restoration Office. There were no negative comments and most people voiced support for the project.

The proposed project has been listed in the Quarterly Chugach National Forest, schedule of proposed actions for environmental analysis since July 1995. This project, among others, is briefly described for interested parties at over 280 addresses. No comment has been received from this effort.

A letter summarizing the scoping meeting and listing the potential issues was drafted and sent to the U. S. Forest Service and other persons and elicited responses from the following: the Cook Inlet Regional Planning Team (CIRPT), Kenai Peninsula Borough Coastal Management Program and members of the Cook Inlet Seiners Association (CISA). All three organizations endorsed the proposed project (Appendix A).

Mr. Roger MacCampbell, District Ranger for the Kachemak Bay State Wilderness Park has received a draft copy of the Environmental Assessment written for the Port Dick Project. Mr. MacCampbell has responded with written comments and found no objections to the implementation of the proposed action.

In addition to the above community involvement, the marine biology class of the Homer High school in cooperation with ADF&G, entered into a program to test and evaluate instream salmon egg incubators. The incubators may be used for the supplemental colonization phase of the Port

Dick Creek tributary restoration project. The high school class secured a fish transport permit and actually incubated salmon eggs in the incubators in Fritz Creek near Homer.

PROJECT DESIGN

A. Objectives

(January 1, 1996 through September 2000)

The ultimate goal of this project is to restore the wild pink and chum salmon stocks of Port Dick Creek.

1. Complete and have approved by the US Forest Service an Environmental Assessment for the proposed restoration project.
2. Secure engineering design and project specifications of the proposed excavation.
3. Conduct the proposed pre-excavation bedload transport survey.
4. Excavate the spawning tributary June 1996.
5. Install water temperature, velocity, salinity and water level instruments into the streambed of the restored tributary and perform proposed measurement of post construction bedload transport.
6. Monitor colonization into the restored tributary and conduct stream side egg-takes if the colonization is not adequate.
7. Monitor and evaluate water/tributary parameters including proposed sediment transport parameters on a bi-monthly basis.
8. Monitor subsequent egg-to-fry survival through on site evaluations beginning in the spring of 1997 through 1999.
9. Prepare annual Port Dick Detailed Project Descriptions and annual reports. Prepare long term monitoring results for peer review and publication.
10. Complete and submit final report.

B. Methods

Ground water level fluctuations were monitored and measured during the winters of 1991/92, 1992/93 and 1994/95 (Figures 3,4&5). The results were used to determine the size, depth and configuration of the spawning channel.

The final spawning tributary restoration/excavation design was completed by Coble Geophysical Services of Homer in February 1996 (Appendix A). The engineering section of the Alaska Department of Fish and Game has or will provide bid document preparation and excavation requirements. The design will be advertised through the official state construction bid process. The actual construction project will be awarded to the lowest qualified bidder.

Excavation/restoration of the spawning channel will be conducted with appropriate heavy equipment such as D9 Caterpillar tractors, excavators and front end loaders. Only on-site gravel

materials will be used. Mobilization and demobilization of heavy equipment and logistical support materials will be conducted using a 110 ft. landing craft vessel.

If natural colonization does not fully seed the new spawning habitat, standard fish culture methods will be used to conduct on-site Port Dick Creek chum salmon egg-takes. Instream incubation systems may be used for incubation to the eyed egg stage. Eyed egg planting devices may be used to supplement the seeding of the spawning channel during the first 1-3 years to increase the probability of success. Influences of physical parameters on spawning success will be evaluated using long term hydrologic monitoring and the proposed bedload transport monitoring.

During the pre-emergent and emergent phase of the salmon fry, a 2 man crew will capture emerging fry with methods and fry traps developed by (Phillips, et al. 1969).

Periodic stream surveys will be conducted during the spawning runs to determine adult spawner density and species composition. Stream life studies will also be conducted concurrent with this adult portion of the evaluation project.

Following construction of the spawning channel in June, 1996, 4 types of sensors will be installed: temperature, water level, water velocity and conductivity. Figure 6 shows the general measurement locations and field arrangement of the equipment.

The changing channel geometry after construction and sensitivity of salmon eggs to water level necessitates monitoring of water levels after the spawning channel is constructed. This data will be collected using pressure transducers accurate to 0.01 ft of water within the pressure range expected at the site. The transducers measure pressure relative to atmospheric pressure so that atmospheric pressure effects need not be taken into account. The standpipes will be situated in the stream bed to a depth of no more than 3 feet, and if there is a noticeable difference in water level due to groundwater pressure differences an alternate method of securing the transducers to the substrate will be devised.

Temperature will be measured to an accuracy > 0.4 C. Temperature effects on salmon cited in the literature (e.g. Pauley, 1988; Wangaard, 1983) correlate fry survival rates to temperature using similar accuracy. When comparing results of the present study to previous studies it is useful to have similar accuracy.

Proposed temperature monitoring locations are shown in Figure 6. There are expected to be some temperature differences between the lower reaches of the spawning channel and the upper reaches, particularly in summer and fall months. The variation of temperature with depth in the spawning channel is not thought to be significant due to the turbulence of the water. The temperature probes will be secured within the top 10 cm of substrate to facilitate comparisons of temperature to egg-fry survival rates and to protect the sensors. An additional temperature monitoring point in Port Dick Creek is proposed to provide a comparison to the known chum and wild pink salmon runs in that reach as shown in Figure 6.

Water velocity measurements are needed because low and high stream velocities can both adversely affect chum salmon. Spawning adult chum salmon use water with velocities varying between 46 and 101 cm/sec (Pauley, 1988). Streamflow therefore regulates the amount of spawning area available: increased flow covers more gravel, thus making more suitable spawning substrate available. Higher stream velocities erode the substrate and suitable spawning is decreased. It is especially critical when constructing a spawning channel to monitor the stream velocities.

In addition, salmon eggs require sufficient water velocities to keep the stream well-oxygenated, protect the streambed from freezing temperatures, and to remove waste metabolites (CO_2). Siltation is a major cause of egg and alevin mortality as mentioned previously, which is directly correlated to stream velocity. The current meter used will be compatible with the USGS Type AA (Price-type) meter, which has an accurate window of measurement between 0.03 and 5.5 meters per second.

Salinity can interfere with fertilization of the eggs of chum salmon spawning in or near the intertidal zone. After absorption of the yolk sac, however, chum salmon can tolerate full-strength sea water. Salinity will be correlated to conductivity which is the parameter proposed for measurement. Sea water has a conductivity of approximately 40 to 50 microhmos, which requires an electrode spacing much greater than conductivity sensors for fresh water. The conductivity meter used will be calibrated from fresh water to full strength sea water, however the electrode spacing will be designed for discerning salinity changes in the spawning channel. The conductivity sensors will be attached to the temperature sensors in the substrate at approximate locations shown in Figure 6.

The datalogging equipment used by the sensors can easily retain measurements every 30 minutes for 2 months, and without power constraints for the proposed sensors. Successive approximations of the original data set will be made and correlated to the original data set to determine what the sampling interval could be within the accuracy for each measured quantity. This process saves some analyses time and conserves power for unplanned delays between data collection periods.

The datalogging equipment is rugged, and can operate under conditions ranging from -55 to +80 degrees centigrade. Dataloggers and power supplies are housed in fiberglass reinforced and humidity controlled field enclosures for long term monitoring.

Methodology of the proposed increase in streambed sediment load transport:

The stability of stream channels and banks substantially affects the quality of riparian and aquatic habitats. Stream stability is affected by channel morphology and channel material (Myers et al., 1992), both factors which are changed during spawning channel excavation. The benefits of characterization of sediment transport in the gravel-bedded channels can range from moderately helpful to extremely important.

Sediment and bedload transport in gravel-bedded rivers has received far less attention in the published literature compared to streambeds of finer grained sediments. There has even been controversy in the recent past about the effect of high discharge events on the sediment transport and bed armor of natural gravel-bedded streams and rivers (Ikeda et al., 1989). Discerning the effects of altering a gravel-bedded stream channel on sediment transport and deposition would be a side benefit of this study useful for future spawning habitat rehabilitation projects.

Salmon spawning channel construction provides a unique opportunity to study these effects, in addition to providing needed information on channel stability. Four methods used in detailed sediment transport studies of gravel-bedded streams are proposed to take advantage of the pre- and post construction phase of this project, and designed for inexpensive long term monitoring in conjunction with the hydrologic parameter monitoring. The four methods include bedload sampling using the Helley-Smith sampler, measurement and comparison of changes in surveyed stream transects, use of tracer cobbles and gravel, and measurement of changes in scour chain orientations. The implementation and justification of each technique is described below.

Bedload sediments will be sampled directly during site visits using a Helley-Smith sampler combined with water velocity measurements at each location across the transect. The proposed stream transects for bedload sampling are shown in Figure 6. Approximately 6 samples per transect will be taken at even intervals across each transect.

Analysis of the bedload samples requires consideration of what is collected by the sampler and whether the sampling period was sufficient or not. This evaluation will be made during the initial sampling period.

The Helley-Smith samples will be taken by placing the sampler upstream of the operator in the location of the stream velocity measurements. Each sample will be dried, weighed and sieved to determine transport rate and size distribution at both pre- and post construction periods. This data provides important information about channel stability, and is a valuable tool for comparison to similar studies done on gravel-bedded streams in natural channels (e.g. Dietrich et al., 1989).

For example, bedload sampling will be used to determine the relationship between streambed material size (channel bottom armor) and bedload transport rate (Dietrich et al., 1989). This relationship can be used to determine the short-term stability of spawning gravel. Other factors that affect streambed stability are dependent on variables that will be measured and observed, including the average size of the bedload, meander geometry, the amount of bedload and upstream erosion.

Surveyed channel transects are the second method used to address short and long term streambed stability. Surveyed markers and marked trees will be used to locate stream transect sections. A surveyor tape will be stretched between the markers for horizontal reference. Streambed elevations will then be measured to ~0.01 ft accuracy using a rotating laser level and stadia rod at approximately 2 foot intervals across the transect. This is a standard method for monitoring changes in streambed morphology with time, compatible with other detailed studies of stream

sediment transport in gravel-bedded streams (e.g. Jacobson, 1995). Eight such transects are proposed with approximate locations shown in Figure 6.

Pre- construction and post construction surveys will be made as close in time as possible. Subsequent transects will show how much the stream channel adjusts to the designed spawning channel, particularly after high discharge events.

Tracer gravel and cobbles will be used to determine rates of transport, of particular concern for the post construction phase of the spawning channels. Port Dick Creek Tributary gravel and cobbles will be constructed into tracer material. Some of the gravel will be in the range useful for spawning grounds. The cobbles and gravel will be marked using holes drilled in the material and filled with numbered aluminum wire and epoxy (the tracers must be unobtrusive, yet easy to find). The shape of the tracer material will be as rounded as possible in order to reduce shape-induced uncertainties in the course of their movement (Cavazza, 1981).

Each tracer will be weighed, and then placed along the proposed marked stream source areas shown in Figure 6. The tracers will be relocated periodically with a metal detector to determine the amount of movement from the source area for the specific tracer material during periods of high discharge. Each tracer will be re-weighed periodically throughout the long-term monitoring, and re-deployed to the source area if found near the mouth of either tributary.

Results from tracer tests are also of fundamental value in characterizing the size and rate of bedload transport averaged between monitored periods. The tracer data will be used to calculate accurate rates of bedload transport by comparison to the continuously monitored water level and stream velocity parameters. Such direct measurements of gravel and cobble transport would be very useful to discussions of construction techniques for future spawning channel projects in gravel-bedded streams.

Use of scour chains is the final method proposed for addressing streambed stability. Scour chains are an inexpensive method for determining the thickness of bed mobility (depth of scour and depth of fill) following high discharge events. The scour chains will consist of vertically oriented and weighted stainless steel link chain (1 inch links or more). The chains will be buried at surveyed locations and elevations in the pool areas shown in Figure 6. This installation may be made by hand auguring, or use of the existing heavy equipment. The chains will be periodically located and unburied; the length of horizontal chain and depth to the chain will be recorded, and the chain reoriented vertically for the next high discharge event. This allows the evaluation of scour events such as the depth of bedload scour and subsequent sediment burial thickness. Such maximum-event data helps determine the mobility of sediment during high discharge (Gordon et al., 1992). The amount of bedload transport from a flood event can be estimated with scour chains in combination with tracer gravel and cobbles.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The actual excavation/restoration of the tributaries was contracted out to the private sector in FY/96. Post excavation monitoring of physical parameters such as temperature, water velocity, salinity and water level were contracted to Coble Geophysical Services in FY/96 and will be in FY/97.

The FY/96 Port Dick Detailed Project Description was approved only with the inclusion of the Coble Geophysical proposal 96139D (Supplemental Monitoring of the Proposed Spawning Channel Project) into 96139A2.

SCHEDULE

A. Measurable Project Tasks for FY/97 (October 1, 1996 - September 30, 1997)

November 1 - January 1, 96	Complete and have approved an environmental assessment for the restoration project.
January 1, 96 - March 1	Secure engineering design and project specifications of the restoration project.
May 25 1996	Perform pre-excavation background measurements of bedload transport.
June 1 - June 15 1996	Excavate the tributaries, install stream channel monitoring equipment. Perform post excavation bedload transport and sediment accumulation survey.
October 1, 96 - April 1, 97	Analyze the restoration/excavation activities of the Port Dick Tributary by monitoring and measuring the extent of colonization by pink and chum salmon, hydrologic parameters (water level, water temperature, stream velocity and salinity) and proposed sedimentologic stability parameters (bedload transport, accumulated sediments and gravel/cobble transport rates). Prepare status reports as required. Develop FY/98 Port Dick Detailed Project Description.
April 1 - April 30	Prepare field equipment and arrange logistics for the pending field season.
May 1 - June 15	Enumerate pink and chum salmon fry emergence at the Port Dick Tributary.
June 16 - August 15	Monitor the pink and chum salmon return to Port Dick Creek and the colonization into the restored tributary. Supplement colonization if natural colonization is not adequate.

August 16 - Sept 97	Evaluate pink and chum salmon fry survival data from springtime emigration.

B. Project Milestones and Endpoints

June 1996	Excavate spawning tributaries at Port Dick Creek.
June 1996	Install water temperature, velocity, salinity and water level instruments. Install scour chains, install sediment transect markers and tracer gravel/cobbles.
July - August 96-1999	Monitor and enumerate adult escapement and colonization into restored habitat. Supplement colonization if needed. Label individual salmon redds for egg/fry survival estimates.
Continuous through 2000	Monitor environmental parameters within restored tributary e.g. water temperature, velocity, salinity and level. Monitor bed load sediment transport as affected by excavation.
May 1997 through 1999	Monitor subsequent egg-fry survival through on-site emergent fry studies. Correlate and analyze hydrologic, sedimentologic parameters with biologic parameters, publish results.
March 1997 - 1999	Prepare Port Dick Detailed Project Description. Attend symposium to present results of monitoring and analyses.
Sept 2000	Complete final report.

C. Completion Date

Completion of the spawning channel is scheduled for the spring of 1996 with follow up survival monitoring completed in 2000.

PUBLICATIONS AND REPORTS

There are no publications for FY/97 anticipated. However, for FY/98 and beyond we will have results of the newly restored spawning habitat available for possible report publication. Monitored hydrologic and sedimentologic parameters as they relate to salmon spawning habitat and stream channel construction are planned for publication for FY/98 and beyond in peer-reviewed publications such as *Water Resources Bulletin*, *Hydrologic Sciences Journal* and/or the *Journal of Hydrology*. The annual reports will be completed and submitted on April 15th.

PROFESSIONAL CONFERENCES

The only conference that we anticipate attending is the annual *Exxon Valdez* Oil Spill Trustee Council Restoration Workshop. Results are also planned for presentation for FY/98 and beyond at the American Geophysical Union Spring or Fall meetings, and/or at an appropriate International Association of Hydrological Sciences symposium.

NORMAL AGENCY MANAGEMENT

The Department of Fish and Game does not have the funding ability to respond to unforeseen crisis events such as the *Exxon Valdez* Oil Spill, which impacted the Port Dick area with moderate to heavy oiling. The Port Dick Creek restoration project was originally funded by the Trustee Council in 1991 and is currently funded in FY/96 for the actual restoration of the tributaries.

The project was originally proposed to facilitate restoration of the depressed Port Dick Creek pink and chum salmon stocks. This is the first spawning channel/spawning habitat restoration project conducted in the Lower Cook Inlet area. Long term funding of this project is not anticipated because the restored habitat should result in increased numbers of spawning salmon on a sustained basis.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This instream habitat restoration project is the only commercial fisheries EVOS related project on Outer Gulf Coast of the Kenai Peninsula and LCI currently being considered for further funding.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

Coble Geophysical Services has proposed to increase the scope of the project for FY/97 by measuring spawning channel bed-load sediment transport that will address the stability of the spawning habitat created through the restoration project. We feel that it will be an important addition to the work already proposed by CGS.

Changes from the FY/96 project description and budget are include:

Objectives

1. Conduct the proposed pre-excavation bedload transport survey.
2. Install water temperature, velocity, salinity and water level instruments into the streambed of the restored tributary and perform proposed measurement of post construction bedload transport.
3. Monitor and evaluate water/tributary parameters including proposed sediment transport parameters on a bi-monthly basis.
4. Prepare long term monitoring results for peer review and publication.

Methods

The stability of stream channels and banks substantially affects the quality of riparian and aquatic habitats. Stream stability is affected by channel morphology and channel material (Myers et al., 1992), both factors which are changed during spawning channel excavation. The benefits of characterization of sediment transport in the gravel-bedded channels can range from moderately helpful to extremely important.

Sediment and bedload transport in gravel-bedded rivers has received far less attention in the published literature compared to streambeds of finer grained sediments. There has even been controversy in the recent past about the effect of high discharge events on the sediment transport and bed armor of natural gravel-bedded streams and rivers (Ikeda et al., 1989). Discerning the effects of altering a gravel-bedded stream channel on sediment transport and deposition would be a side benefit of this study useful for future spawning habitat rehabilitation projects.

Salmon spawning channel construction provides a unique opportunity to study these effects, in addition to providing needed information on channel stability. Four methods used in detailed sediment transport studies of gravel-bedded streams are proposed to take advantage of the pre- and post construction phase of this project, and designed for inexpensive long term monitoring in conjunction with the hydrologic parameter monitoring. The four methods include bedload sampling using the Helley-Smith sampler, measurement and comparison of changes in surveyed stream transects, use of tracer cobbles and gravel, and measurement of changes in scour chain orientations. The implementation and justification of each technique is described below.

Bedload sediments will be sampled directly during site visits using a Helley-Smith sampler combined with water velocity measurements at each location across the transect. The proposed stream transects for bedload sampling are shown in Figure 6. Approximately 6 samples per transect will be taken at even intervals across each transect.

Analysis of the bedload samples requires consideration of what is collected by the sampler and whether the sampling period was sufficient or not. This evaluation will be made during the initial sampling period.

The Helley-Smith samples will be taken by placing the sampler upstream of the operator in the location of the stream velocity measurements. Each sample will be dried, weighed and sieved to determine transport rate and size distribution at both pre- and post construction periods. This data provides important information about channel stability, and is a valuable tool for comparison to similar studies done on gravel-bedded streams in natural channels (e.g. Dietrich et al., 1989).

For example, bedload sampling will be used to determine the relationship between streambed material size (channel bottom armor) and bedload transport rate (Dietrich et al., 1989). This relationship can be used to determine the short-term stability of spawning gravel. Other factors that affect streambed stability are dependent on variables that will be measured and observed, including the average size of the bedload, meander geometry, the amount of bedload and upstream erosion.

Surveyed channel transects are the second method used to address short and long term streambed stability. Surveyed markers and marked trees will be used to locate stream transect sections. A surveyor tape will be stretched between the markers for horizontal reference. Streambed elevations will then be measured to ~0.01 ft accuracy using a rotating laser level and stadia rod at approximately 2 foot intervals across the transect. This is a standard method for monitoring changes in streambed morphology with time, compatible with other detailed studies of stream sediment transport in gravel-bedded streams (e.g. Jacobson, 1995). Eight such transects are proposed with approximate locations shown in Figure 6.

Pre- construction and post construction surveys will be made as close in time as possible. Subsequent transects will show how much the stream channel adjusts to the designed spawning channel, particularly after high discharge events.

Tracer gravel and cobbles will be used to determine rates of transport, of particular concern for the post construction phase of the spawning channels. Port Dick Creek Tributary gravel and cobbles will be constructed into tracer material. Some of the gravel will be in the range useful for spawning grounds. The cobbles and gravel will be marked using holes drilled in the material and filled with numbered aluminum wire and epoxy (the tracers must be unobtrusive, yet easy to find). The shape of the tracer material will be as rounded as possible in order to reduce shape-induced uncertainties in the course of their movement (Cavazza, 1981).

Each tracer will be weighed, and then placed along the proposed marked stream source areas shown in Figure 6. The tracers will be relocated periodically with a metal detector to determine the amount of movement from the source area for the specific tracer material during periods of high discharge. Each tracer will be re-weighed periodically throughout the long-term monitoring, and re-deployed to the source area if found near the mouth of either tributary.

Results from tracer tests are also of fundamental value in characterizing the size and rate of bedload transport averaged between monitored periods. The tracer data will be used to calculate accurate rates of bedload transport by comparison to the continuously monitored water level and stream velocity parameters. Such direct measurements of gravel and cobble transport would be

very useful to discussions of construction techniques for future spawning channel projects in gravel-bedded streams.

Use of scour chains is the final method proposed for addressing streambed stability. Scour chains are an inexpensive method for determining the thickness of bed mobility (depth of scour and depth of fill) following high discharge events. The scour chains will consist of vertically oriented and weighted stainless steel link chain (1 inch links or more). The chains will be buried at surveyed locations and elevations in the pool areas shown in Figure 6. This installation may be made by hand auguring, or use of the existing heavy equipment. The chains will be periodically located and unburied; the length of horizontal chain and depth to the chain will be recorded, and the chain reoriented vertically for the next high discharge event. This allows the evaluation of scour events such as the depth of bedload scour and subsequent sediment burial thickness. Such maximum-event data helps determine the mobility of sediment during high discharge (Gordon et al., 1992). The amount of bedload transport from a flood event can be estimated with scour chains in combination with tracer gravel and cobbles.

Milestones

June 1996	Install water temperature, velocity, salinity and water level instruments. Install scour chains, install sediment transect markers and tracer gravel/cobbles.
Continuous through 2000	Monitor environmental parameters within restored tributary e.g. water temperature, velocity, salinity and level. Monitor bed load sediment transport as affected by excavation.
May 1997 through 1999	Correlate and analyze hydrologic, sedimentologic parameters with biologic parameters, publish results.
March 1997 - 1999	Prepare Port Dick Detailed Project Description. Attend symposium to present results of monitoring and analyses.

The additional monitoring proposal is included to address pre- and post construction stream channel stability using standardized long-term sediment transport techniques. It will be important to examine the influence of streambed stability on other factors that affect spawning channel success.

PROPOSED PRINCIPAL INVESTIGATOR

Nick Dudiak
Alaska Department of Fish and Game
3298 Douglas Street
Homer, Alaska 99603
907-235-8191
907-235-2448

PERSONNEL

Project leader: Nick C. Dudiak; Lower Cook Inlet Fisheries Resource Development Biologist.

Mr. Dudiak has been a fisheries biologist with the Alaska Department of Fish and Game for the last 18 years. He has been responsible for the commercial and sport fisheries rehabilitation and enhancement work in the Lower Cook Inlet area during those 18 years. In this capacity, he has been responsible for multi-disciplinary work involving the rehabilitation of depleted salmon stocks as well as enhancement activities that have created new and developing commercial and sport fisheries.

Mark Dickson, Fish and Wildlife Technician IV.

Mr. Dickson has been employed as a fish culturist and fish and game technician with the Alaska Department of Fish and Game for the past 18 seasons. He has considerable experience in fish cultural practices in the field and in the hatchery management projects that restore and enhance sport and commercial fisheries in the Lower Cook Inlet area.

Geoff Coble, Manager and Principal Hydrologist, Coble Geophysical Services.

Mr. Coble has been employed as a hydrologist for the last 12 years in government (Kansas Geological Survey), private industry (Environmental Science and Engineering, Inc.) and his own firm (Coble Geophysical Services). He has most recently provided long term hydrologic data collection at high sampling frequencies in field conditions for the City of Kenai and various Kenai Peninsula clients. He has considerable field experience in hydrologic monitoring and analysis.

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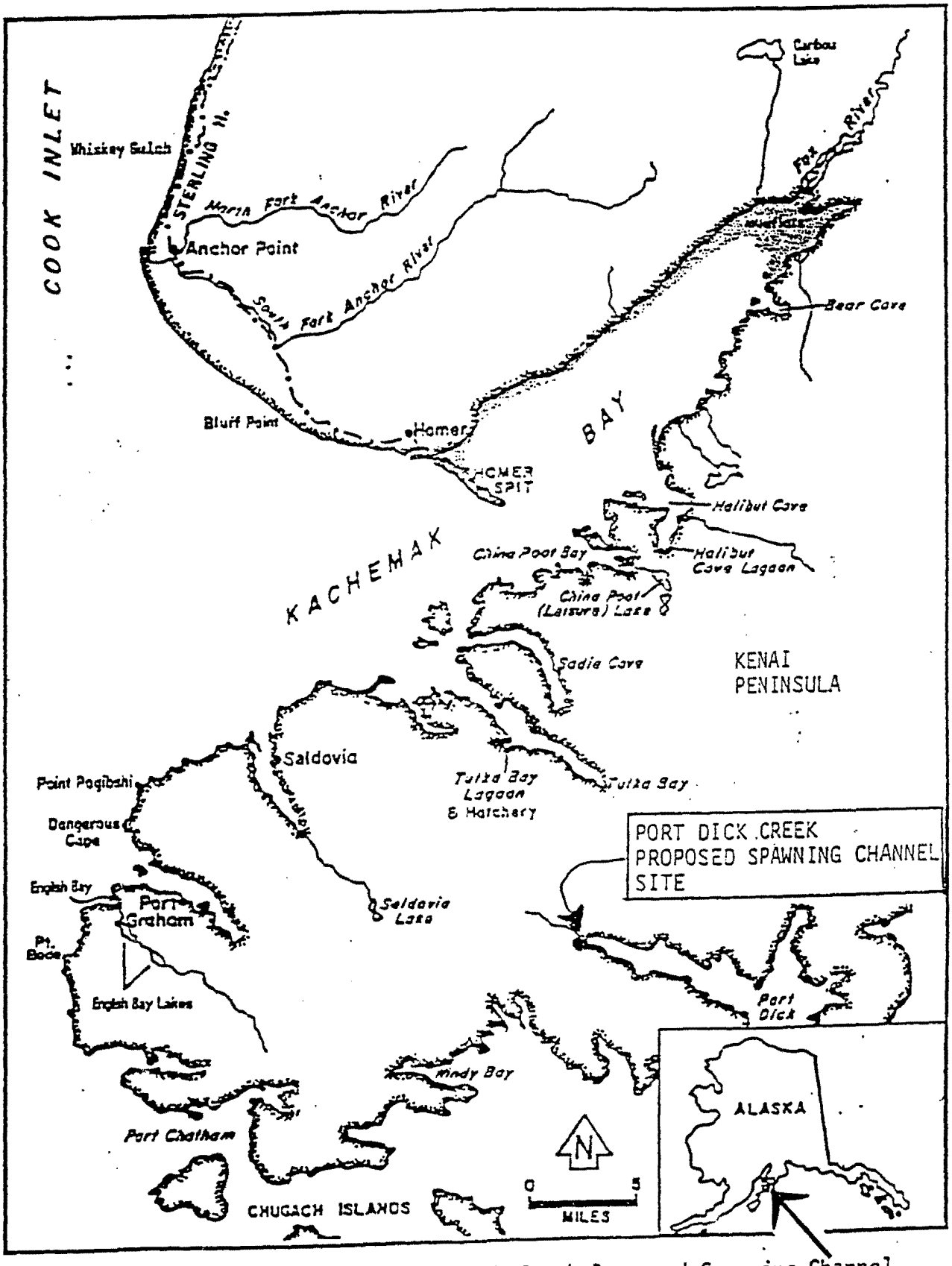


Figure 1. Location map of the Port Dick Creek Proposed Spawning Channel Site, Kenai Peninsula.

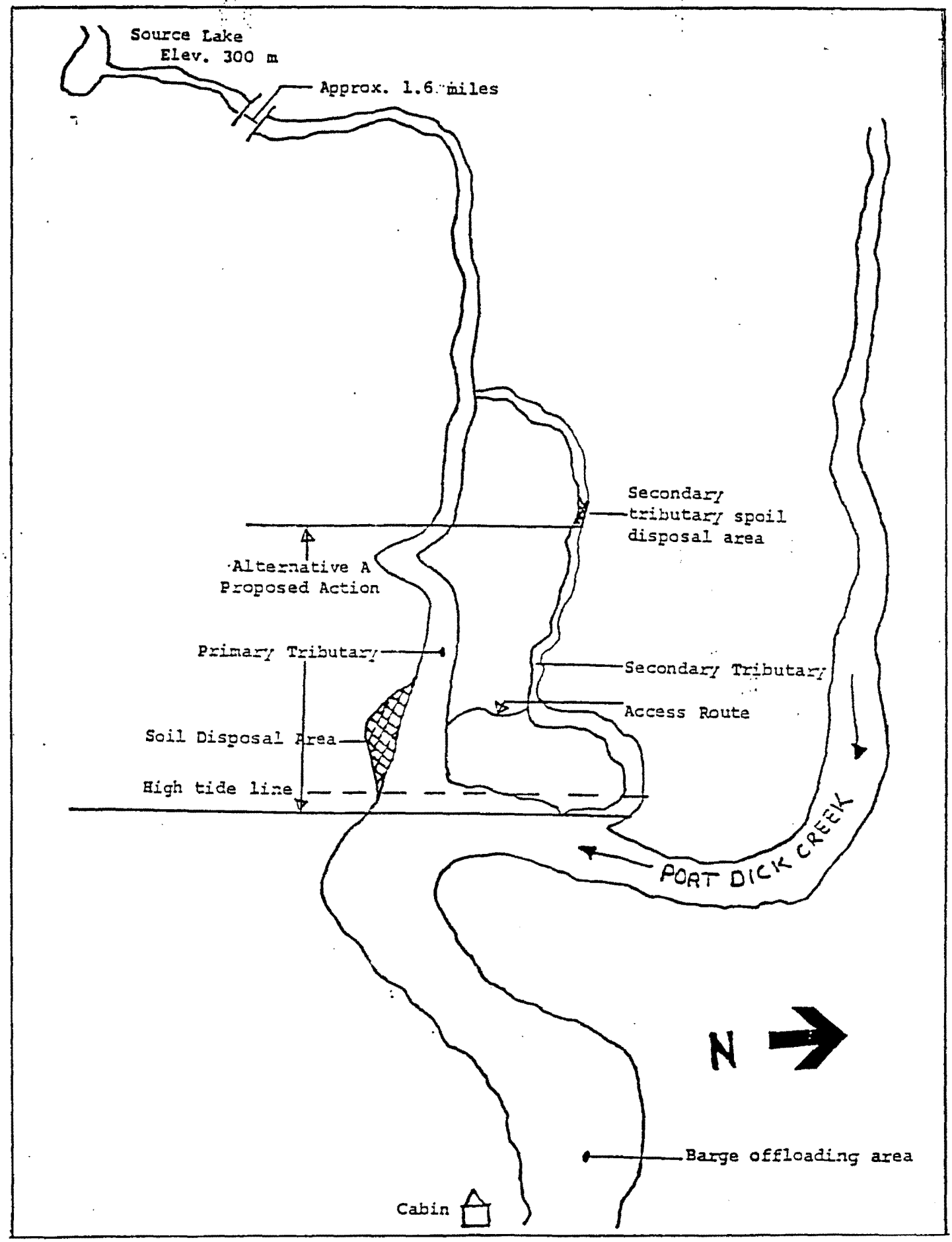

Source Lake
Elev. 300 m
Approx. 1.6 miles
Secondary tributary spoil disposal area
Alternative A
Proposed Action
Primary Tributary
Secondary Tributary
Access Route
Soil Disposal Area
High tide line
PORT DICK CREEK
N
Barge offloading area
Cabin

Figure 2.

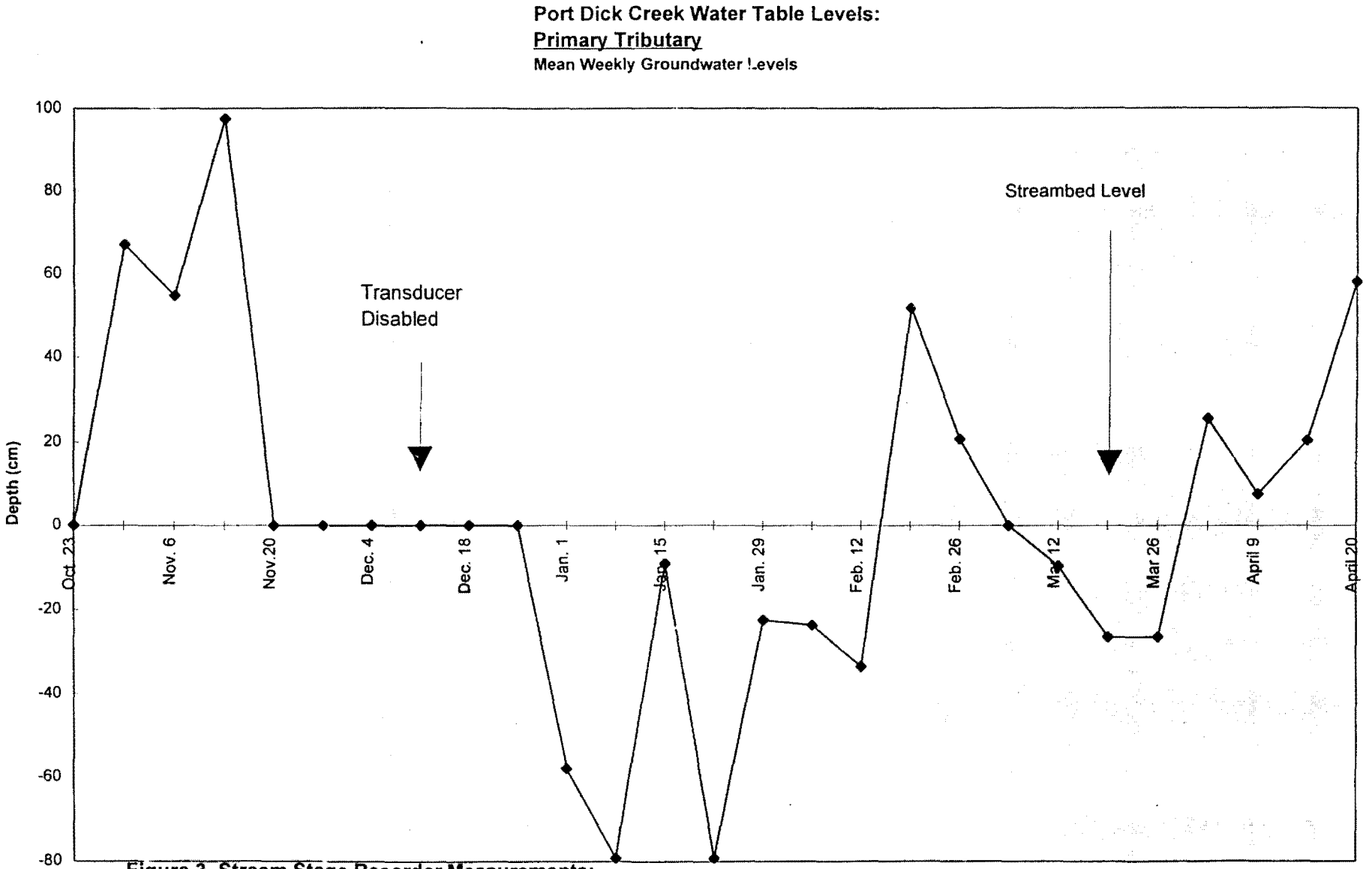


Figure 3. Stream Stage Recorder Measurements: October 1992 to April 1993

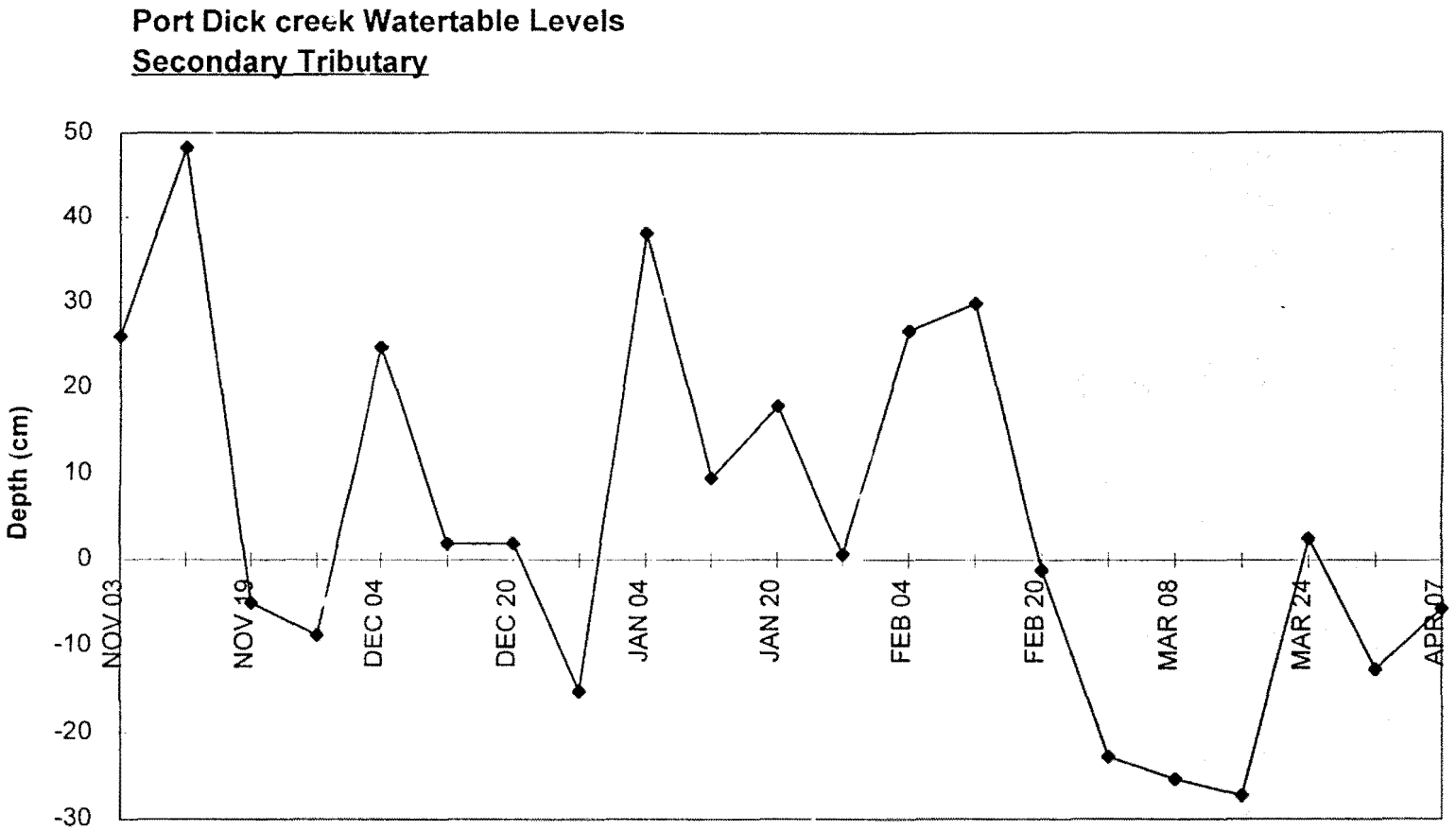


Figure 4.

Stream Stage Recorder Measurements Nov. 1994 to April 1995

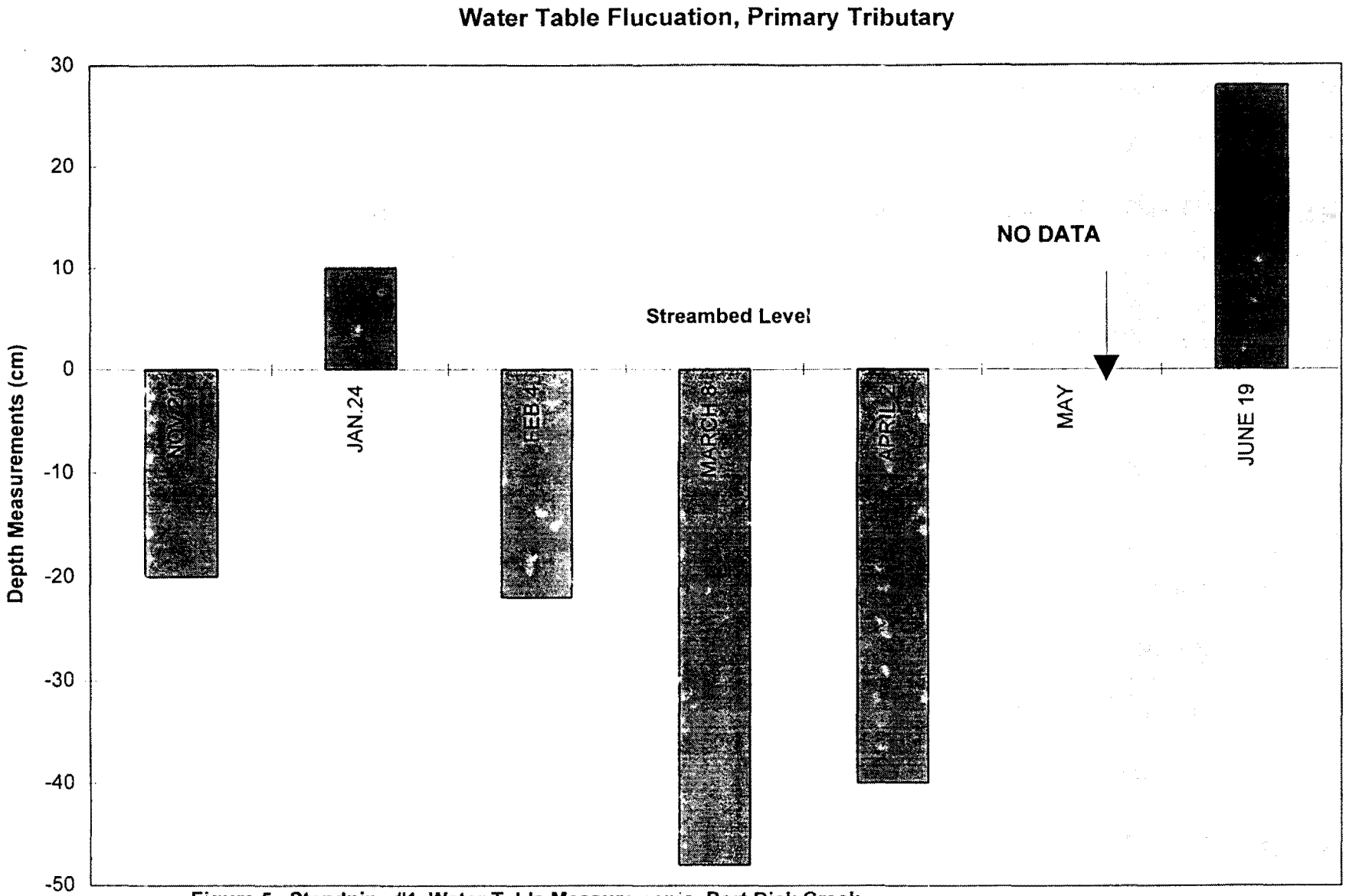


Figure 5. Standpipe #1, Water Table Measurements, Port Dick Creek, November 1991 to June 1992

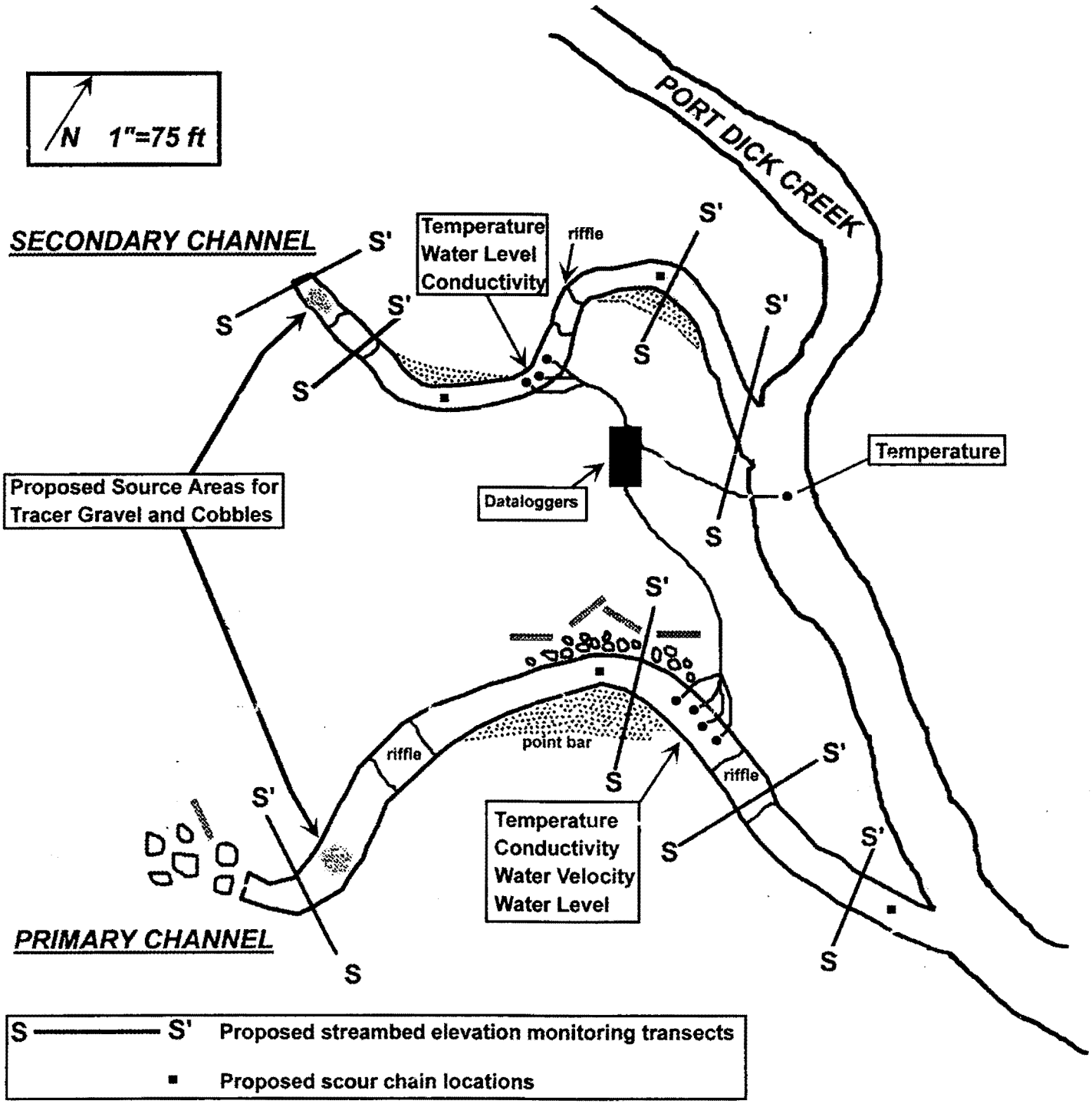


Figure 6. Physical Parameter Monitoring Locations for Post Construction Primary and Secondary Tributary Spawning Channels

APPENDICES

Appendix A Letters of Support

KENAI PENINSULA BOROUGH
144 N. BINKLEY SOLDOTNA, ALASKA 99669-7599
BUSINESS (907) 262-4441 FAX (907)262-1892

DON GILMAN
MAYOR

28 September, 1995

State of Alaska
Department of Fish and Game, CFMD
3298 Douglas Street
Homer, AK 99603

Attention: Nick Dudiak or Mark Dickson

RE: Port Dick Creek Spawning Channel

The Kenai Peninsula Borough Coastal Management Program (KPBCMP) Staff reviewed ADF&G's proposal for spawning channel restoration at Port Dick Creek, and supports the project. The project as proposed is consistent with the following KPB Coastal Management Program policies:

2.6 Mitigation - step c.
When the loss of habitat cannot be avoided or minimized, restore or rehabilitate the resource that was lost or disturbed to its pre-disturbed condition, to the extent feasible and prudent; or

2.6 Mitigation - step d.
When loss or damage [of habitat] is substantial and irreversible and the above objectives cannot be achieved, compensation for the resource and/or harvest loss shall be considered. In the case of loss of habitat production potential, enhancement of other habitats shall be considered as an alternative means of compensation. In general compensation with similar habitats in the same locality is preferable to compensation with other types of habitat or habitats located elsewhere.

7.6 Fish Enhancement and Stocking
Fish enhancement and stocking projects shall use local, indigenous stocks whenever possible to maintain the genetic integrity of wild and indigenous fish populations.

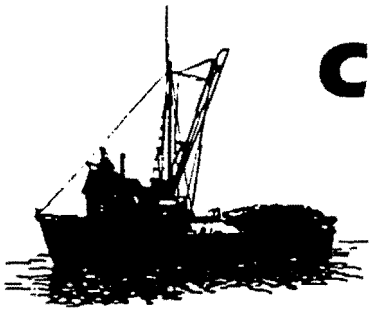
The proposed project is also compatible with the following Coastal Management Program Borough Administrative Policy:

A8. Fish Passage Improvements
The Borough favors the continued cooperative efforts by the Alaska Department of Fish and Game, Cook Inlet Aquaculture Association and other state and federal agencies to accomplish stream or fish passage improvements and increase fish habitat throughout the Borough.

KPBCMP staff supports the use of EVOS funding to restore and enhance fish and wildlife habitats and populations along the heavily damaged outer coast of the Kenai Peninsula.

Sincerely,

Margaret Spahn
Planner



Cook Inlet Seiners Association

P.O. Box 4311
Homer, Alaska 99603
235-2656

Nick Dudiak &
Mark Dickson
ADFG
3298 Douglas Street
Homer, Alaska 99603

Dear Mr. Dudiak and Mr. Dickson:

As you are aware, CISA enthusiastically supports the Port Dick Creek Spawning Channel Project. Not only is this a valuable and worthwhile project, it makes good business sense to finish what has been started so that funds already expended will no be wasted.

CISA firmly believes much needs to be done in LCI to restore our salmon runs to pre-spill health. In the past, LCI supported healthy salmon fisheries that economically benefitted the entire region as well as the state. Since the calamitous impact of the spill in 1989, LCI has suffered run failures across almost all species of salmon and throughout most of the geographic area which resulted in across the board economic concerns. The Port Dick Creek Spawning Channel Project will be an initial yet significant step in restoring some of the lost economic viability to LCI commercial seine fleet, Homer and the surrounding region as well as the state.

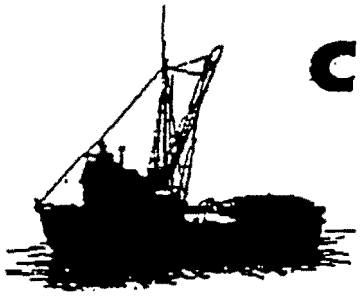
CISA is extremely pleased with this project. Its focus on restoration of wild salmon stock is most appropriate based on Trustee criteria. The project should have long term benefits and be a model for other areas to use in restoring wild stocks in their regions.

Thank you for the opportunity to comment and for your support over the years.

Sincerely,

Chuck Walken DMH
Chuck Walken, sr.-President
Cook Inlet Seiners Association

cc: Exxon Valdez Trustee Council
Dr. Joe Sullivan



Cook Inlet Seiners Association

P.O. Box 4311
Homer, Alaska 99603
235-2656

April 12, 1995

Dr. Joe Sullivan
Resource Program Manager
Habitat and Restoration Division
Alaska Department of Fish and Game
333 Raspberry Rd.
Anchorage, Alaska 99518-1599

Re: Proposed Spawning Channel--Project Port Dick Creek, LCI Project I.D. Number--95139

Dear Dr. Sullivan:

As you know, based on your presentation at our 1992 Annual Membership Meeting and on-going encouragement, Cook Inlet Seiners Association has been actively engaged in the Exxon Valdez Trustee process. CISA has had representatives at most meetings, written many letters, and given testimony as well as provided a number of project proposals for Lower Cook Inlet. Basically our situation has not altered since your visit; even though we have taken an assertive role in presenting our need for restoration in this area, to date, we, astonishingly, still have had no fish related restoration projects funded in LCI.

CISA enthusiastically supports Nick Dudiak's Proposed Spawning Channel--Project Port Dick Creek, Lower Cook Inlet: Project I.D. Number--95139. Not only is this a valuable and worthwhile project, it makes good business sense to finish what has been started so that funds already expended will no be wasted.

CISA firmly believes much needs to be done in LCI to restore our salmon runs to pre-spill health. As you probably know, since the calamitous impact of the spill in 1989, LCI has suffered run failures across almost all species of salmon and throughout most of the geographic area. Prior to this time, the LCI supported healthy salmon fisheries that economically benefitted the entire region as well as the state. Project 95139 will be an initial yet significant step in restoring the oil devestated pink and chum runs in the Port Dick area of the outer coast.

Thank you for the opportunity to participate in the process and for your support over the last few years.

Sincerely,

Charles Wakefield, Sr.
President, Cook Inlet Seiners Association

April 15, 1995

Joe Sullivan
Resource Program Manager
Habitat and Restoration Division
Alaska Department of Fish and Game
333 Raspberry Rd.
Anchorage, Alaska 99518-1599

Re: Proposed Spawning Channel--Project Port Dick Creek, Lower Cook Inlet: Project I.D. Number--95139

Dear Mr. Sullivan:

I am writing to convey my ideas and concerns about the lack of restoration activities in the outer coast of the Kenai Peninsula. I was unable to attend the Trustee meeting that was held in Homer a couple of days ago.

The Lower Cook Inlet was one of the most heavily oil spill dameged area in Alaska. It is clear to me that no one can dispute that the region was seriously dameged by the spill. (Just take a look at one of the Trustees' own publications--the map on the cover of the Exxon Valdez Oil Spill Restoration 1993 Draft Work Plan.)

Since the 1989 spill, the Lower Cook Inlet has suffered run failure after run failure across most species of salmon in the geographic area. Prior to '89, we had healthy salmon fisheries that economically benefitted the fishermen and related communities as well as the entire region and state.

The frustration level is high in LCI because we have seen no restoration projects in our area even though it is the mission and responsibility of the Trustees to address such situations. Our salmon runs have been affected and yet nothing has been done. I believe that Project # 95139 is a well throughout and workable project that will address some of the spill related issues in the outer coast. As a result, I strongly support funding for this project.

I also request that your office work closely with the Cook Inlet Seiners Association's office to develop other projects. In order for our wild runs in the outer coast to achieve pre-spill levels, they need restorative support.

I know that everyone believes that their project is vital. I would just ask you look at the map that I referred to before. It graphic depicts the oil spill area and makes it obvious that we were hit hard.

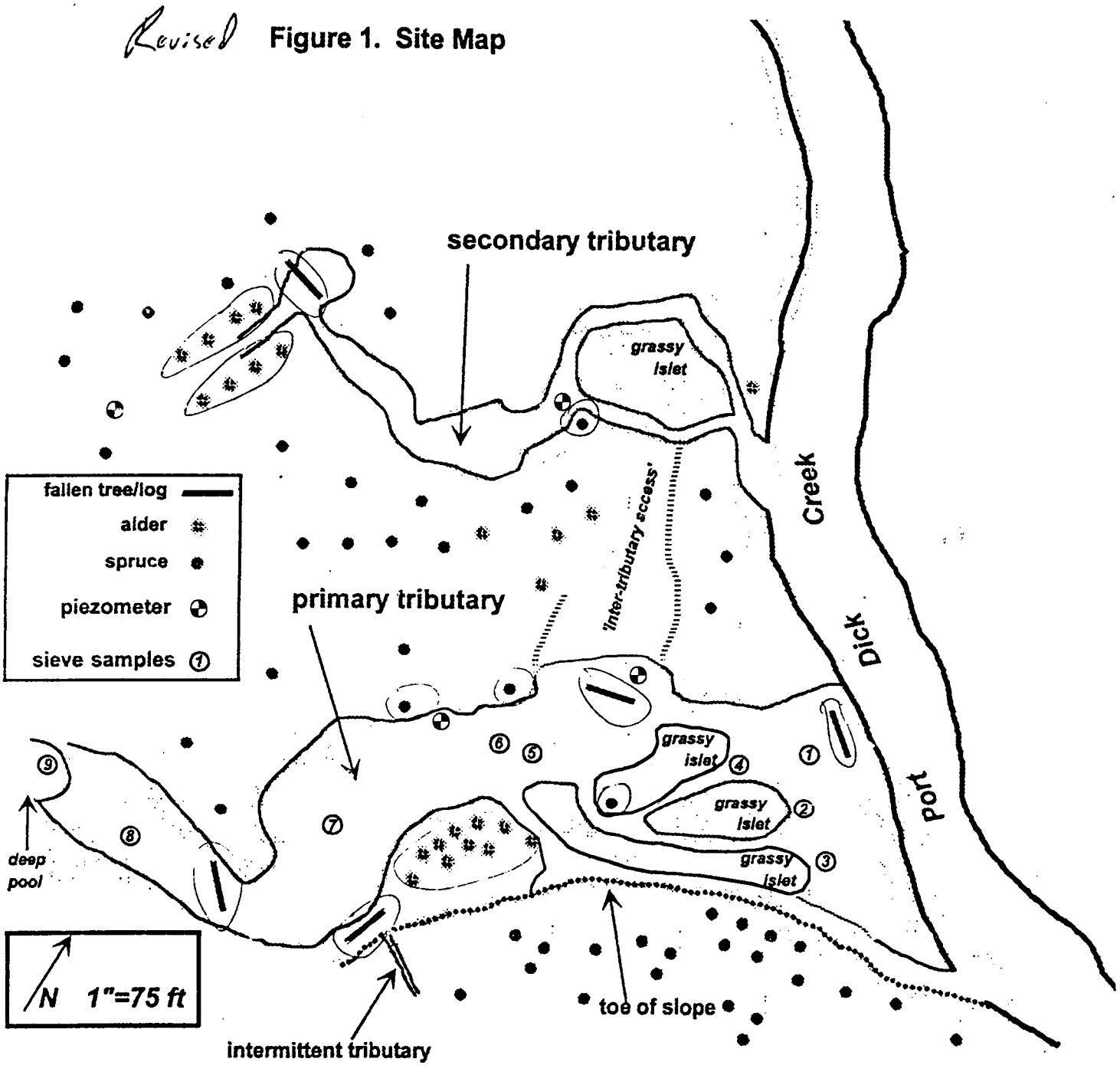
Thank you for your time and assistance.

Sincerely,

Appendix B Engineering Design, Coble Geophysical Services

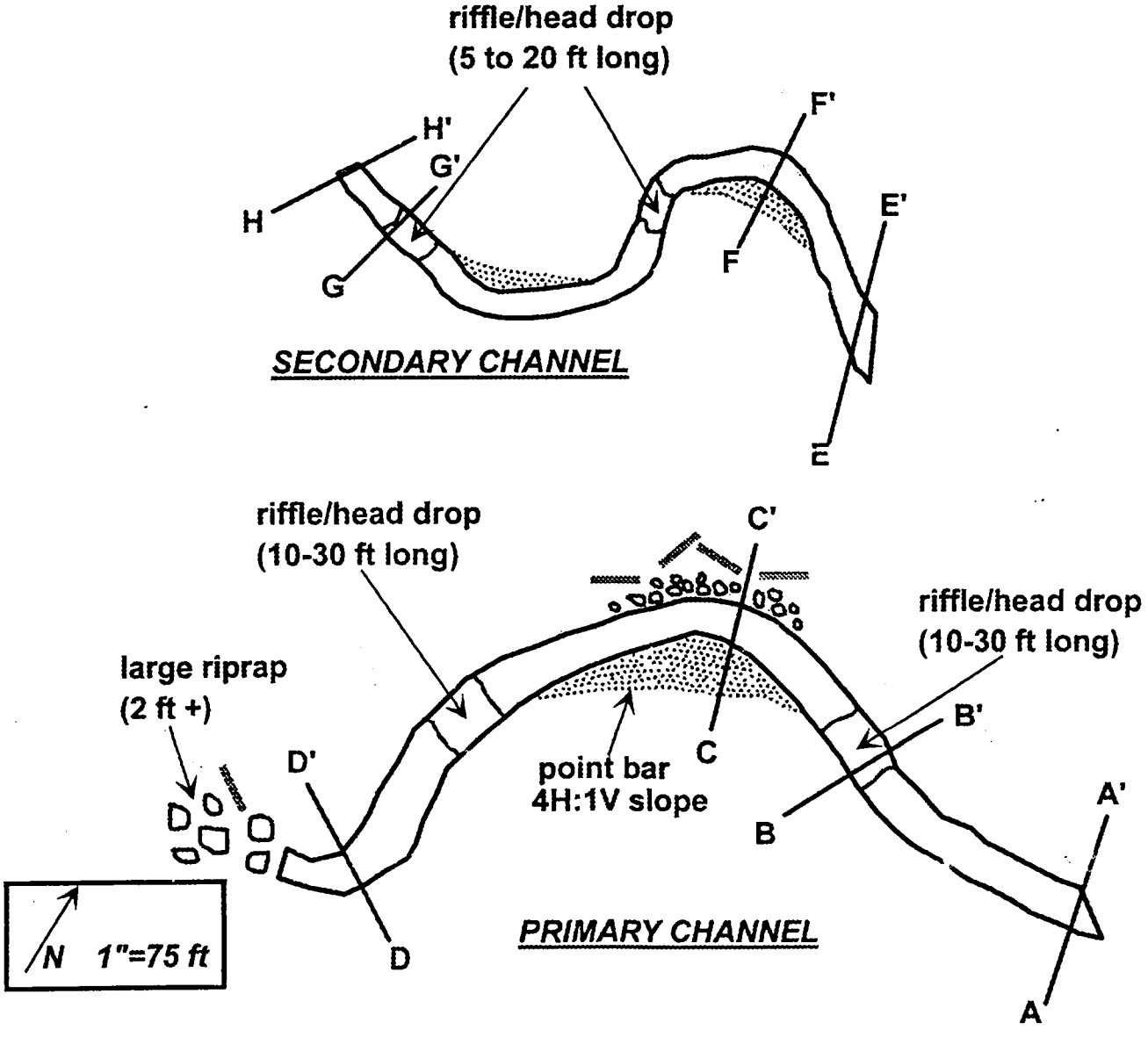
Appendix B Engineering Design, Coble Geophysical Services

Revised **Figure 1. Site Map**

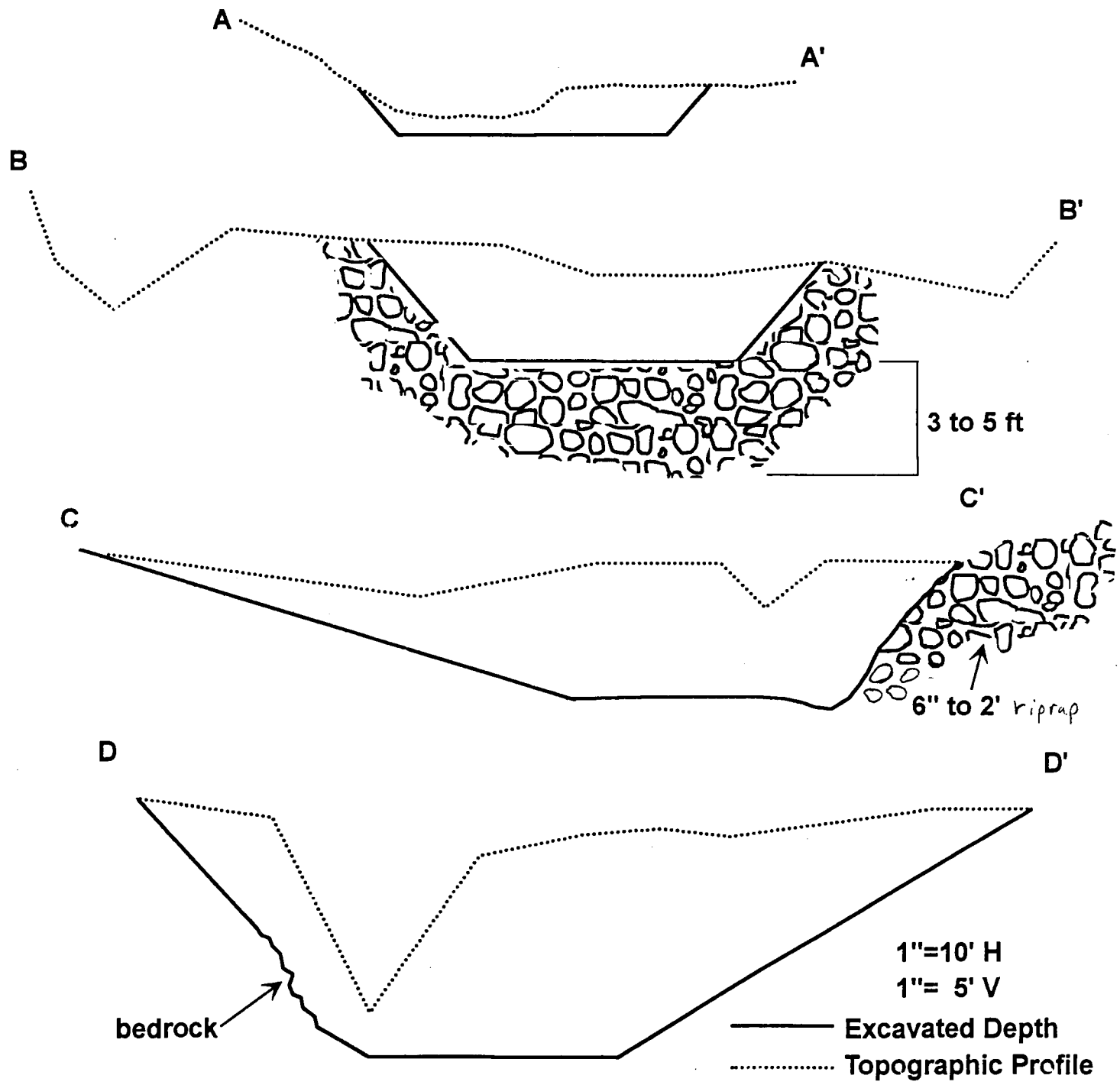


Circled trees & logs were mapped in the field; other trees denote general trends

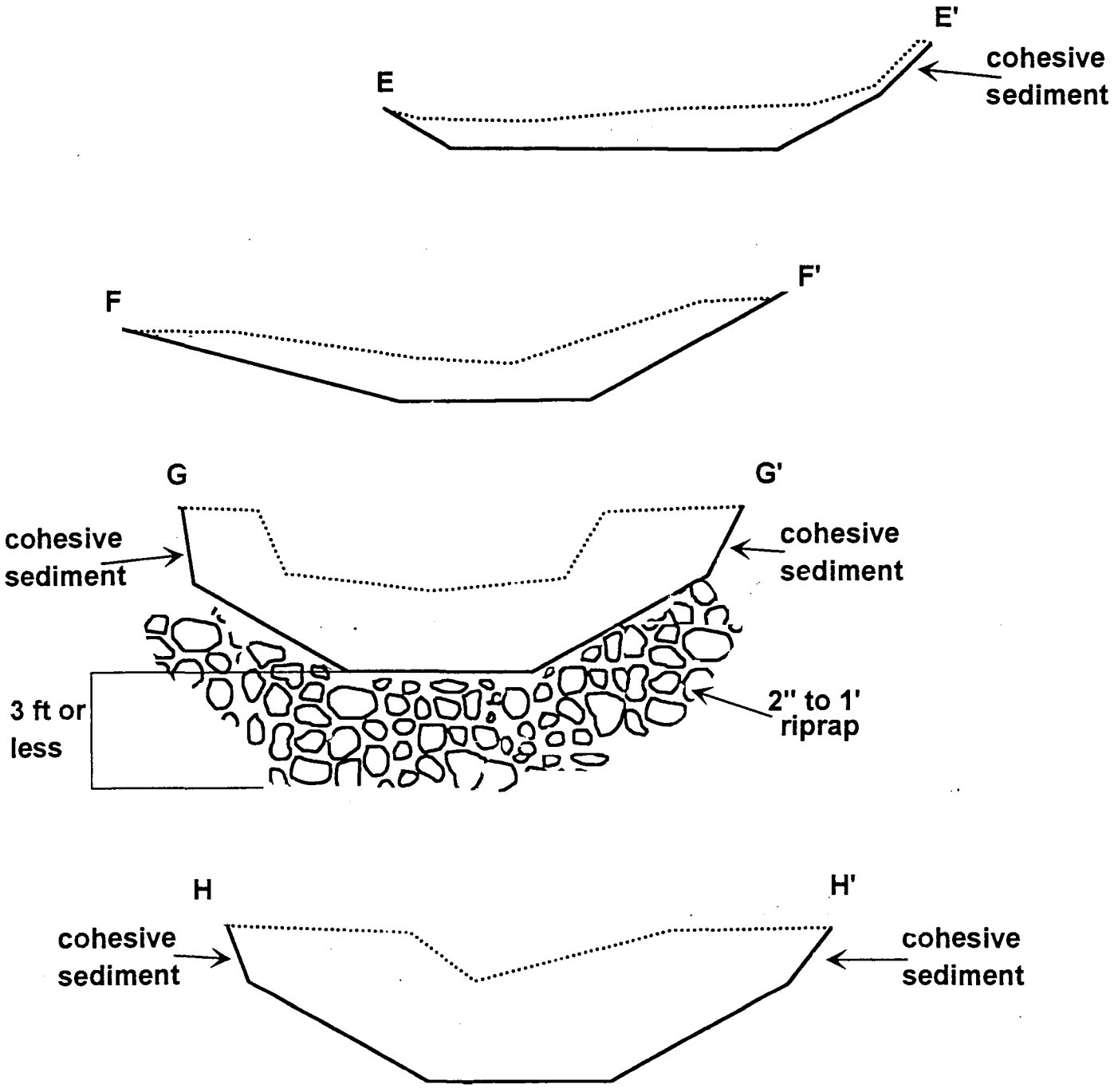
CROSS-SECTION KEY



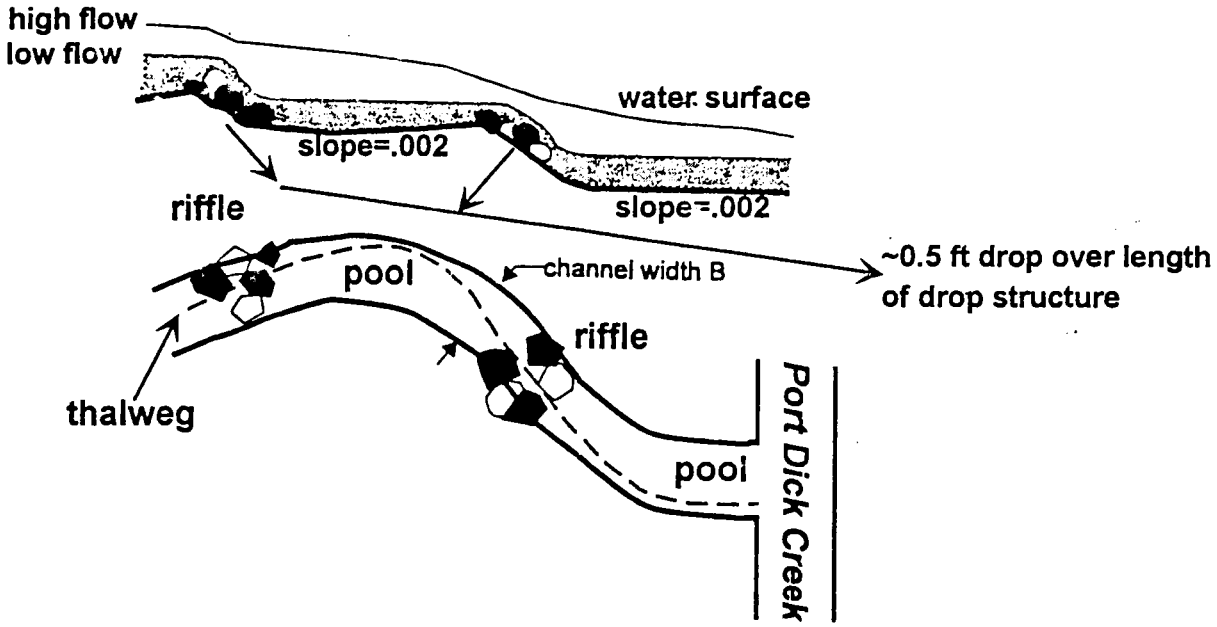
PRIMARY CHANNEL CROSS SECTIONS



SECONDARY CHANNEL CROSS SECTIONS



1"=10' H
1"= 5' V
——— Excavated Depth
..... Topographic Profile



(after Newbury, 1995)

1997 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1996	Proposed FFY 1997	LONG RANGE FUNDING REQUIREMENTS					
Personnel		$37.0						
Travel		$0.6						
Contractual		$36.4						
Commodities		$0.6						
Equipment		$0.0						
Subtotal	$0.0	$74.6	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	
General Administration		$8.1						
Project Total	$0.0	$82.7	$49.7	$39.7	$31.5			
Full-time Equivalents (FTE)		0.9						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

Explanation of FY/97 Budget Increment: The project total, $82,7000.00 reflects a $21,060.00 budget increment from the $53,700 .00 estimated for FY/97. The following is a explanation of the increments:

ADF&G trustee agency:

Budget increases for FY/97 that are included in this proposal reflect the encouragement of the chief scientist to develop further, the salmon fry evaluation phase of this project. An increase of $5360.00 is for personnel costs for on-site fry survival and emigration studies.

Coble Geophysical, Project contract Engineer:

A total of $15,700 budget increment is proposed for project 97139-A2 for further monitoring of spawning channel bed load sediment transport by the project contract engineer (Coble Geophysical Services). Please see cover letter and DPD for further justification.

Received/edited: 8 Ap96 (WJH)

1997

Project Number: 97139-A2
Project Title: Port Dick Creek Tributary Restoration Project
Agency: Alaska Dept. of Fish and Game

FORM 3A
TRUSTEE
AGENCY
SUMMARY

print: 4/10/96

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1997
Fry survival evaluation phase						
April 15-May 15 1997						
11-5362	Fish and Game Tech. III	11A	1.5	3225.0		4.8
11-5319	Fish and Game Tech.II	9A	1.5	2800.0		4.2
Adult Colonization Phase						0.0
June 15 -July 15						0.0
11-5362	Fish and Game Tech III	11A	1.0	3225.0		3.2
11-5319	Fish and Game Tech II	9A	1.0	2800.0		2.8
Project Admin: Annual report						0.0
writing' project management,	Fish and Game Tech IV	13F	5.0	4075.0		20.4
development	Fish and Game Tech III	11A	0.5	3225.0		1.6
						0.0
	Subtotal		10.5	19350.0	0.0	
					Personnel Total	$37.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
Round trip, Anchorage for 3 days and return	180.0	1	3	150.0	0.6
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.6

1997

Prepared:

Project Number: 97139-A2
Project Title: Port Dick CreekTributary Restoration Project
Agency: Alaska Dept of Fish and Game

FORM 3B
Personnel
& Travel
DETAIL

4/10/96

1997 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Contractual Costs:	Proposed
Description	FFY 1997
4A Linkage	32.2
Fry survival evaluation phase:	
Air charter to transport 2 man crew in and out of project site @ 1 hr per trip at $500.00 per trip	1.0
Logistical support, 4 trips @ 1 hr. @ $160.00 per hr.	0.6
Adult colonization phase	
Air charter to transport 2 man crew in and out of project site @ 2 hrs per trip @ $500.00 per hr.	1.0
Logistical support, 4 trips @ 1 hr @ $160.00 per hr	0.6
Fall evaluation, i.e. plant eyed-up salmon eggs and label selected salmon nests for spring evaluation	
Air charter in and out of project site @ 2 hrs @ $500.00 per hr	1.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$36.4

Commodities Costs:	Proposed
Description	FFY 1997
Food for 2 people for 20 days @ $15.00 per day per person while estimating fry survival.	0.6
Commodities Total	$0.6

1997

Project Number: 97139-A2
Project Title: Port Dick Creek Tributary Restoration Project.
Agency: Alaska Dept of Fish and Game

FORM 3B
Contractual & Commodities DETAIL

Prepared:

4/10/96

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
No new equipment purchases are anticipated at this time.			0.0
Equipment purchased in FY/96 will be used throughout the remainder of the project			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
Full set camping and cooking set to accommodate 3 people	1	ADF&G
Fish cultural equipment such as spawning knives, buckets, nets, ice chests and holding nets	1	ADF&G
Full sets of rain gear and hip waders	4	ADF&G
Fyke net; to capture and enumerate emigrating salmon fry.	1	ADF&G
1750 generator	1	ADF&G
High frequency radio	2	ADF&G
Whetherport portable shelter for use while in the field	1	ADF&G

1997

Project Number: 97139-A2
Project Title: Port Dick Creek Tributary Restoration Project
Agency: Alaska Dept of Fish and Game

FORM 3B
Equipment
DETAIL

Prepared: 4/10/96

1997 EXXON VALDEZ TRUS COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1996	Proposed FFY 1997	LONG RANGE FUNDING REQUIREMENTS					
Personnel		$22.8						
Travel		$2.0						
Contractual		$7.4						
Commodities		$0.0						
Equipment		$0.0						
Subtotal	$0.0	$32.2	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	
Indirect								
Project Total	$0.0	$32.2	$16.5	$16.5	$17.0	$17.0		
Full-time Equivalents (FTE)		48.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

A total of $15,700 increment is proposed by Coble Geophysical Services to further monitor spawning channel bed load sediment transport. Please see cover letter and DPD for further justification.

1997

Prepared:

Project Number: 97139-A2
Project Title: Port Dick Creek Tributary Restoration Project
Name: Coble Geo Technical Services

FORM 4A
Non-Trustee
SUMMARY

4/10/96

1997 EXXON VALDEZ TRU! COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FFY 1997
	Original Proposal (Physical Parameter Monitoring)					0.0
	-					0.0
	G. Coble	Field Hydrologist/Technician	12.0	0.1		1.2
	G. Coble	Field Hydrologic /Technician	12.0	0.7		8.4
						0.0
						0.0
	Proposed Increment (Spawning Channel Stability Evaluation)					0.0
	G. Coble	Field Hydrologist/Technician	12.0	0.8		9.6
	G. Coble	Field Hydrologist/Technician	12.0	0.3		3.6
						0.0
						0.0
						0.0
		Subtotal	48.0	1.9	0.0	
					Personnel Total	$22.8

Travel Costs:		Ticket	Round	Total	Daily	Proposed
	Description	Price	Trips	Days	Per Diem	FFY 1997
	Helicopter for Instrument Inspection, download data	0.8	2	2	0.2	2.0
						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

1997

Prepared:

Project Number: 97139-A2
Project Title: Port Dick Creek Tributary Restoration Project
Name: Coble Geo Technical Services

FORM 4B
Personnel
& Travel
DETAIL

4/10/96

Contractual Costs:	Proposed FFY 1997
Description	
Original Proposal (Physical Parameter Monitoring)	
1 USGS Type AA (Price-type) Current Meter, Digital, rental	0.5
2 Pressure Transducer, Hastelloy diaphragm-stainless casing, rental	1.0
3 Temperature Probe, rental	0.3
2 Conductivity probe, rental	0.2
2 Datalogger, rugged full bridge, half bridge and pulse measurements, rental	1.9
Misc. Downloading Equip. shielded sensor cable and installation supplies	1.1
Proposed Increment(Spawning Channel Stability Evaluation)	
1 rotating laser level,stadia rod, detector and 300 ft surveyor tape, rental	0.5
1 scour chains, stainless, and installation equipment, rental	0.5
1 metal detector for tracer gravel, 1 meter depth sensitivity, and tracer gravel expendables, rental	0.8
1 Helly-Smith bedload sampler, with bags and expendables, rental	0.6
Contractual Total	$7.4

Commodities Costs:	Proposed FFY 1997
Description	
Commodities Total	$0.0

1997

Project Number: 97139-A2
Project Title: Port Dick Creek Tributary Restoration Project
Name: Coble Geo Technical Services

FORM 4B
Contractual & Commodities DETAIL

Prepared:

4/10/96

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
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
Datalogger, rugged full bridge, half bridge and pulse measurements	3
Pressure transducer, Hastelloy diaphragm-stainless casing, 0,01 ft accuracy	3
thermistors, 0.4 degree C accuracy, soil and water measurement	4
data downloading equipment (laptop, optical interface, keypad etc.)	1
data field enclosures for datalogging equipment	4
temperature and conductivity instrument for field calibrations	1
conductivity sensors	2
Helly-Smith bedload sampler, with bags and expendables	1
rotating laser level, stadia rod, detector and 300 ft surveyors tape	1
scour chains, stainless, and installation equipment	1
metal detector for tracer gravel, 1 meter depth sensitivity	1
installation supplies (mounting brackets, conduit for exposed cable, expendables	1

1997

Project Number: 97139-A2
Project Title: Port Dick Creek Tributary Restoration Project
Name: Coble Geo Technical Services

FORM 4B
Equipment
DETAIL

Prepared:

4/10/96

Montague Riparian Rehabilitation Monitoring

Project Number:	97139C1
Restoration Category:	Monitoring
Proposer:	USDA Forest Service, Cordova Ranger District
Lead Trustee Agency:	USDA Forest Service
Cooperating Agencies:	None
Alaska SeaLife Center:	
Duration:	4th year, 4-year project.
Cost FY 97:	$9,300
Geographic Area:	Prince William Sound, Montague Island
Injured Resource:	Pink salmon, chum salmon

ABSTRACT

The proposal for 1997 is a close-out of project 96139C1. Originally, 1996 was to be the close-out year, but some instream structures failed. In 1996, the structures which failed will be repaired using better anchoring techniques. Crowded stands of Sitka spruce, which were thinned to accelerate growth, will also be monitored. In 1997 we propose to monitor the repaired structures to make sure they have withstood the high flows associated with the spring runoff, collect the final data on spruce growth, and write the final report.

INTRODUCTION

This project is a close-out of project 94-96 139C1.

In the late 1960's and early 1970's, a number of watersheds on Montague Island were logged without leaving buffer strips along the streams. Large woody material was also removed from the channels in the mistaken belief that the removal would help fish spawning and passage. As a result of these activities, the number of pools decreased, channels became shallower and wider, flows became more erratic, erosion increased, and the riparian vegetation was reduced to crowded stands of Sitka alder (*Alnus sinuata*) and Sitka spruce (*Picea sitchensis*) seedlings. The loss of pools reduced coho salmon (*Oncorhynchus kisutch*) habitat. The increased erosion, water velocities, and bedload transport could also affect pink salmon (*O. gorbuscha*) and chum salmon (*O. keta*) spawning by increasing fine sediments and dislodging redds.

In 1994, 32 instream structures were built to create pools, reduce water velocities, trap sediments, reduce erosion, or provide fish habitat. Basically the structures would serve the same functions as large woody material would in a natural system. With the loss of the riparian forest, there is also no source of large woody material to enter into the stream in the future. At the time there were only crowded stands of alder and Sitka spruce saplings. To accelerate the growth of Sitka spruce, 9.0 acres of crowded stands were thinned. The intent was to create larger trees by reducing competition and re-establish the forest more quickly than the natural process.

In 1995, monitoring showed that eight structures in the main channel of Hanning Creek were destroyed by high flows. These were mainly structures that were supposed to help moderate flows. Structures in the smaller tributaries were successful, however. During low streamflows Dolly Varden char (*Salvelinus malma*) were observed using the pools created by the structures. Monitoring of spruce growth showed that growth in the thinned areas was significantly greater than in untreated areas. These results are preliminary, however, since a full growing season had not been completed at the time of the measurements. An additional 2.0 acres were thinned and a control site was established on Quadra Creek for long-term monitoring.

In 1996, the structures that can be repaired will be reworked using better anchoring techniques. More extensive monitoring of the spruce growth will also be conducted. In 1997, we will need to examine and evaluate the structures that were repaired. The final evaluation of the project will depend largely on whether structures can be made to withstand the flows in Hanning Creek. The final report will then be written.

NEED FOR THE PROJECT

A. Statement of Problem

The overall intent of this project is to help restore the watersheds to more natural conditions, and in doing so, improve the habitat for all aquatic species. The primary species of concern in these systems are pink salmon, a species which is listed as injured, and chum salmon, which is not. Although Dolly Varden char were not targeted when the project was conceived, we have found that this injured species has benefited from the structures. Pink salmon are listed as not having recovered from the effects of the oil spill, while the staus of Dolly Varden char is unknown.

B. Rationale/Link to Restoration

This is the closeout of an ongoing project. The work in 1997 will help to fully assess the project. The overall success of the project hinges mainly on the question of whether the repaired structures can withstand the flows in Hanning Creek.

C. Location

The project is being conducted on Hanning Creek, Swamp Creek, and an unnamed creek, all on the west coast of Montague Island.

COMMUNITY INVOLVEMENT

Since this s the close-out of an ongoing project, there will probably be no further opportunity for local input. It may be possible to hire local people as technicians in 1997. Supplies and equipment will continue to be purchased locally.

PROJECT DESIGN

A. Objectives

1. Assess the effects of the structures by noting changes in channel geometry, substrate, bank erosion, and riparian vegetation.

2. Assess the differences in the growth of Sitka spruce in thinned and unthinned areas and note the relative health of the trees.

B. Methods

To assess the effects of the repaired structures, measurements will be taken of the channel geometry before and after the structures are repaired. The structures being repaired are intended to moderate flows by dissipating energy in plunge pools. The structures should also store sediment upstream and reduce bedload movement (Smith et al. 1993). The formation of plunge pools and changes in substrate size should indicate what effects the structures are having. Over time, changes in bank erosion and colonization of gravel bars or other areas by vegetation would indicate changes in flows.

Differences in Sitka spruce growth rates will be determined by measuring mainstem and whorl growth in thinned and unthinned areas. Comparisons would be made with single classification ANOVA tests (Sokal and Rohlf 1969). Since some of the thinned areas are small and contain a limited number of trees, sample size may be limited for some comparisons. Thus, in regard to the question concerning the statistical power of the sampling program, there will be some uncertainty until the sample sizes can be determined and an estimate of the standard deviation can be made (Sokal and Rohlf 1969).

C. Cooperating Agencies, Contracts, and Other Agency Assistance

N/A

SCHEDULE

A. Measurable Project Tasks for FY 97

May 1-15 Arrange logistics, hire personnel.

June 20-30 Examine structures, measure channel changes, collect growth data.

Sept. 1-30 Analyze data, write final report.

B. Project Milestones and Endpoints

1. Evaluate structures: June 30, 1997

2. Collect growth data: June 30, 1997

3. Finish Final Report September 30, 1997

C. Completion Date

The project will be finished September 30, 1997.

PUBLICATIONS AND REPORTS

There are no plans to submit the project report for publication.

PROFESSIONAL CONFERENCES

There are no plans to present this project at professional conferences, but if the opportunity arises, we will not require additional travel expenses.

NORMAL AGENCY MANAGEMENT

This is the close-out of an ongoing project. This question has been addressed in earlier proposals.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

No coordinationis expected at this time, although the U.S. Forest Service will provide the use of a boat and other equipment for this project.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

Originally this project was to be completed in FY 96, but the unanticipated failure of some of the structures necessitates additional repair work in FY 96. Monitoring of the repaired structures will be required in FY 97. The overall success of half of the project hinges on the question of whether the instream structures can withstand the flows in Hanning Creek. This cannot be fully answered until the structures have been tested by the spring runoff in 1997.

PROPOSED PRINCIPAL INVESTIGATOR

David E. Schmid
USDA Forest Service, Cordova Ranger District
P.O. Box 280 Cordova, AK 99574
(907) 424-7661
(907) 424-7214 (fax)

PERSONNEL

David Schmid is the program amanger and a fisheries biologist for the Cordova Ranger District. He has a B.S. degree in resource management from the University of Wisconsin, Stevens Point. He worked on the Glacier Ranger District for four years as a fisheries technician and two years as a fisheries biologist. During this time he managed the fisheries program and oversaw the construction of several fish ladders and other fisheries habitat restoration and enhancemnet projects. Since 1990 he has been the program manager on the Cordova Ranger District.

Ken Hodges will be the crew leader for the project and will be responsible for the repair of the structures, collecting the growth data, and writing the final report.

LITERATURE CITED

Smith, R.D., R.C. Sidle, and P.E. Porter. 1993. Effects on bedload transport of experimental removal of woody debris from a forest gravel-bed stream. Earth Surface Processes and Landforms 18:455-468.

Sokal, R.R. and F.J. Rohlf. 1969. Biometry, second edition. W.H. Freeman Co. San Francisco, California.

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1996	Proposed FFY 1997	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	
Personnel	$7.7	$6.6						
Travel	$0.0	$0.9						
Contractual	$0.6	$0.0						
Commodities	$0.2	$0.8						
Equipment	$0.0	$0.0						
Subtotal	$8.5	$8.3						
General Administration	$1.2	$1.0						
Project Total	$9.7	$9.3						
Full-time Equivalents (FTE)	0.2	0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: This project is a continuation of 96139C1.

1997

Project Number: 97139C1
Project Title: Montague Chum Salmon Habitat Monitoring
Agency: USFS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 4/10/96

4/15/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1997
D. Schmid	Fish Biologist	GS-11	0.2	5.0		1.0
K. Hodges	Fish Biologist	GS-9	1.0	3.9		3.9
M. Schelske	Boat operator	GS-7	0.3	3.0		0.9
Seasonal	Fish Tech	GS-4	0.3	2.5		0.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.8	14.4	0.0	
					Personnel Total	**$6.6**

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
RT Cordova to Anchorage, EVOS workshop	200.0	1	3	224.0	872.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$872.0

1997

Prepared:

Project Number: 97139C1
Project Title: Montague Chum Salmon Habitat Monitoring
Agency: USFS

FORM 3B
Personnel
& Travel
DETAIL

4/15/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Contractual Costs:	Proposed
Description	FFY 1997
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed
Description	FFY 1997
Field food, 10 days/3 people/ $15/ day	0.7
Supplies	0.1
Commodities Total	$0.8

1997

Prepared:

Project Number: 97139C1
Project Title: Montague Chum Salmon Habitat Monitoring
Agency: USFS

FORM 3B
Contractual & Commodities DETAIL

4/15/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
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
USFS computers, radios, office equipment, boats		

1997

Project Number: 97139C1
Project Title: Montague Chum Salmon Habitat Monitoring
Agency: USFS

FORM 3B
Equipment
DETAIL

Prepared: 4/15/96

STATUS AND ECOLOGY OF KITTLITZ'S MURRELET IN PRINCE WILLIAM SOUND
Submitted Under the BAA

Project Number:	97142
Restoration Category:	Research
Proposer:	ABR, Inc.
Lead Trustee Agency:	NOAA
Cooperating Agencies:	USFWS
Duration:	2nd year of a 3-year project
Cost FY 97:	$176,200
Cost FY 98:	not known yet
Geographic Area:	Prince William Sound
Injured Resource:	Kittlitz's Murrelet

ABSTRACT

We propose to conduct a second year of investigations on the status and ecology of Kittlitz's Murrelet, a rare seabird breeding in glaciated fjords of Prince William Sound (PWS). Our study will continue to evaluate the abundance, distribution, habitat use, productivity, and trophic position of this little-known seabird in northwestern PWS. Given uncertainty about the effects of the *Exxon Valdez* oil spill on this species, a better understanding of its status and ecology is required to ensure its long-term conservation.

INTRODUCTION

This study will continue to investigate the population status and trends, habitat requirements, reproductive performance, and trophic characteristics of Kittlitz's Murrelet (*Brachyramphus brevirostris*) in northwestern Prince William Sound (PWS). We will evaluate the abundance, distribution, at-sea habitat use, productivity, and trophic position of this little-known seabird.

The primary reasons for this study are (1) the small population size and restricted distribution of this rare seabird and (2) uncertainty about impacts from the *Exxon Valdez* oil spill and the species' population trends after the spill. The world population of Kittlitz's Murrelets has been estimated to be as low as 20,000 birds, with the majority residing in Alaska (van Vliet 1993). (Although this estimate probably is too low, the total world population still is quite small and on the order of several tens of thousands.) The magnitude of mortality of this species as a result of the oil spill is unknown, but one estimate was that 5-10% of the total world population may have been killed; if true, this would be the highest percent population decline known for any species affected by any oil spill (van Vliet and McAllister 1994). Although we question the basis and accuracy of this claim, the species' small total world population size make any loss of great concern. Because of the van Vliet and McAllister paper and a lack of information on this species, the *Exxon Valdez* Oil Spill Trustee Council (1996) listed Kittlitz's Murrelet as "injured with recovery unknown."

The Kittlitz's Murrelet is a small alcid that nests solitarily in remote areas of Alaska and the Russian Far East (A.O.U. 1983, Day et al. 1983). Because of its low nesting density, the extreme difficulty of finding nests, and the paucity of surveys in its preferred nesting habitat, only 22 known or probable nests of this species have ever been located (Day et al. 1983, Piatt et al. 1994, Day 1995, Day and Stickney 1996). Based on the small sample of nests, it appears that the species is adapted to nesting in rocky, poorly vegetated scree slopes that occur at high elevations in the southern part of its range and at lower elevations in the northern part of its range (Day et al. 1983, Piatt et al. 1994, Day 1995).

Exact knowledge about the nesting phenology and breeding biology of Kittlitz's Murrelet anywhere in its range is poor. For example, the incubation period is not known (but probably ~30 days, as in the Marbled Murrelet *Brachyramphus marmoratus*; Sealy 1974), and the fledging period has been determined (for only one nest) to be ~24 days (J. F. Piatt, National Biological Service, Anchorage, AK, pers. comm.), or slightly shorter than that for the Marbled Murrelet (27-28 days; Simons 1980; Hirsch et al. 1981). Synthesizing records of eggs in birds, eggs and young in nests, laying and hatching dates, and first fledging dates, Day (1996) has derived the following estimates of nesting phenology in southcoastal Alaska (including PWS): known or probable egg-laying dates are 22 May-17 June, hatching dates are 22 June-17 July, and fledging dates are 15 July-10 August. It is unknown whether relaying occurs and, if it does, how much it protracts the nesting phenology described here.

Food habits and feeding ecology of Kittlitz's Murrelet also are poorly known. The few specimens that have been examined in the Gulf of Alaska (all from one collection on Kodiak Island) fed on macrozooplankton (the euphausiids *Thysanoessa inermis* and *T. spinifera*) and fishes (Pacific sandlance *Ammodytes hexapterus*, capelin *Mallotus villosus*, Pacific herring *Clupea harengus*, Pacific sandfish *Trichodon trichodon*, and unidentified fishes; Sanger 1987, Vermeer et al. 1987). Elsewhere within the Kittlitz's Murrelet's range, a bird collected at Cape Chaplina (in the northwestern Bering Sea) contained 10-20 crustaceans, and a bird collected at Wrangel Island (in the western Chukchi Sea) contained 24 (probably zoeae) *Spirontocaris* shrimp (Portenko 1973). Information on food habits thus far suggests that Kittlitz's Murrelet functions primarily as a secondary carnivore (Sanger 1987). The few samples of isotope ratios in Kittlitz's Murrelet examined from Kachemak Bay (Hobson et al. 1994), which is partially glaciated, also suggest that the species' trophic level is 3.8 (i.e., secondary carnivore), or identical to that estimated from food habits in a non-glaciated area (Sanger 1987).

Information on habitat use by Kittlitz's Murrelet is nearly nonexistent. In southeastern Alaska, it is restricted in distribution almost entirely to glaciated fjords: Glacier Bay, glaciated fjords on the mainland southeast of there between the Stikine and Taku rivers, and probably in very low numbers around Baranof Island, which is the only glaciated island in the Alexander Archipelago (Day, unpubl. data). In PWS, they are found primarily in the glaciated fjords of the northern and northwestern Sound (Isleib and Kessel 1973), although they also occur in very low numbers in non-glaciated fjords with scree slopes along their margins (Day et al., unpubl. data). Unakwik Inlet, and the vicinity of its submarine sill in particular, has been reported in the past to be used by large numbers of Kittlitz's Murrelets (Isleib and Kessel 1973). Recently, D. A. Flint (U.S. Fish and Wildlife Service [USFWS], Anchorage, AK, pers. comm.) estimated that several hundred occur in Blackstone Bay, in western PWS.

Given this rare seabird's small global population and uncertainty about population trends and threats, Kittlitz's Murrelet currently is classified a Species of Special Concern (formerly a Category 2 Candidate Species) under the Endangered Species Act (J. Fadely, USFWS, Fairbanks, AK, pers. comm.). This category includes a species for which "the best available scientific and commercial information indicates that it might qualify for protection under the Endangered Species Act, but the Service needs additional information on vulnerability and threats before the qualifications for listing can be determined." The proposed research described here is designed to provide new information on the population status and basic biology of the Kittlitz's Murrelet that will be important for effective conservation of this species.

NEED FOR THE PROJECT

A. Statement of Problem

Kittlitz's Murrelet currently is on the Trustee Council's official list of injured resources as "injured with recovery unknown" (*Exxon Valdez* Oil Spill Trustee Council 1996). Little unequivocal information is known about the effects of the *Exxon Valdez* oil spill on Kittlitz's Murrelet, but van Vliet and McAllister (1994) recently suggested that Kittlitz's Murrelet was the species experiencing the greatest proportional impact from the spill. Extrapolating from the small number of dead Kittlitz's Murrelets collected after the spill, making assumptions about the proportion of Kittlitz's among unidentified murrelet carcasses, and multiplying those numbers by correction factors generated by Ecological Consulting, Inc. (1991), those authors estimated that 1,000-2,000 Kittlitz's Murrelets may have been killed directly by oil. This number represents 5-10% of the estimated world population of this species (20,000 birds; van Vliet 1993). Although we consider this claim unsupported at this time, it is possible that a substantial number of birds were killed by the spill. Further, field studies conducted after the oil spill were unable to measure impacts to Kittlitz's Murrelets directly, either because they were not distinguished adequately from similar-looking Marbled Murrelets (Klosiewski and Laing 1994), because this species was not abundant enough at sample sites to permit statistical analysis (Day et al. 1995, in review; Murphy et al., in review), or because the data for Kittlitz's Murrelets were pooled with those of other species in community-level analyses that made species-specific examination of impacts impossible (Wiens et al. 1996). It is clear, however, that no oil entered the glaciated fjords in northwestern PWS, so any impacts that occurred actually had to happen during the open-water phase of the species' life as it returns to PWS in late winter.

B. Rationale/Link to Restoration

The Kittlitz's Murrelet is perhaps the most poorly known seabird in North America. The small size of its world population, its restricted distribution, and uncertainty over the impacts to its PWS population from the *Exxon Valdez* oil spill all result in concern over a high risk of population decline for this species. This risk was recognized by the USFWS when it classified the Kittlitz's Murrelet as a Species of Special Concern (formerly Category 2 Candidate Species) under the Endangered Species Act, which means that it perhaps should be placed under protection of the Act

but more data are needed before a determination is possible. So little is known about the biology of Kittlitz's Murrelet that any new information will help managers and scientists define conservation goals and research needs for this species.

Our study will provide crucial information on population status and trends over a 3-year period, so that we can begin to estimate approximate population sizes and determine whether Kittlitz's Murrelet populations in portions of PWS are declining and/or are at risk. We will evaluate distribution and habitat use during the breeding season, to obtain a basic understanding of where Kittlitz's Murrelets spend their time and feed during that critical time. We also will study productivity, to determine whether birds are producing many young. Finally, we will describe the trophic level of this species in glaciated fjords so that its trophic role can be defined better and (if possible) related to population trends. The Sound Ecosystem Assessment (SEA) study and the Seabird Forage Fish Project (APEX) are studying potential changes in the marine environment and in forage species that may affect Kittlitz's Murrelets. However, such effects can be assessed only after trophic relationships of this species are understood. In addition, this study will provide a baseline for monitoring long-term population changes, which will be essential for efforts to conserve the species. All of these data may be useful in developing restoration strategies for this rare seabird.

C. Location

The study will be conducted in the glaciated fjords of northern and northwestern Prince William Sound. Communities that probably will realize financial benefits from this study include Valdez, Cordova, and Whittier. In FY 96, a vessel will be chartered out of Cordova, and also we want to charter the FY 97 boat out of a local PWS community. To our knowledge, no communities will be affected by this project other than financially.

COMMUNITY INVOLVEMENT

In FY 97, we will charter a boat and crew from a local PWS community to provide berthing and logistical support. When requested, we will provide articles and photographs for the Trustee Council Newsletter and will be available to make public presentations of our study at appropriate forums. These articles and presentations will disseminate information on the objectives and major findings of this study to the general public.

Although our understanding is that seabirds (and, because of their small size, probably Kittlitz's Murrelets in particular) play a very small role in subsistence use by local Natives in Prince William Sound, we would be happy to draw on any local information that is available on this species and, especially, to be able to partake of samples from any Kittlitz's Murrelets that are killed for subsistence use. (Tatitlik is the one Native community that might take Kittlitz's Murrelets, since its hunters do some subsistence hunting in at least Unakwik Inlet.) We emphasize, however, that we are unclear at this time about how to locate this information and how to establish connections for securing samples.

PROJECT DESIGN

A. Objectives

1. To conduct population surveys for Kittlitz's Murrelets in four glaciated fjords in northwestern PWS.

2. To estimate population sizes and determine population trends for each fjord and the northwestern PWS area as a whole.

3. To determine distribution and habitat use in each fjord.

4. To develop and measure indices of reproductive performance in each fjord.

5. To describe trophic levels in each fjord.

B. Methods

This study proposes investigating aspects of the ecology of this species during 2 cruises/year over 3 years of sampling. Cruises will be conducted from late May to mid-June (early summer) and from mid-July to mid-August (late summer). During each cruise, we will sample 4 fjords in northwestern PWS 2 times each: Unakwik Inlet, Barry Arm/Harriman Fjord, College Fjord, and Blackstone Bay. (The addition of Blackstone Bay is contingent on our being able to make at least one sampling visit there in 1996.) Each sample replicate will consist of two types of sampling (nearshore and offshore surveys) to measure population size, population trends, habitat use, and reproductive performance. Each cruise also will include sampling of blood and feathers of birds to elucidate trophic levels.

Hypothesis 1: Population size does not differ among years. Abundance data from nearshore surveys will be used to compare pre-spill with post-spill counts (when possible) and to compare post-spill counts among years. Nearshore surveys have been conducted in PWS by Irons et al. (unpubl. report), Klosiewski and Laing (1994), Murphy et al. (in review), and Day et al. (1995; in review), and offshore surveys have been conducted by Klosiewski and Laing (1994) and Day et al. (1995; in review). We will use methods common to these studies.

To conduct nearshore surveys in each fjord, we will use a small skiff to travel at ~10 km/h parallel to the shoreline. We will identify, count, and map all locations (for later entry into a Geographic Information System [GIS]) of all Kittlitz's Murrelets on the water 200 m from the shoreline or flying over that zone. Fjord shorelines will be divided into segments 3-5 km long, and nearshore counts will be converted to densities by dividing the number of birds on a segment by the area in the segment boundaries and within 200 m of the shoreline. Correction factors generated in the field for numbers of birds probably missed while sampling will be used to correct these estimates. Areas for shoreline segments will be calculated from digitized maps measured with GIS software.

To conduct offshore surveys in each fjord, we will use a modified strip-transect sampling technique also used by the USFWS (Gould et al. 1982, Gould and Forsell 1989), to sample a transect line that is fixed geographically in the centers of these fjords, beyond the 200-m-wide nearshore survey zone. In each fjord, we will identify and count all Kittlitz's Murrelets seen in a 300-m-wide zone from the research vessel. We then will calculate the density of birds for each bay-visit by dividing the total count by the total area sampled (trackline length x 300 m total width). As will be done for nearshore surveys, the offshore survey trackline will be divided into segments for later analysis of use of different parts of a bay and for examining trends in abundance among years. Offshore data also will be corrected for birds probably missed while sampling.

Paired t-tests of changes in numbers of birds in each nearshore and offshore segment will be used in a before-after analysis to provide powerful tests for examining trends in abundance among years (Stewart-Oaten et al. 1986; Murphy et al., in review). Related to Hypothesis 1 are subordinate hypotheses about differences among fjords and differences among nearshore and offshore zones. A multi-factor analysis of variance (ANOVA) will be used to test for differences in densities among years, among fjords, among zones (nearshore vs. offshore), and among two-way interaction terms. Densities will be transformed as needed to normalize the data. This analysis will evaluate the sources of variability in murrelet densities and will determine whether changes in densities among years are consistent among fjords and among segments.

The population size of Kittlitz's Murrelets in each fjord will be estimated from a combination of data from both nearshore and offshore surveys. Data from nearshore surveys will be treated as a

census of birds in that zone (and corrected, if needed). Data from offshore surveys will be calculated as densities (and corrected, if needed), and those densities will be multiplied by the area of the entire fjord beyond the nearshore zone (i.e., area >200 m from shore calculated with GIS software) to estimate the number of birds in the offshore zone. These two numbers then will be added together to estimate the total population size for that fjord during that visit. A modification of this technique has been used to estimate total population sizes of individual species of birds in other bays of PWS (Wiens et al. 1996). These estimates of population size will not be used in any test of hypotheses; instead, they will be used for descriptive purposes.

Hypothesis 2: Habitat use by Kittlitz's Murrelets does not differ within and among fjords. Habitat use will be examined by stratifying each fjord and the sampling segments of both nearshore and offshore surveys into five strata: (a) nearshore zone/affected by glacier (≤200 m from the glacier face or ice edge, whichever is farther from the glacier face; to be determined in 1996); (b) nearshore zone/not affected by glacier (>200 m from the glacier face or ice edge, whichever is farther from the glacier face); (c) offshore zone/affected by glacier; (d) offshore zone/not affected by glacier; and (e) marine glacial sill (≤200 m up- and down-fjord from each side of the sill). During surveys, we will map locations of Kittlitz's Murrelets seen on the water. We will use the data on birds on the water and flying to calculate densities of birds in each stratum. We will use two-way analysis of variance, log-linear models, and/or logistic regression to test for differential use of habitats within and among fjords, depending on the distribution of murrelet numbers among habitat strata and among fjords.

Hypothesis 3: Reproductive performance does not differ among years or among fjords. In both nearshore and offshore surveys, we will classify birds into (1) breeding plumage (probably adult); (2) winter plumage (unknown age if seen in early summer, when some adults may be molting back into breeding plumage; probably subadult if seen later in summer); (3) juvenile plumage (only in late summer); or (4) unknown plumage. The percentage of birds in juvenile plumage during the late-summer cruise will provide an index of reproductive performance for comparison among years. Work by Kuletz et al. (1995) for Marbled Murrelets in this region suggests that the most appropriate comparison for developing a productivity index is the ratio of the number of juveniles divided by the number of adults seen in June. Differences among years and among fjords will be evaluated with a two-way analysis of variance.

Corrections for turnover of numbers of juveniles in each area, as determined from the residence time of juveniles, will be generated from daily telemetry sampling of 10 radio-tagged juveniles. Juveniles will be captured with a dip-net and will be radiotagged with small, glue-on transmitters. We will determine daily (or bi-daily) movements and map locations of these birds by searching the fjord in a small boat with a telemetry receiver mounted on a pole.

Hypothesis 4: Trophic levels do not differ among years or among fjords. We will capture live (with floating mist nets, as described in Kaiser et al. 1995) and sample up to 30 Kittlitz's Murrelets in each fjord during each cruise, for a maximum of 120 samples/cruise. We will attempt to capture birds in two habitats where they may be feeding (e.g., areas near glaciers and waters around glacial sills, which are not affected by glaciers) and to take samples from these living birds for examination of stable-isotope ratios (Hobson et al. 1994, Thompson and Furness 1995). Samples taken will include (1) blood (for information on the trophic position of foods eaten recently), (2) primary feathers (for information on the trophic position of foods eaten while the bird was undergoing the fall molt), (3) body contour feathers (for information on the trophic position of foods eaten while the bird was undergoing the spring molt), and (4) small subsets of any prey items that we acquire opportunistically while we are examining birds. Don Schell of the University of Alaska will be analyzing our FY 96 samples, and we assume that he also will be conducting FY 97 analyses for the Trustees Council; if he will not be analyzing FY 97 samples for the Council, we will need to determine where else these samples can be analyzed and how much they will cost as an add-on to the enclosed budget. We will take standard measurements of all birds caught and will examine all for reproductive status.

We will use ANOVA analytical techniques (for $\delta^{13}C$ and $\delta^{15}N$ separately) or multivariate statistics (for both ratios together) to evaluate whether Kittlitz's Murrelets in a fjord feed at different trophic levels at different times of the year (i.e., do the isotope ratios for different sample types [blood, primaries, contours] differ significantly?). We also will test for differences in isotope ratios among fjords and among cruises. The few samples of isotope ratios in Kittlitz's Murrelets examined by Hobson et al. (1994) suggest an excellent agreement between trophic levels estimated from food habits (Sanger 1987) and those estimated by isotope ratios alone.

Any food items that are acquired opportunistically (either dropped by live birds that are mist-netted or from birds that die accidentally) will be preserved, identified to the lowest possible taxon, counted, and weighed. We then will calculate an Index of Relative Importance (IRI) for each prey taxon, following Day and Byrd (1989).

C. Cooperating Agencies, Contracts, and Other Agency Assistance

We will contract a research vessel and crew from PWS to provide berthing, logistic support, and a platform from which to conduct surveys. All field and office work will be conducted by ABR, Inc. We will follow FY 96 study requirements and pay the USFWS for a Program Manager and for general administration. (These management costs will be funded directly from NOAA to the USFWS, which is how our contract was set up. Hence, that management money is not listed on the enclosed budget.)

SCHEDULE

A. Measurable Project Tasks for FY 97 (October 1, 1996-September 30, 1997)

January-March 1997:	Arrange logistics (boats, equipment, etc.)
≈25 May-≈15 June 1997:	Conduct early summer cruise
≈15 July-≈15 August 1997:	Conduct late summer cruise
August-October 1997:	Analyze isotope ratios and stomach contents
August-November 1997:	Keypunch data and QA/QC
August-September 1997:	Digitize, measure, and QA/QC geographic data
November-December 1997	Data analyses
15 April 1998:	Submit Annual Report on FY 97 research

B. Project Milestones and Endpoints

1. "To conduct population surveys for Kittlitz's Murrelets in four glaciated fjords in northwestern PWS." Field work will begin in FY 96 and will continue during all three years of the study (i.e., FY 96-98).

2. "To estimate population sizes and determine population trends for each fjord and the northwestern PWS area as a whole." Population sizes will be estimated and will be tested for annual differences during each year of study (FY 96-98).

3. "To determine distribution and habitat use in each fjord." Mapped distributions and densities of birds in each habitat stratum will be compared each year for individual cruises (FY 96-98). Habitat strata will be evaluated and revised each year, if necessary.

4. "To develop and measure indices of reproductive performance in each fjord." Data on numbers of juveniles will be recorded during each late-summer cruise, and an index of reproductive performance will be compared among fjords and among years each year of study. The reproductive performance index will be evaluated for its effectiveness and practicality and will be revised, as necessary, as new information is collected (FY 96-98).

5. "To describe trophic levels in each fjord." Samples for stable-isotope analyses will be collected on each cruise and in each year and will be analyzed each year. Any food-habits that are collected opportunistically will be analyzed for each fjord and habitat during each year (FY 96-98).

C. Completion Date

Sampling for the project will be completed in FY 98. Data analysis and preparation of the Final Report and publications will run into FY 99.

PUBLICATIONS AND REPORTS

We will submit annual reports during each year of the study. Each report will be submitted to the Chief Scientist no later than 15 April of the year following data collection and will cover data collected during that year. Those reports also will synthesize and compare results for that year and previous years. After the final year of data collection, we will submit a Final Report that will synthesize and compare results from all years of the study.

At this time, we do not plan to publish any papers from this research until the entire study is completed. Hence, no request for publication support is envisioned for FY 97. If, however, we collect some data or make some observations in FY 96 or 97 that warrant immediate publication, we will contact the Trustees Council Office about financial support. We understand about the Acknowledgment and Disclaimer that are required for publication and agree to abide by them.

PROFESSIONAL CONFERENCES

We have no plans to attend any scientific conferences in FY 97.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

To our knowledge, no other Trustees studies are being conducted in these glaciated fjords of northwestern PWS. Hence, integration with existing studies will be difficult, in view of the differences between these fjords and other environments in PWS. However, if the trophic data (and any food-habits data that become available) indicate that the birds are eating large amounts of fishes, we may be able to integrate our study with the Seabird/Forage Fish (APEX) Study. We definitely would be able to take advantage of information that that study and the Sound Ecological Assessment (SEA) Study generates on the biology and distribution of fish and invertebrate prey species, and we will be requesting that the SEA Study conduct a series of CTD stations up the middle of one of these fjords (probably Unakwik Inlet) during cruises, so that we can examine water-column structure.

We have no cofunding source for this project and anticipate none becoming available in FY 97.

This project will be valuable in that it will assist the USFWS in learning about a Species of Special Concern under their management and will provide information useful in the conservation of the species. The data on population trends will help in evaluating whether this species is declining in the center of its range in PWS. Investigating habitat use, reproductive performance, and trophic characteristics will be the initial step in increasing the baseline knowledge of the biology of this poorly known species.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

All budgeted costs have been increased by approximately 5% to account for inflationary increases from FY 96 costs. An additional ~$11,200 from 1996 costs reflect additional sampling during the second cruise, which will enable us to collect more extensive data on productivity (i.e., we will sample for a greater part of the fledging period) and which reflects the addition telemetry research on turnover rates of juveniles in these fjords and the addition of sampling in Blackstone Bay. The greatest addition to FY 97 costs is the cost for ship charters: although we were able to get a favorable daily charter rate for FY 96, we may not be able to secure such a rate for FY 97. Hence, we are using an estimated daily rate of $1,200/day in this budget.

PROPOSED PRINCIPAL INVESTIGATOR

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PERSONNEL

Dr. Robert H. Day will be the Project Leader/Principal Investigator for the project. Bob has conducted research on seabirds, marine ecology, impacts of marine pollution, and marine conservation topics in Alaska for 21 years. His research topics have included the biology of poorly known seabirds in Alaska; the ingestion of plastic pollutants by seabirds in Alaska; the mortality of seabirds in the high-seas drift-gillnet fishery of the North Pacific; and the distribution, abundance, and decomposition of plastic pollution and other marine debris in the North Pacific. Recently, he conducted several years of research on impacts of the *Exxon Valdez* oil spill on habitat use by marine-oriented birds and on bird communities (sponsored by Exxon Company, USA). Bob has been contracted by the A.O.U. to write the species account of Kittlitz's Murrelet in the *Birds of North America* project. He will be assisted in these studies by another qualified ABR biologist who will be named later (we are in the process of hiring a person at this time).

Dr. Day is employed by ABR, Inc. (formerly Alaska Biological Research, Inc.). ABR is an Alaskan-owned small business—headquartered in Fairbanks since its formation in 1976—that specializes in environmental research and services. During two decades of operation in Alaska, ABR has served a variety of clients, including private industry, state and federal government agencies, and the University of Alaska. During this time, ABR has developed a reputation for conducting objective research that provides the basis for sound management decisions. ABR remains committed to the goals of providing timely, accurate, and cost-effective information to those who manage or develop our natural resources.

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RESUME

ROBERT H. DAY
Senior Scientist

EXPERTISE: ORNITHOLOGY (BREEDING BIOLOGY, FEEDING ECOLOGY, PELAGIC DISTRIBUTION OF SEABIRDS, MIGRATION, SEABIRD-FISHERY INTERACTIONS), MARINE POLLUTION, BIOLOGICAL OCEANOGRAPHY.

EDUCATION: B.A., Environmental Sciences, 1974. Antioch College, Yellow Springs, OH.
M.S., Zoology, 1980. University of Alaska, Fairbanks, AK.
Ph.D., Oceanography, 1992. University of Alaska, Fairbanks, AK.

RESEARCH PROFILE: Bob has 21 years of research experience in Alaska and elsewhere, in both marine and terrestrial studies. His research interests primarily are on the effects of humans on the environment and on the biology of poorly-known and rare species, and he has conducted research on such diverse topics as: the migration of birds between Europe and Africa; effects of the *Exxon Valdez* oil spill on birds and mammals; the quantitative distribution of tarballs, marine debris, plastic pollutants and seabirds in the North Pacific and Bering Sea with respect to oceanography; the mortality of seabirds in gillnets used by foreign fishing fleets; the distribution of mesopelagic fishes and squids in the North Pacific; reproductive and feeding biologies of seabirds in the Gulf of Alaska, Aleutian Islands, and Bering Sea; the biology of gulls in Kenai Fjords National Monument; the ingestion of plastic pollutants by seabirds; nocturnal migration of birds in the Midwest, using radar; and censuses of seabird, marine mammal, and raptor populations in the Shumagin and Aleutian islands. In addition he has assisted in research on the effects of weather patterns on sea ice in the Bering Sea; the effects of oil development on waterfowl in the Prudhoe Bay oilfields; and the effects of the Alyeska Pipeline terminal on intertidal and subtidal benthic communities and feeding of fishes, crabs, and shrimps in Port Valdez. He currently is Principal Investigator on two projects: studying the distribution and nesting biology of Kittlitz's Murrelets in western and northwestern Alaska and studying the migration of birds between Europe and Africa through the Strait of Gibraltar. In addition to his responsibilities as a research biologist, Bob serves as an assistant editor for ABR and assists in preparation of publications.

RESEARCH EXPERIENCE:

Co-principal Investigator, Wind Power/Bird Collision Studies. Studied the diurnal and nocturnal migration of birds (particularly soaring raptors and storks) near a wind power site across the Strait of Gibraltar in southern Spain (1995-1996). Studies were conducted with respect to weather conditions and behavior around turbines, involved estimation of turbine-caused mortality, and were used to modify operational procedures of the wind-farm.

Principal Investigator, Kittlitz's Murrelet Studies. Studied the distribution, abundance, and habitat use of this species of concern on 4 Long-range Radar Sites (formerly DEW-line sites) in western and northwestern Alaska (1995).

Principal Investigator, Spectacled Eider Studies. Studied the distribution, abundance, and habitat use of this endangered species on 10 Long-range Radar Sites (formerly DEW-line sites) in northwestern and northern Alaska (1994).

Co-principal Investigator, Endangered Seabird Radar Studies. Studied movements and abundance of nocturnal Dark-rumped Petrels and Newell's Shearwaters on the island of Hawaii (1994).

Co-principal Investigator, Endangered Seabird Radar Studies. Studied movements and behavior of nocturnal Dark-rumped Petrels and Newell's Shearwaters on the island of Kauai, Hawaii. Also investigated the impact of powerlines on these endangered species (1992-1994).

Co-principal Investigator, Oilspill Studies. Studied the impacts to and recovery of wildlife from effects of the *Exxon Valdez* oil spill. Studies were on a diverse suite of birds and mammals and were conducted in Prince William Sound and on the Kenai Peninsula (1989-1994).

Principal Investigator, OTH-B (Over-The-Horizon, Backscatter) Radar Avian Studies. Studied the nocturnal migration of birds with respect to weather conditions near potential OTH-B radar sites in South Dakota and Minnesota (1989).

Co-principal Investigator, Marine Pollution Studies. Studied the quantitative distribution of tarballs, marine debris, and plastic pollutants in the Gulf of Alaska, North Pacific, and Bering Sea with respect to oceanography. Studied the decomposition of plastic debris at sea and its ingestion by and entanglement of seabirds, marine mammals, fishes, and squids (1976-1980, 1984-1989).

Principal Investigator, Studies of Seabirds at Sea. Studied the quantitative distribution, behavior, and migrations of seabirds in relation to oceanographic parameters, including extensive pelagic surveys in the Gulf of Alaska, North Pacific, and Bering Sea aboard NSF, NOAA, and foreign research vessels (1982-1988).

Principal Investigator, Seabird-Gillnet Studies. Studied the species composition, behavior, numbers, and mortality rates of seabirds killed in drift gillnets fished for squid and salmon in the North Pacific by Japanese, Korean, and Taiwanese fishermen (1982-1987).

Principal Investigator, Flying Squid Fishery Studies. Studied the oceanography; the species composition and abundance of zooplankton; the species composition and vertical distribution of mesopelagic fishes and squids that are eaten by Dall's Porpoises; and the quantitative distribution of seabirds and marine mammals in the North Pacific flying squid fishery (1987-1988).

Research Associate, Sea Ice-Atmospheric Studies. Worked with Dr. Joseph Niebauer of the University of Alaska on computer time-series analyses of oceanographic and atmospheric data sets, to determine the importance of several variables in affecting interannual patterns of sea ice, sea-surface temperatures, and air temperatures in the Bering Sea (1987).

Principal Investigator/Research Associate, Seabird Biology Studies. Studied the feeding biology of several species of seabirds; the nesting biology, nest-site characteristics, and reproductive performance of seabirds; and techniques for conducting seabird censuses at several locations in the Shumagin and Aleutian islands and Bering Sea (1975-1978, 1980-1983).

Research Assistant, Port Valdez Environmental Studies. Assisted Dr. Howard Feder of the University of Alaska with studies on the effects of discharge and tanker operations on the biology, species composition, feeding, and survivorship of intertidal and subtidal benthic invertebrates in Port Valdez. Also assisted with studies on species composition and distribution of benthic invertebrate communities for OCS offshore oil studies in the Bering Sea (1980-1983).

Research Associate, Gull Studies. Studied the effects of food and habitat characteristics on the reproductive performance of Glaucous-winged Gulls in Kenai Fjords National Monument. Also, conducted censuses of other seabirds and assisted with studies on ice-inhabiting Harbor Seals (1979).

Principal Investigator, Aleutian and Shumagin islands Wildlife Studies. Mapped and conducted censuses of seabird, marine mammal, and raptor colonies and populations in the central and western Aleutian Islands National Wildlife Refuge (1977-1978) and the Shumagin Islands Unit of the Alaska Maritime National Wildlife Refuge (1976).

Research Assistant, Puffin Studies. Assisted with research on breeding biology and feeding ecology of puffins in the western Aleutian Islands (1975).

EMPLOYMENT HISTORY:

ALASKA BIOLOGICAL RESEARCH, INC. Senior Scientist, 1989-present. Research Associate, 1986-1988 (part-time).

U.S. FISH AND WILDLIFE SERVICE, OFFICE OF MIGRATORY BIRDS, Washington, DC. Research Consultant, 1988.

N.O.A.A., NATIONAL MARINE FISHERIES SERVICE, Auke Bay Laboratory, Juneau, AK. Research Consultant, 1986-1988 (intermittent contracts).

JOINT INSTITUTE OF MARINE AND ATMOSPHERIC RESEARCH, UNIVERSITY OF HAWAII, Honolulu, HI. Research Consultant, 1988.

N.O.A.A., NATIONAL MARINE FISHERIES SERVICE, NATIONAL MARINE MAMMAL LABORATORY, Seattle, WA. Chief Scientist/Research Consultant, 1987-1988.

INSTITUTE OF MARINE SCIENCES, UNIVERSITY OF ALASKA, Fairbanks, AK. Graduate Research Assistant, 1983-1988 (part-time). Research Assistant/Research Associate, 1980-1983.

ALASKA PARKS STUDIES UNIT, UNIVERSITY OF ALASKA, Fairbanks, AK. Research Associate, 1979.

U.S. FISH AND WILDLIFE SERVICE, ALEUTIAN ISLANDS NATIONAL WILDLIFE REFUGE, ADAK, AK. Research Associate, 1977-1978. Research Assistant, 1975.

U.S. FISH AND WILDLIFE SERVICE, OFFICE OF BIOLOGICAL SERVICES, Anchorage, AK. Research Associate, 1976.

DIVISION OF LIFE SCIENCES, UNIVERSITY OF ALASKA, Fairbanks, AK. Teaching Assistant, 1983, 1976-1979.

PUBLICATIONS:

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Day, R. H., D. M. Clausen, and S. E. Ignell. 1986. Distribution and density of plastic particulates in the North Pacific Ocean in 1986. Document submitted to the International North Pacific Fisheries Commission, Anchorage, AK (November 1986) by American Section [N.O.A.A., N.M.F.S., Northwest and Alaska Fisheries Center, Auke Bay Laboratory, Auke Bay, AK]. 17 pp.

Day, R. H. 1986. Report on the cruise of the *Pusan 851* to the North Pacific Ocean, July-August 1986. Unpubl. rep. prepared for N.O.A.A., N.M.F.S., Auke Bay Laboratory, Auke Bay, AK. 93 pp.

Feder, H. M., R. H. Day, S. C. Jewett, K. McCumby, S. McGee, and S. V. Schonberg. 1985. The infauna of the northeastern Bering and southeastern Chukchi seas. Environmental assessment of the Alaskan continental shelf, final rep. 32: 1-120.

Day, R. H. 1980. The occurrence and characteristics of plastic pollution in Alaska's seabirds. M.S. Thesis, Univ. of Alaska, Fairbanks, AK. 111 pp.

Moe, R. A., and R. H. Day. 1979. Populations and ecology of seabirds of the Koniuji Group, Shumagin Islands, Alaska. Environmental Assessment of the Alaskan Continental Shelf, ann. rep. 2: 395-491.

Day, R. H., B. E. Lawhead, T. J. Early, and E. B. Rhode. 1978. Results of a marine bird and marine mammal survey of the western Aleutian Islands. U.S. Fish and Wildlife Service, Unpubl. ann. rep. Aleutian Islands NWR, Adak, AK. 243 pp.

Day, R. H., E. P. Knudtson, and T. J. Early. 1978. A bird and mammal survey of the west-central Aleutian Islands. U.S. Fish and Wildlife Service, ann. rep. Aleutian Islands NWR, Adak, AK. 180 pp.

PROFESSIONAL MEMBERSHIPS:
American Ornithologists' Union (Life Member)
Association of Field Ornithologists (Life Member)
British Ornithologists' Union (Life Member)
Colonial Waterbird Group (Life Member)
Cooper Ornithological Society (Life Member)
Ornithological Society of New Zealand (Life Member)
Pacific Seabird Group (Life Member)
Royal Australasian Ornithologists' Union
Sigma Xi, the Scientific Research Society
Society of Western Field Ornithologists (Life Member)
Wilson Ornithological Society (Life Member)

HONORS/ACHIEVEMENTS/PUBLIC SERVICE:

1995-1996	On Local Organizing Committee for 6th Alaska Bird Conference, Fairbanks, AK.
1994	Listed in *Dictionary of International Biography* (23rd ed.)
1993-1995	On Endangered Species Recovery Team for Spectacled Eiders, AK.
1993	Listed in *Who's Who in the West* (24th ed.)
1993	Co-chair of Local Organizing Committee for 111th Annual Meeting of the American Ornithologists' Union, Fairbanks, AK.
1988-1989	Board of Directors of Alaska Chapter Sigma Xi, the Scientific Research Society
1987-1988	Resource Fellow, University of Alaska, Fairbanks, AK.
1987	Sea Grant Fellow, University of Alaska, Fairbanks, AK.
1987	Listed in *Who's Who in American Universities and Colleges.*
1985-1986	Angus Gavin Memorial Fellow, University of Alaska, Fairbanks, AK.
1984	Listed in *Who's Who in American Frontiers of Science and Technology.*
1980-1981	President, Fairbanks Bird Club.
1980	Most Outstanding Student in Biological Sciences, University of Alaska, Fairbanks, AK.
1970-1974	Alfred P. Sloan Scholar, Antioch College, Yellow Springs, OH.

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
May 1, 1997 - April 30, 1998

Budget Category:	Authorized FFY 1996	Proposed FFY 1997	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 1998	Estimated FFY 1999	Estimated FFY2000	Estimated FFY 2001	Estimated FFY 2001	Estimated FFY 2002
Personnel		$106.6						
Travel		$2.3						
Contractual		$62.5						
Commodities		$4.8						
Equipment		$0.0						
Subtotal	$0.0	$176.2						
Indirect		$0.0						
Project Total	$0.0	$176.2	N/A	N/A	N/A	N/A	N/A	
Total Personnel Hours *		1,790						
	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 28, 1995 to substitute all inclusive hourly rates for monthly costs and indirect costs.

- Full-Time Equivalents (FTE's) have been changed to Total Personnel Hours.
- This budget reflects 1997 expendituresonly; long-range funding requirements will need to be recalculated based on results of the1997 program.
- As requested by theTrustees, this budget includes all costs required to complete the 1997 study, including data analysis and report-writing costs that actually will occur in FFY 1998.
- The dates indicated in this proposal correspond to the dates effective for our current 1996-1997 NOAA contract. (Contract No. 52ABNF600063)
- USFWS Administrative and Management costs ($15,800), are not listed here; they will be handled separately by NOAA .

1997

Project Number: 97142
Project Title: **Status and Ecology of Kittlitz's Murrelet in Prince William Sound**
Name: **ABR, Inc.**

FORM 4A
Non-Trustee
DETAIL

Prepared:

3/29/96

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
May 1, 1997 - April 30, 1998

Personnel Costs:				*** Hours**	*** Hourly**		Proposed
Name		Position Description		Budgeted	Costs	Overtime	FFY 1997
Ritchie	R	Principal		8.0	$92.40	$0	0.7
Murphy	S	Research Coordinator		28.0	$87.15	$0	2.4
Day	R	Senior Scientist		858.0	$71.40	$0	61.3
DeLong	T	Office/Contracts Manager		20.0	$64.05	$0	1.3
Smith	B	GIS Specialist		24.0	$52.50	$0	1.3
Staff		Research Biologist II		596.0	$48.30	$0	28.8
Zusi-Cobb	A	Graphic Technician/GIS		176.0	$47.25	$0	8.3
Staff		Word Processor/Administrative Assistant		48.0	$34.65	$0	1.7
Staff		Technician Aide		32.0	$26.25	$0	0.8
			Subtotal	1790.0	N/A	0	
						Personnel Total	$106.6

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
Commercial Air Travel (Fairbanks-Anchorage) to attend EVOS Meetings	430	2	7	140	1.8
Ground Transportation (Fairbanks-Valdez) for cruises	240	2	4	0	0.5
				Travel Total	$2.3

1997

Project Number: 97142
Project Title: **Status and Ecology of Kittlitz's Murrelet in Prince William Sound**
Name: **ABR, Inc.**

FORM 4B
Personnel
& Travel
DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
May 1, 1997 - April 30, 1998

Contractual Costs:		Proposed
Description		FFY 1997
1 Boat Charter for 21 days @ $1,200/day (includes food, water, and skiff)	Late May--Mid June Cruise	25.2
2 Boat Charter for 25 days @ $1,200/day (includes food, water, and skiff)	Late July -- Mid August Cruise	30.0
3 Truck Rental (7 weeks @ $375/wk)--ABR Equipment Lease		2.6
4 35 mm Camera Rental (7 weeks @ $75/week)--ABR Equipment Lease		0.5
5 Dissecting Microscope (1 weeks at $120 week)--ABR Equipment Lease		0.1
6 Electronic Scale (1 week @ $75/week)--ABR Equipment Lease		0.1
7 Telemetry Receiver (1 month @ $275/month)-- ABR Equipment Lease		0.3
8 Phone/Fax/Modem		0.3
9 Photocopying		0.3
10 Report Printing		0.3
11 Fee (5%) on Contractual Costs (excluding ABR Equipment Lease)		2.8
	Contractual Total	$62.5

Commodities Costs:	Proposed
Description	FFY 1997
1 Telemetry Receivers	1.8
2 Misc Gear and Supplies	2.2
3 Mist-Netting Gear	0.6
4 Fee (5%) on Contractual Costs (excluding ABR Equipment Lease)	0.2
Commodities Total	$4.8

1997

Project Number: 97142
Project Title: **Status and Ecology of Kittlitz's Murrelet in Prince William Sound**
Name: **ABR, Inc.**

FORM 4B
Contractual & Commodities DETAIL

1996 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
May 1, 1997 - April 30, 1998

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1996
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those 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 Dissecting Laboratory	1
2 Library reference books	
3 Computer Resources	
4 GIS/Digitizing Station (s)	2
5 Office Space	
6 Equipment Storage	

1997

Project Number: 97142
Project Title: **Status and Ecology of Kittlitz's Murrelet in Prince William Sound**
Name: **ABR, Inc**

FORM 4B
Equipment
DETAIL

3/29/96

Common Murre Population Monitoring

Project Number:	97144
Restoration Category:	Restoration Monitoring
Proposer:	DOI-FWS
Lead Trustee Agency:	USFWS
Cooperating Agencies:	None
Alaska SeaLife Center:	
Duration:	2 years (however, if a proposed 2rd optional year is added to the project to count the Chiswell Islands murre colonies in FY98, the duration of the study will increase by one year).
Cost FY97:	$73,800
Cost FY98:	$21,500 (or $50,000, if a proposed 3rd optional year is added to the project to count the Chiswell Islands murre colonies in FY98).
Geographic Area:	Under the proposed 2-year program, field work will be conducted at the Barren Islands murre colonies in FY97. If an optional 3rd year of work is approved, murre populations will be counted at the Chiswell Islands colonies in FY98.
Injured Resource/Service:	Common murres

ABSTRACT

This proposed restoration monitoring study is a continuation of recently approved Project 96144, a common murre *(Uria aalge)* population monitoring study that will be conducted in 1996. Project 96144 was designed to collect common murre population numbers data at nesting colonies affected by the T/V *Exxon Valdez* oil spill to help assess the recovery status of this injured species in the spill area. The study was divided into two components. Under the proposed 2-year long FY96-FY97 primary program (see the Project 96144 DPD), murres were scheduled to be counted at the Barren Islands nesting colonies during FY96 and FY97. An optional 3rd year of census work at the Chiswell Islands murre colonies was also proposed in the FY96 Project 96144 DPD. If this optional FY98 study component is approved, it will supply complimentary data from another injured nesting location that will help evaluate the overall recovery status of common murres in the spill area. During FY97, the same methods used during the FY93-FY94 common murre restoration monitoring studies (Projects 93049 and 94039) and the recently approved FY96 work will be used to collect and analyze the population numbers data (see Roseneau *et al.* 1995, 1996; and the Project 96144 DPD). Products will include annual and final reports that will compare the FY97 counts with all previous postspill data (i.e., 1989-1996) and discuss differences among years, presence and absence of trends, and differences between 1990-1992 U.S. Fish and Wildlife Service (FWS), University of Washington (UW), and Dames & Moore (D&M) counts.

INTRODUCTION

This proposed restoration monitoring study is a continuation of recently approved Project 96144, a common murre *(Uria aalge)* population monitoring study that will be conducted in 1996. The FY97 component of the project is designed to collect a second consecutive year of data on population numbers of common murres *(Uria aalge)* at the Barren Islands nesting colonies that are needed to evaluate the recovery status of this species in the T/V *Exxon Valdez* oil spill area. During 1989-1991, the U.S. Fish and Wildlife Service (FWS) conducted several *Exxon Valdez* Oil Spill Trustee Council-sponsored murre damage assessment projects at 5 index nesting locations in the spill zone: the Chiswell Islands (1989-1991), Barren Islands (1989-1991), Triplet islands (1989), Puale Bay (1989-1991), and Ugaiushak Island (1990-1991). These early studies concluded that timing of nesting events was late, productivity was below normal levels, and population numbers were smaller than prespill estimates (e.g., Nysewander *et al.* 1993). Murre restoration monitoring projects were begun in 1992; FWS crews collected information at the Chiswell Islands, Barren Islands, and Puale Bay colonies that year (Dragoo *et al.* 1995), and in 1993-1994, additional data were obtained from the Barren Islands nesting complexes (Roseneau *et al.* 1995, 1996). Murres were also studied at the Barren Islands in 1995, the first year of a Trustee Council-sponsored APEX project on seabird productivity and energetics (see Project 95163J). Results from the restoration monitoring studies and the FY95 APEX pilot work have shown that productivity (fledglings per egg) reached normal levels at Puale Bay by 1992 (the last study year at this index location; see Dragoo *et al.* 1995) and fell within these ranges at the Barren Islands colonies in 1993-1995 (Roseneau *et al.* 1995, 1996; Roseneau *et al.*, unpubl. data). However, based on all information collected to date, clear evidence has not been found that indicates murre populations are increasing at Gulf of Alaska study locations affected by the spill.

To help address this problem, we proposed to census the East Amatuli Island - Light Rock and Nord Island - Northwest Islet Barren Islands murre colonies in FY96 and again in FY97 (see the Project 96144 DPD). These colonies were last counted completely in 1994 (Project 94039), the year when positive trends were first detected on two small sets of East Amatuli Island - Light Rock index plots (Roseneau *et al.* 1996). Based on limited information from the recent FY95 Barren Islands APEX pilot study (Project 95163J), positive trends were also present on these plot sets in 1995 (Roseneau *et al.*, unpubl. data). However, these data cannot be interpreted as evidence of population growth until significant increases are found on larger sets of population monitoring plots. Currently, conditions are becoming favorable at the Barren Islands for detecting changes on plot sets, because birds produced during the high productivity years of 1993-1994 should begin returning to the area by FY97 (Roseneau *et al.* 1996). Completely censusing these colonies and making replicate counts on all sets of special index monitoring plots (multicount plot sets) in FY97 will provide the additional data needed to confirm or deny the presence of population increases at this injured nesting location.

The FY97 Barren Islands study component is also designed to address another problem: the differences remaining between some of the 1990-1992 FWS counts and estimates reported by Exxon-sponsored 1990-1992 University of Washington (UW) and 1991 Dames & Moore (D&M) studies (e.g., Nysewander *et al.* 1993, Boersma *et al.* 1995, Dragoo *et al.* 1995, Erikson 1995). Collecting whole-colony, whole-island, Light Rock, and multicount plot population numbers data at the Barren Islands colonies in FY97 will supply additional information that may help resolve this issue (i.e., in conjunction with FY96 data—see the Project 96144 DPD).

We proposed an optional component in the FY96 Project 96144 DPD to conduct common murre population monitoring studies at the Chiswell Islands in FY98, and we have also included it in this DPD. The Chiswell Islands murre colonies have not been censused since 1992 (see Dragoo *et al.* 1995), and counting birds at them during FY98 is justified, because they were also affected by the spill (e.g., Nysewander *et al.* 1993, Dragoo *et al.* 1995, Erikson 1995). New up-to-date data on population numbers are needed from at least one murre nesting location in the spill area in addition to the Barren Islands to help evaluate the overall recovery status of this injured species in the spill area.

NEED FOR THE PROJECT

A. Statement of Problem

Based on carcass counts and computer modeling studies, more common murres were killed during the spill than other species (e.g., Piatt *et al.* 1990, ECI 1991). This injured species is currently in the process of being upgraded from "not recovering" to "recovering" by the Trustee Council because productivity (fledglings per egg) returned to normal levels at Puale Bay by 1992 (Dragoo *et al.* 1995) and was within normal ranges at the Barren Islands colonies during the last three consecutive nesting seasons (1993 - 1995; Roseneau *et al.* 1995, 1996; Roseneau *et al.*, unpubl. data). However, based on the most recent postspill studies at four index locations (the Triplets, 1989; Ugaiushak Island, 1991; Puale Bay, 1992; and the Chiswell Islands, 1992—see Nysewander *et al.* 1993, Dragoo *et al.* 1995), and more current information from the Barren Islands (1993-1995), murre numbers are still below reported prespill estimates and no clear evidence has been found that indicates populations of these seabirds are growing at nesting locations affected by the spill. Although positive trends were detected on two small plot sets at the East Amatuli Island - Light Rock Barren Islands colony in 1994-1995, one of these increases was barely significant (Kendall's Tau, significance level 0.1), and changes were not apparent on a larger set of population monitoring plots (Roseneau *et al.* 1996; Roseneau *et al.*, unpubl. data). Before common murres can be declared recovered, data are needed that clearly show these birds are increasing at the Barren Islands and other injured nesting locations in the spill area. Also, differences are still present between some of the reported 1990-1992 FWS, UW, and D&M Barren Islands population estimates (e.g., Nysewander 1993, Boersma *et al.* 1995, Dragoo *et al.* 1995, Erikson 1995, Roseneau *et al.* 1996). Censusing murres at the East Amatuli Island - Light Rock and Nord Island - Northwest Islet colonies in FY97 will update the population data base and provide additional information on population sizes that may help resolve these differences between counts (i.e., in conjunction with FY96 data—see the Project 96144 DPD).

B. Rationale/Link to Restoration

Data are needed to determine whether common murre populations are increasing at Gulf of Alaska nesting colonies injured by the spill. The reproductive strategy of common murres is characteristic of long-lived animals and populations tend to grow slowly (e.g., Heinemann 1993). As a result, it is now becoming more feasible to detect changes in population numbers at injured nesting locations in the spill area. The Barren Islands colonies provide an opportunity for documenting population growth because murre productivity was high there during 1993-1995, and birds from the 1993-1994 age-classes should begin returning to the area by 1996-1997 (Roseneau *et al.* 1995, 1996; Roseneau *et al.*, unpubl. data). The FY96-FY97 Barren Islands restoration monitoring project is designed to take advantage of this opportunity and supply population numbers data that can be rigorously tested for trends. These data will also provide new information on population numbers that will help re-evaluate the differences between some of the 1990-1992 FWS, UW, and D&M postspill estimates. The proposed FY98 Chiswell Islands counts, if approved, will supply new data on population numbers that are needed to help assess the recovery status of common murres in the spill area. After the spill, damage assessment studies reported that population numbers were lower than prespill estimates at 5 index nesting locations: the Chiswell Islands, Barren Islands, Triplet islands, Puale Bay, and Ugaiushak Island (e.g., Nysewander *et al.* 1993). With the exception of the Barren Islands, data have not been collected from some of these locations since 1989-1991, and when the Puale Bay and Chiswell Islands colonies were last visited in 1992, no evidence was found indicating murres were increasing at them (e.g., Dragoo *et al.* 1995). The Chiswell Islands are well-suited for conducting additional murre restoration monitoring studies because of their position closer to the point of the spill, their data history (postspill data were collected in 1989-1992), and their less expensive logistical requirements, compared with other index study sites. Therefore, we believe that the Chiswell colonies should be considered for study in FY98, because counting murres at them will compliment the FY96-FY97 Barren Islands monitoring projects by providing population numbers data from another injured nesting location that can be used to assess the overall recovery status of the species within the spill area.

C. Location

In FY96, the recently approved Project 96144 common murre population monitoring study will be conducted at the East Amatuli Island - Light Rock and Nord Island - Northwest Islet colonies in the Barren Islands, about 100 km south of Homer in the northwestern Gulf of Alaska (see the Project 96144 DPD). In FY97, field work will be conducted at this same location as a continuation of the FY96 work. If an optional 3rd study year is approved, additional field work will be conducted at the Chiswell Islands near the entrance to Resurrection Bay in FY98. No communities will be affected by the study.

COMMUNITY INVOLVEMENT

Large format, computer-generated color posters summarizing annual results will be prepared and submitted to the Trustee Council for public display each year after data have been analyzed (similar posters showing preliminary results from two FY95 APEX pilot studies—95163K and J—were submitted to the Trustee Council after public display at the 16-18 January 1996 restoration workshop). The printed posters are easy to transport and can be used by Trustee Council staff for a variety of purposes, including public displays at oil spill community meetings and schools. Abstracts summarizing annual findings and the posters will also be available on-disk for inclusion in any on-line products that the Trustee Council may develop for public use. Field activities will be photographed and a file of 35 mm color slides will be compiled for Trustee Council use at community meetings and in public newsletters, displays, and on-line information services. Copies of annual and final reports will be available to the public in Homer and Anchorage. Study results will also be presented at public Trustee Council-sponsored meetings and workshops, and in scientific publications. Any vessels or aircraft needed for travel to/from the Barren Islands during the project will be chartered locally. Most supplies will also be purchased locally (i.e., in Homer), and an attempt will be made to find local volunteers for the study.

PROJECT DESIGN

A. Objectives

The overall objective of the proposed project is to determine whether murre populations are increasing at injured nesting colonies in the spill area. Under the proposed 2-year Barren Islands program (i.e., combined work by recently approved Project 96144 in FY96 and this study), specific objectives are to:

1. Collect multiple sets of population numbers data from the East Amatuli Island - Light Rock and Nord Island - Northwest Islet colonies in FY96-FY97 for direct comparison with 1989-1995 FWS, 1990-1992 UW, and 1991 D&M information and population trend analyses; and

2. Use the results to re-evaluate and resolve differences remaining between some the 1990-1992 FWS and UW counts.

If a 3rd-year of study is approved to make counts at the Chiswell Islands nesting location in FY98, additional objectives will be to:

3. Collect multiple sets of population numbers data from the Natoa, Matuska, Chiswell, Chiswell "B", Beehive, and Beehive "B" colonies for direct comparison with 1989-1992 FWS and 1991 D&M information and population trend analyses; and

4. Discuss these results in context with results from 1989-1997 Barren Islands studies.

B. Methods

The project is designed to test the null hypothesis that murre populations have not increased at nesting colonies in the spill area since the time of the event. The hypothesis will be tested by censusing birds at breeding locations that were injured during the spill and statistically testing these and other postspill data for differences among years and trends in population size.

The same methods used during the FY93-FY94 common murre restoration monitoring studies (Projects 93049 and 94039; Roseneau *et al.* 1995, 1996) and recently approved FY96 population monitoring project (Project 96144) will be used to collect and analyze the data. Field work will begin about 16 July and end about 19 August. During the FY97 Barren Islands work, a light helicopter will transport personnel from Homer to East Amatuli Island to make some of the East Amatuli Island - Light Rock counts, and a 15-25 m vessel will be hired to support censuses at Nord Island - Northwest Islet (a vessel is needed at this location because of strong rip currents, and using it also eliminates the cost of maintaining a camp on Ushagat Island). If the optional 3rd-year study component to count the Chiswell Islands colonies is approved, a 10-15 m vessel will be contracted to support this effort in FY98 (a vessel is required at this location because of strong tidal flows, distances between colonies, and lack of suitable camp sites).

Data Collection

Census teams will be led by experienced observers (e.g., D.G. Roseneau, A.B. Kettle). Personnel, working in pairs, will use previously prepared photographic guides to locate plot boundaries, and they will simultaneously count birds on plots from small boats using 7x42 binoculars and hand-held tally meters. One person will record the plot scores without revealing his/her own count to the other observer. The recorder will compare the scores as they are being made to see if they fall within 10% of each other (i.e., within 5% of their average; in some cases at the Barren Islands, the 15% level will be used as the guideline—see Roseneau *et al.* 1995, 1996). If they are not and time allows, the observers will recount the plots until both scores fall within this range. Counts will be made by 10's or 1's, depending on plot histories (e.g., at the Barren Islands, some UW plots have been traditionally counted by 1's), and they will be conducted during the part of the nesting season when attendance is most stable. The census period will be defined as the interval between the peak of egg-laying and first sea-going of chicks (see Byrd 1989; Hatch and Hatch 1989; Roseneau *et al.* 1995, 1996). Counts will also be made during 1100-2000 hrs Alaska Daylight Time (ADT), the most appropriate time of day for censusing murres at northern Gulf of Alaska latitudes (e.g., Boersma *et al.* 1993; Dragoo *et al.* 1995; Roseneau *et al.* 1995, 1996; FWS, unpubl. data).

In FY97 (as during FY96—see the Project 96144 DPD), two types of counts will be made at the Barren Islands murre colonies using previously established sets of population monitoring plots (see Fig. 1 and Roseneau *et al.* 1995, 1996). Entire colonies and their major subunits (e.g., Light Rock and East Amatuli Island), will be censused two to four times on different days during the census period to obtain general population numbers information for comparison with previous postspill whole-colony, whole-island, and Light Rock estimates (e.g., Nysewander *et al.* 1993; Boersma *et al.* 1995; Dragoo *et al.* 1995; Erikson 1995; Roseneau *et al.* 1995, 1996). Sets of index plots (multicount plots; see Roseneau *et al.* 1995, 1996) will also be counted at least five separate times on different dates at both colonies to obtain data for making statistical comparisons among years and tracking trends in population sizes (these plot sets contain about 10-15% of the murres on the cliffs at both colonies; a minimum of five separate counts are needed to account for daily variation in bird numbers—e.g., see Byrd 1989, Hatch and Hatch 1989). The Nord Island - Northwest Islet multicount plot information will be compared with 1989-1994 FWS data (Nysewander *et al.* 1993; Dragoo *et al.* 1995; Roseneau *et al.* 1995, 1996). Information obtained on the more recently created East Amatuli Island - Light Rock multicount set, which also contains two plots censused by FWS crews during 1989-1992 (the BMC3-4 plots; see Roseneau *et al.* 1995, 1996) and three plots counted by UW personnel in 1990-1992 (the OSTR plots; see Boersma *et al.* 1995), will be compared directly with 1993-1996 FWS data (Roseneau *et al.* 1995, 1996; unpubl. data). Comparisons will also be

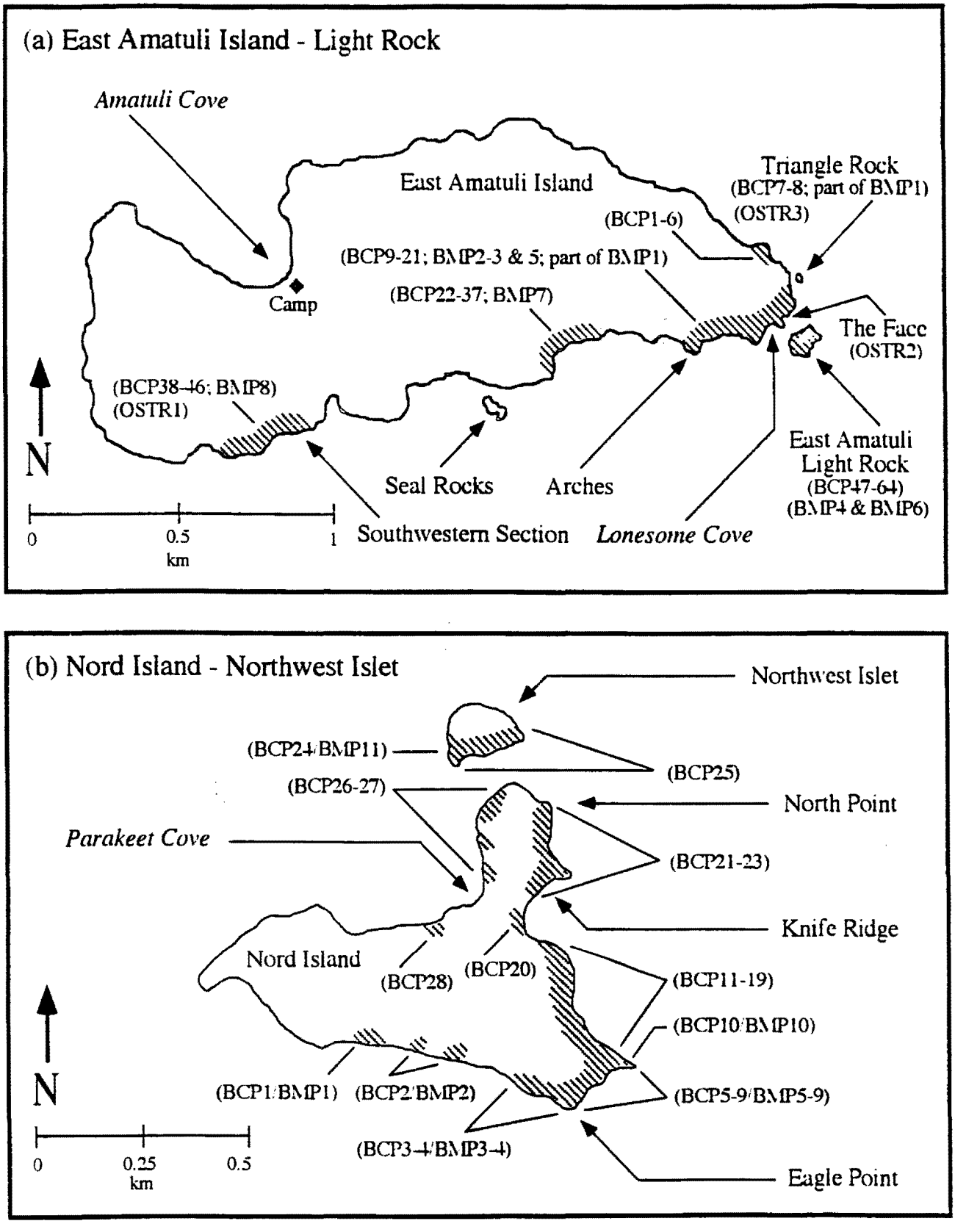

Figure 1. Murre nesting habitat (shaded areas), population census plots (BCP), multicount plots (BMP), and other index plots (OSTR) at the (a) East Amatuli Island - Light Rock and (b) Nord Island - Northwest Islet murre colonies, Barren Islands, Alaska.

made between subsets of this information and 1989-1996 FWS 2-plot data (see Nysewander *et al.* 1993; Dragoo *et al.* 1995; Roseneau *et al.* 1995, 1996; unpubl. data), and 1990-1996 OSTR plot information (see Boersma *et al.* 1995; Roseneau *et al.* 1996; unpubl. data). *[The 1996 data will be obtained during the recently approved Project 96144 work.]*

If the optional Chiswell Islands work is approved for FY98, the Natoa, Matuska, Chiswell, Chiswell "B", Beehive, and Beehive "B" colonies will be counted completely at least five separate times on different dates during the census period for comparison with 1989-1992 FWS and 1991 D&M postspill data (see Dragoo *et al.* 1995 and Erikson 1995, respectively; because the Chiswell colonies are relatively small and easy to count, all previously established FWS plots serve as multicount plots). Boundaries of plots will be located using photographs in Alaska Maritime NWR files.

Data Analysis

The statistical power of the proposed samping program to detect significant changes in numbers is discussed in Appendix 1. Data will be analyzed by the same methods used in FY96 (see the Project 96144 DPD) and during the 1993 and 1994 murre restoration monitoring studies (Projects 93049 and 94039; see Roseneau *et al.* 1995,1996). During the analyses, the 1-day totals obtained on the different plot sets (e.g., whole colony census plots, multicount plots) will be treated as sample units, and average values will be calculated from these 1-day scores. One-way analysis of variance (ANOVA) and Tukey HSD multiple pairwise comparison tests will be used to check for differences among years, and Kendall's Tau rank correlation tests and regressions (probably log-transformed, because population growth may not be linear) will be run to look for postspill trends at the 0.1 significance level (the 0.1 significance level will be used to increase the power of the tests and reduce Type II error; the 0.90 confidence interval is both adequate and acceptable for our purposes).

C. Cooperating Agencies, Contracts and Other Agency Assistance

A contract will be required to hire a vessel for 24 days to support the Barren Islands population counts in FY97 (the majority of the vessel time will be utilized during censuses at the Nord Island - Northwest Islet colony). A similar contract will also be needed in FY98, if the optional Chiswell Islands study component is approved for that year. *[A similar contract was required for Project 96144 in FY96; see the 96144 DPD.]*

SCHEDULE

A. Measurable Project Tasks for FY96 (1 October 1995 - 30 September 1996), FY97 (1 October 1996 - 30 September 1997), and FY98 (1 October 1997 - 30 September 1998)

Schedules for FY96, FY97, and FY98 are provided here for clarity (also see the Project 96144 DPD)

FY96

1 Feb - 30 Apr 1996:	Arrange for vessel contract and hiring of seasonal employee, coordinate logistics with APEX project 96163J, begin checking/repairing equipment and other gear (e.g., boats, outboard motors, radios, binoculars, survival suits).
1-31 May 1996:	Finalize vessel contract, check and update census plot booklets for the colonies, finish checking/repairing equipment and other gear.
1-30 Jun 1996:	Purchase supplies.

1-14 Jul 1996:	Pack equipment and supplies and load them on contract vessel.
15 Jul 1996:	Depart Homer for Barren Islands study area.
16 Jul - 19 Aug 1996:	Collect data.
20 Aug 1996:	Depart Barren Islands study area and return to Homer.
21-25 August 1996:	Unload vessel, clean and store equipment.
5-30 Sep 1996:	Enter data.

FY97

1 Oct - 30 Nov 1996:	Analyze data.
1 Dec 1996 - 28 Feb 1997:	Prepare draft annual report, arrange for vessel contract, begin coordinating logistics with APEX project 96163J.
1 Mar 1997:	Submit report for in-house review.
2-15 Mar 1997:	Arrange for hiring of seasonal employee.
20 Mar - 10 Apr 1997:	Finalize annual report, begin checking/repairing equipment and other gear (e.g., boats, outboard motors, radios, binoculars, survival suits).
13 Apr 1997:	Submit annual report to Chief Scientist for peer review.
20 Apr- 31 May 1997:	Finalize vessel contract, check and update census plot booklets for the colonies, finish checking/repairing equipment and other gear.
1-30 Jun 1997:	Purchase supplies.
1-14 Jul 1997:	Pack equipment and supplies and load them on contract vessel.
15 Jul 1997:	Depart Homer for Barren Islands study area.
16 Jul - 19 Aug 1997:	Collect data.
20 Aug 1997:	Depart Barren Islands study area and return to Homer.
21-25 August 1997:	Unload vessel, clean and store equipment.
5-30 Sep 1997:	Enter data.

FY98

1 Oct - 30 Nov 1997:	Analyze data, review information on 1989-1992 FWS, 1990-1992 UW, and 1991 D&M counts.
1 Dec 1997 - 28 Feb 1998:	Prepare draft final project report.
1 Mar 1998:	Submit report for in-house review.
20 Mar - 10 Apr 1998:	Finalize final project report.

13 Apr 1998: Submit final project report to Chief Scientist for peer review.

[Note: If the optional 3rd year study component is approved to count the Chiswell Island colonies in FY98, the schedule will be modified to prepare for the FY98 field season (i.e., it will closely resemble the schedule listed for 1 December 1996 - 10 April 1998; however, the Chief Scientist will receive an annual report on 13 April 1998 and the final report on 13 April 1999.]

B. Project Milestones and Endpoints

Project Milestones and Endpoints for FY96-FY98 are provided here for clarity (also see the Project 96144 DPD)

August 1996:	Field work completed at Barren Islands colonies.
April 1997:	Annual report on FY96 field activities submitted to Chief Scientist.
August 1997:	Field work completed at Barren Islands colonies.
April 1998:	Final project report on FY96-FY97 field activities submitted to Chief Scientist.

[Note: If the optional 3rd year study component is approved to count the Chiswell Island colonies in FY98, project milestones and endpoints will be modified to reflect 1 additional year of field work. An annual report on FY97 activities will be submitted to the Chief Scientist in April 1998, Field work will be completed at the Chiswell Islands colonies in August 1998, and a final project report on FY96 - FY98 activities will be submitted to the Chief Scientist in April 1999.]

C. Completion Date

Under the proposed 2-year Barren Islands program (i.e., censuses in FY96 and FY97—see the Project 96144 DPD), field work will be completed in FY97 and a final report will be submitted to the Chief Scientist by 15 April 1998. If the optional 3rd year of monitoring work at the Chiswell Islands is approved, field work will be finished in FY98 and the final report will be sent to the Chief Scientist by 15 April 1999 (see milestones/endpoints below).

PUBLICATIONS AND REPORTS

Project 97144 is a multiyear study (see the Project 96144 DPD). It will begin in FY96 and be completed in FY98. In FY98 a paper will be written on postspill trends in murre populations at the Barren Islands colonies. The paper will be submitted to either the Auk or Condor.

PROFESSIONAL CONFERENCES

Results from the FY96-FY97 field seasons will be presented at the Alaska Bird Conference in 1998. About $0.8K will cover the travel-related costs of attending this 3 day meeting and giving a paper on the EVOS-sponsored Barren Islands murre population monitoring research. Also, the results of the work may be presented at other conferences that may be scheduled for 1998 (i.e., if such conferences are held and are an appropriate forum for the work).

NORMAL AGENCY MANAGEMENT

The proposed common murre population census work at the Barren Islands is not something that AMNWR or the FWS is required to do by statute or regulation. Until recently, the Barren Islands were listed as an intermittent monitoring site for tufted puffins and fork-tailed storm-petrels *(Oceanodroma furcata)* in the refuge's seabird monitoring program. In 1994, these islands were also designated as an annual population monitoring site for murres and kittiwakes, primarily because EVOS-sponsored restoration studies (Projects 93049 and 94039) demonstrated that data could be collected at them that satisfied standard refuge monitoring protocols for these species. Designating the Barren Islands as a annual monitoring site has improved the refuge's chances of obtaining funding for conducting studies of murre populations at them. However, because the islands are not part of the FWS's highest priority ecosystem, the Bering Sea, monetary support for this kind of annual work will not be available until overall FWS priorities change (i.e., from the Bering Sea to other officially designated ecosystems within Alaska). The proposed project is needed to obtain census data to determine whether common murre populations are recovering at Gulf of Alaska nesting colonies injured by the spill. Results of the study will help formulate management strategies for common murres in the Gulf of Alaska.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The proposed common murre restoration monitoring study (Project 97144) is fully coordinated and integrated with the FY97 APEX Barren Islands seabird studies (Project 97163J). The vessel hired to support population counts of murres at the East Amatuli Island - Light Rock and Nord Island - Northwest Islet colonies will provide transportation to the APEX project during FY97, and in return, the APEX project will supply camp and radio communications facilities, a rigid-hulled inflatable boat, and personnel to help make population counts, thereby reducing overall costs of both projects. The restoration monitoring study is also coordinated with Alaska Maritime National Wildlife Refuge work at other locations in the Gulf of Alaska. The refuge will provide several items (e.g., office supplies, survival gear, radios, inflatable rafts, outboard motors, tents, cameras, binoculars) to the project that are not required by these other studies. During the field work, feeding concentrations of seabirds and whales will be noted to assist APEX investigators conducting hydroacoustic and trawl surveys in the area (e.g., J. Piatt, Project 97163M), and at the conclusion of the study, results from the population counts will be provided to the APEX project for use during a multiyear, multispecies analysis of seabird productivity and energetics.

EXPLAINATION OF CHANGES IN CONTINUING PROJECTS

No changes have been made to the project design or schedules for the FY97 portion of the common murre population monitoring project (i.e., project design, including methods, and schedules are the same as those proposed in the recently approved Project 96144 DPD).

PROPOSED PRINCIPAL INVESTIGATOR

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Fax number: (907) 235-7783
E-mail address: R7amnwr@mail.fws.gov (Please enter my last name under the Subject option)]

PERSONNEL

A. Project Manager - G. Vernon Byrd

Vernon Byrd received a B.S. degree in wildlife management from the University of Georgia in 1968, did post-graduate studies in wildlife biology at the University of Alaska-Fairbanks in 1975, and completed a M.S. degree in wildlife resources management at the University of Idaho in 1989. His thesis, entitled "Seabirds in the Pribilof Islands, Alaska: Trends and monitoring methods", explored statistical procedures for analyzing kittiwake *(Rissa* spp.*)* and murre *(Uria* spp.*)* population data. Mr. Byrd has worked for the U.S. Fish and Wildlife Service for over 20 years, focusing on studies of marine birds in Alaska and Hawaii. His major interests center around monitoring long-term trends in seabird populations, including numbers of birds and reproductive performance at colonies. He has worked at murre colonies in the Aleutian Islands, the Bering and Chukchi seas, and western Gulf of Alaska. Mr. Byrd was a co-author of the final T/V *Exxon Valdez* oil spill damage assessment report for murres. Also, he was project manager of the 1993-1994 common murre restoration monitoring studies (Projects 93049 and 94039, respectively), the APEX Barren Islands seabird studies in 1995 (Project 95163J) and projects to remove predators from islands containing seabird colonies (Projects 94041 and 95041, in 1994 and 1995, respectively). Currently Mr. Byrd is project manager of APEX Project 96163J (Barren Islands seabird studies) and EVOS common murre population monitoring Project 96144. Mr. Byrd has authored over 45 scientific papers and 50 U.S. Fish and Wildlife Service reports on field studies, and has made about 25 presentations on seabirds at scientific meetings. Mr. Byrd is the supervisory wildlife biologist at the Alaska Maritime National Wildlife Refuge, the premier seabird nesting area in the national public land system.

Selected Seabird Publications

Byrd, G.V., E.C. Murphy, G.W. Kaiser, A.J. Kondratyev, and Y.V. Shibaev. (In press). Status and ecology of offshore fish-feeding alcids (murres and puffins) in the North Pacific Ocean. Proceedings of "Symposium on the Status, Ecology, and Conservation of Marine Birds of the Temperate North Pacific". Canadian Wildlife Service, Ottawa.

Byrd, G.V., and J.C. Williams. Whiskered Auklet. 1993. A chapter describing the biology of the species *in* The birds of North America, No. 76 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia PA, and the American Ornithologists' Union, Washington, D.C. 12 pp.

Byrd, G.V., and J.C. Williams. Red-legged Kittiwake. 1993. A chapter describing the biology of the species *in* The birds of North America No. 60 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia PA, and the American Ornithologists' Union, Washington, D.C. 12 pp.

Springer, A.M. and G.V. Byrd. 1989. Seabird dependence on walleye pollock in the southeastern Bering Sea. Pages 667-677 *in* Proceedings of the International Symposium on the Biology and Management of Walleye Pollock. Alaska Sea Grant Rep. No. 89-1, Univ. of Alaska-Fairbanks.

B. Project Leader & Principal Investigator - David G. Roseneau

David Roseneau received his B.S. degree in wildlife management and M.S. degree in biology from the University of Alaska - Fairbanks in 1967 and 1972, respectively. His thesis research was on the numbers and distribution of gyrfalcons, *Falco rusticolus* on the Seward Peninsula, Alaska. He joined the U.S. Fish and Wildlife Service in January 1993 and was project leader of common murre restoration monitoring Projects No. 93049 and 94039 in the Barren Islands during 1993-1994. In 1995, Mr. Roseneau was also principal investigator of the APEX seabird studies pilot study in the Barren Islands (Project 95163J), and is currently principal investigator of the recently approved 1996 APEX Project Barren Islands seabird studies (Project 96163J) and the 1996 EVOS common murre population monitoring project in the Barren Islands (Project 96144). Prior to 1993, he was a consulting biologist for 20 years, and he has conducted and managed marine bird, raptor, and large mammal projects in Alaska and Canada for government agencies and private-sector clients. Mr. Roseneau has been involved in several large-scale murre *(Uria* spp.*)* population monitoring projects.

During 1976-1983, as co-principal investigator of NOAA/OCSEAP Research Unit 460, he conducted monitoring studies of murres and black-legged kittiwakes *(Rissa tridactyla)* at capes Lisburne, Lewis, and Thompson in the Chukchi Sea, and St. Lawrence, St. Matthew, and Hall islands in the Bering Sea. He also studied auklets *(Aethia* spp.*)* at St. Lawrence and St. Matthew islands, and participated in murre and kittiwake projects at Bluff in Norton Sound. In 1984-1986, he participated in follow-up studies of murres and kittiwakes in the northeastern Chukchi Sea, and during 1987-1988, 1991-1992, and 1995 he conducted additional murre and kittiwake work at capes Lisburne and Thompson, and at Chamisso and Puffin islands. Mr. Roseneau is experienced in collecting and analyzing data on numbers, productivity, and food habits of seabirds; relating trends in numbers and productivity to changes in food webs and environmental parameters (e.g., air and sea temperatures, current patterns); and assessing potential impacts of petroleum exploration and development on nesting and foraging marine birds. He has broad knowledge of rock climbing techniques and has operated inflatable rafts and other outboard-powered boats in the Bering, Chukchi, and Beaufort seas and on various Alaskan rivers in excess of 2,800 hrs. Mr. Roseneau has also accrued several hundred additional hours operating time in small boats and larger, more powerful vessels (e.g. 25 ft, 300-400 hp HydroSports and Boston Whalers) in Kachemak Bay, Prince William Sound, and Kenai Peninsula and Barren Island waters. During his career, Mr. Roseneau has authored and co-authored over 70 reports and publications, including 23 on Alaskan seabirds.

Selected Seabird Publications

Murphy, E.C., A.M. Springer, and D.G. Roseneau. 1991. High annual variability in reproductive success of kittiwakes *(Rissa tridactyla* L.*)* at a colony in western Alaska. J. Anim. Ecol. 60: 515-534.

Springer, A.M., E.C. Murphy, D.G. Roseneau, C.P. McRoy, and B.A. Cooper. 1987. Paradox of pelagic food webs in the northern Bering Sea - I. Seabird food habits. Cont. Shelf Res. 7: 895-911.

Murphy, E.C., A.M. Springer, and D.G. Roseneau. 1986. Population status of *Uria aalge* at a colony in western Alaska: results and simulations. Ibis 128: 348-363.

Springer, A.M., D.G. Roseneau, D.S. Lloyd, C.P. McRoy, and E.C. Murphy. 1986. Seabird responses to fluctuating prey availability in the eastern Bering Sea. Marine Ecol. Prog. Ser. 32: 1-12.

Springer, A.M. and D.G. Roseneau. 1985. Copepod-based food webs: auklets and oceanography in the Bering Sea. Marine Ecol. Prog. Ser. 21: 229-237.

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B. Field Team Leader - Arthur B. Kettle

Arthur Kettle received his B.A. degree in Human Ecology from the College of the Atlantic in 1984. Since that time, he has participated in several large-scale seabird projects at remote locations. He joined the U.S. Fish and Wildlife Service in May 1993, and is currently the field team leader for the upcoming 1996 APEX Barren Islands seabird studies (Project 96163J). He also served as field team leader during the 1995 APEX Barren Islands seabird work (Project 95163J). In that capacity, Mr. Kettle was responsible for logistics at Amatuli Cove camp. He was also responsible for ensuring that data were collected according to study design. Mr. Kettle was in charge of field work at East Amatuli Island field during previous common murre restoration monitoring projects (Projects 93049 and 94039 in 1993 and 1994, respectively). During these studies, his broad knowledge of boat-mooring systems and technical rock climbing techniques allowed him to safely collect productivity and chronology data from a series of study plots he established on East Amatuli Island (a difficult technical task not accomplished during previous pre- and postspill studies). Mr. Kettle censused birds at East Amatuli Island and East Amatuli Light Rock during 1993-1994, and he also counted these same murre colonies

and collected productivity data at Light Rock during Exxon-sponsored University of Washington studies in 1990-1992. In addition to this work, he also participated in large-scale University of Washington studies of magellanic penguins *(Spheniscus magellanicus)* in Argentina during 1987-1991, and tufted puffins *(Fratercula cirrhata)* and fork-tailed storm-petrels *(Oceanodroma furcata)* at the Barren Islands colonies in 1990-1992. Mr. Kettle has over 16 years experience safely operating small boats in the north Atlantic and Pacific oceans (e.g., Maine and Alaska), including 6 consecutive field seasons running outboard-powered craft at the Barren Islands.

Selected Seabird Publications

Boersma, P.D., J.K. Parrish, and A.B. Kettle. 1995. Common murre abundance, phenology, and productivity on the Barren Islands, Alaska: The *Exxon Valdez* oil spill and long-term environmental change. *Exxon Valdez* Oil Spill: Fate and effects in Alaskan waters, ASTM STP 1219, P.G. Wells, J.N. Butler, and J.S. Hughes (eds.), Amer. Soc. for Testing and Materials, Philadelphia, PA.

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Roseneau, D.G., A.B. Kettle, and G.V. Byrd. 1995. Common murre restoration monitoring in the Barren Islands, Alaska, 1993. Unpubl. final rept. by the Alaska Maritime National Wildlife Refuge, Homer, Alaska for the *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska (Restoration Project 93049). 82 pp.

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Appendix 1. Power analysis of common murre counts in the Barren Islands, Alaska.[1]

We know from prior work that a total of about 5-7 counts made on separate days are needed in each year to detect among-year differences of 20% at the $P = 0.1$ level with 90% power (see Byrd 1989, Hatch and Hatch 1989). Using a computer program called "TRENDIO" written by T. Gerrodette (i.e., Gerrodette 1987), we ran a series of simulations to predict the number of surveys needed and the number of years required at different survey intervals to detect a significant positive trend in murre populations with the following assumptions:

1. *Rate of Change*: 2 levels (8% yr^{-1} and 13% yr^{-1}) — these levels were chosen because they represent the normal range of values reported in the literature for common murres.

2. *Coefficient of Variation CV)*: 15% was used because that is the average value recorded for counts made in the Barren Islands during 1992-1994.

3. Alpha (α) and Beta (β) Levels: We were more concerned about Type II errors than Type I errors; therefore we relaxed Alpha to 0.1 and set the power at 0.9.

4. *Model Selection*: Murre populations are expected to grow exponentially rather than in a linear fashion.

Table 1. Summary of power analysis simulation for detecting a significant positive trend (1-tailed) in murre populations in the Barren Islands.

Rate of Change ($year^{-1}$)	Years Between Surveys	CV	α	β	Number of Surveys Required[a]	Number of Years Required to Detect Trends
0.8	1	0.15	0.1	0.9	7	7
	2	0.15	0.1	0.9	5	10
	3	0.15	0.1	0.9	4	12
	4	0.15	0.1	0.9	4	16
	5	0.15	0.1	0.9	4	20
0.13	1	0.15	0.1	0.9	5	5
	2	0.15	0.1	0.9	4	8
	3	0.15	0.1	0.9	4	12
	4	0.15	0.1	0.9	3	12
	5	0.15	0.1	0.9	3	15

[a] Each survey would include 5 replicate counts. Increasing the number of replicate counts to 10 would reduce the CV to 0.10 and generally reduce the number of surveys needed by 1 in each category.

Conclusions: If murre populations in the T/V *Exxon Valdez* oil spill area are increasing at 8% yr^{-1}, it would require 7 years of annual surveys (at 5 replicate counts yr^{-1}) to detect a significant trend at the 0.1 level with 90% power. However, if the number of replicates yr^{-1} were increased to 10, it would take only 6 years of annual surveys to detect a significant trend at the same level. If populations were increasing at 13% yr^{-1}, the same comparisons listed above would require 4 and 5 years, respectively. If surveys were conducted every 3 years (5 replicate counts yr^{-1}), it would take 12 years, whether the rate of increase was 8% or 13% (rounding in the reason the values are the same), but increasing the number of replicates
yr^{-1} to 10 would reduce the time required to detect a trend to 9 years. Surveys conducted at 5-year intervals would take 15 to 20 years (at 5 replicate counts yr^{-1}) to detect a significant trend in population size.

[1] Information used to conduct this power analysis is available from the Alaska Maritime NWR upon request. Contact D.G. Roseneau or G.V. Byrd at (907) 235-6546.

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1996	Proposed FFY 1997						
Personnel	$12.1	$16.0						
Travel	$4.2	$5.2						
Contractual	$43.2	$43.2						
Commodities	$2.2	$2.8						
Equipment	$4.0	$1.2	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$65.7	$68.4	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	
General Administration	$4.8	$5.4						
Project Total	$70.5	$73.8	$21.5	See Below	$76.0	$53.0	$0.0	
Full-time Equivalents (FTE)	0.3	0.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: This project is designed to monitor the recovery of murres (Uria spp.) at colonies in the Gulf of Alaska affected by the T/V Exxon Valdez oil spill. The proposed FFY97 study is a continuation of recently approved Project 96144. The work focuses on collecting a 2nd year of population data at the Barren Is. murre colonies (East amatuli I. - Lt. Rock & Nord I. - Northwest Islet) in 1997. An optional 3rd year of work proposed for FFY98 focuses on collecting population numbers data at the Chiswell Is. murre colonies, which have not been censused since 1992.

The FFY97 budget reflects the costs of writing an annual report of FFY96 activities & censusing murres at the Barren Is. colonies (East Amatuli I. - Lt. Rock & Nord I.) in FFY97. Under the 2-year program, about $21.5K will be needed to fully analyze & compare FFY96-FFY97 data with all previous postspill counts (1989-1995 FWS, 1990-1992 UW, & 1991 D&M data) & produce a final report in FFY98. If a 3rd fyear of work is added to the project to count the Chiswell Is. colonies, about $50.0K will be needed in FFY98 (instead of $21.5K) & estimated final report writing costs will increase by about $6.9K &shift from FFY98 to FFY99. Travel costs for workshops in Anchorage are included in the FFY97 part of the budget. The FWS is donating up to 1 month of the project manager's time & 0.5 months of the program manager's time at no extra cost to the project.

Estimates for FFY2000 and FFY2001 are the costs of recounting the Barren Is. and Chiswell Is. 3 years after FFY97 and FFY98, respectively.

1997

Prepared: 04/10/96

Project Number: 97144
Project Title: Common Murre Population Monitoring
Agency: DOI-FWS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1997
David G. Roseneau	Project Leader (Principal Investigator)	GS11/4	2.5	4.3	0.0	10.8
(To be selected)	Biological Science Tech. (Wildlife)	GS6/1	2.0	2.2	0.8	5.2
G. Vernon Byrd	Project Manager	GS12/5	1.0	0.0	0.0	0.0
C. Berg	Program Manager	GS12	0.5	0.0	0.0	0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		6.0	6.5	0.8	
					Personnel Total	$16.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
4 helicopter round trips @ $1.0K/trip, Homer-Barren Is.-Homer to	1.0	4	4		4.0
transport personnel to & from Amatili Camp (a helicopter is more efficient					0.0
& cost effective than a vessel for some needs--e.g., to quickly get people					0.0
to East Amatuli I. where the APEX Barren Is. seabird studies (97163J)					0.0
team can provide use of small boats & help make counts).					0.0
					0.0
Per diem for field crews (per diem for field personnel is calculated at $3.00					0.0
per day times 66 person days = $0.2K--this token amount must be paid to					0.2
all FWS employees & non-SCA volunteers for each day spent in the field.					0.0
					0.0
Travel to Anchorage EVOS workshop (2 people)	0.1	2	8	0.1	1.0
					0.0
				Travel Total	$5.2

1997

Prepared: 04/10/96

Project Number: 97144
Project Title: Common Murre Population Monitoring
Agency: DOI-FWS

FORM 3B
Personnel
& Travel
DETAIL

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Contractual Costs:	Proposed FFY 1997
Description	
24 vessel days @ $1.8K/day = $43.2K (a large vessel is needed to supportthe countsof birds at Nord I. & transport census teams & small boats to & from the study area & between East Amatuli I.. & Nord I.)	43.2
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$43.2

Commodities Costs:	Proposed FFY 1997
Description	
Food for 2 people at the Amatuli camp @ $12.00/day/person for 12.5 days (25 person days x $12.00/day = $0.3K)	0.3
Fuel (outboard gas & oil; estimated @ $0.15K)	0.2
Other field supplies (maps, notebooks, film =$ 0.2K; boating supplies, including ropes, spark-plugs, emergency flares& other survival gear = $0.8K; miscellaneous camping supplies replacement of rain gear, rubber boots, waterproof bags = $0.7K)	1.7
Costs of producing & printing 2 large format posters for public display of project results	0.6
[Note: FWS will fumish office materials and additional camping, boating, & survival supplies.]	
Commodities Total	$2.8

1997

Prepared: 04/10/96

Project Number: 97144
Project Title: CommonMurre Population Monitoring
Agency: DOI-FWS

FORM 3B
Contractual & Commodities DETAIL

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
			0.0
Equipment cleaning/repair/service (includes checking, cleaning, repairing & servicing binoculars, cameras, rafts, radios, outboard motors, survival suits, emergency locator becons & tents)			1.2
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$1.2

Existing Equipment Usage: Description	Number of Units	Inventory Agency
Inflatable raft	1	FWS
Outboard motors	2	FWS
Hand-held VHF radios	2	FWS
Camera	2	FWS
Computer	1	FWS
Binoculars	4	FWS

[Note: FWS will also supply other items, including, including 1 tent, 3 sleeping bags, 3 survival suits, & 3 Mustang suits.]

1997

Prepared: 04/10/96

Project Number: 97144
Project Title: Common Murre Population Monitoring
Agency: DOI-FWS

FORM 3B
Equipment
DETAIL

Project Title: Cutthroat Trout and Dolly Varden in Prince William Sound, Alaska: the Relation Among and Within Populations of Anadromous and Resident Forms

Project Number: 97145

Restoration Category: Monitoring and Research

Proposer: USFS, Pacific Northwest Research Station

Lead Trustee Agency: USFS

Cooperating Agencies: Dept. of Fisheries and Wildlife, Oregon State University

Duration: 3 years

Cost FY 96: $200,000.

Cost FY 97: $229,700.

Cost FY 98: $100,000.

Geographic Area: Prince William Sound

Injured Resource/Service: Dolly Varden
Cutthroat Trout

ABSTRACT

Dolly Varden and cutthroat trout are listed as injured resources whose recovery is unknown. Restoration efforts have taken the form of instream habitat modification and stock supplementation. Given that the impact of the oil spill on these fish is unknown at present this approach is conservative. Since the usefulness of this approach in the longterm is unknown, a strategy based on ecological and genetic relations of the affected fish is needed. We are proposing to determine the relation between resident and anadromous forms of these fish within the same watershed and between watersheds in Prince William Sound. We will examine genetic, meristic, and life-history features of each group in FY96 and FY97. Results from this study will allow development of a longterm, comprehensive and ecologically sound restoration strategy for these fish.

INTRODUCTION

Dolly Varden (*Salvelinus malma*) and cutthroat trout (*Oncorhynchus clarki clarki*) are important fish resources in Prince William Sound and are listed as injured resources whose recovery is unknown. This project is designed to gain an understanding of the relation between populations of cutthroat trout and of populations of Dolly Varden within Prince William Sound. It will examine the genetic, life-history, and

meristic features of these populations and is the second year of a study that began in FY96. There are no results from the FY96 work at this point because field work has not begun yet. It is scheduled to begin later this month. Results from the study will form the foundation for the development of an ecologically sound restoration strategy for these resources, which are important for recreation and ecological purposes.

NEED FOR THE PROJECT

A. Statement of Problem

Dolly Varden and cutthroat trout are important ecological and recreational resources in Prince William Sound. Populations of each species are found throughout Prince William Sound (Mills 1988). There are resident and anadromous (i.e. sea-going) forms of each species. Anadromous individuals spend varying amounts of time in freshwater (up to 4 years) before going to the marine environment (Scott and Crossman 1979). There, both species feed in nearshore and estuary areas (Scott and Crossman 1979, Morrow 1980). Dolly Varden feed on crustaceans, small invertebrates, and fish (Armstrong 1971) and cutthroat feed on fish (Narver and Dahlberg 1965).

Areas used by these fish were impacted by petrogenic hydrocarbons from the *Exxon Valdez* oil spill. Benthic organisms in nearshore areas are particularly susceptible to petrogenic hydrocarbons (Teal and Howarth 1984). In Prince William Sound, the size of epifauna and numbers of amphipods, which are food sources for Dolly Varden, decreased in areas exposed to the spill (Jewett and Dean 1993, Jewett et al.1993). Hepler et al. (1993) found that Dolly Varden and cutthroat trout populations in oiled areas had slower growth rates compared to populations in unoiled streams from 1989 to 1990, the year of the spill. A similar pattern was observed for cutthroat trout in 1990 to 1991. However, growth rates of Dolly Varden in oiled areas did not differ from those in unoiled areas during that period (Hepler et al. 1993). Survival rates for each species from 1989 to 1990 were less in oil impacted areas than in unimpacted areas (Hepler et al. 1993). Hepler et al. (1993) hypothesized that chronic starvation and/or direct exposure to petrogenic hydrocarbons were responsible for the differences in growth and survival of the species in oiled and unoiled areas. The *Exxon Valdez* Oil Spill (EVOS) Trustee Council officially lists these species as injured resources whose recovery is unknown.

B. Rationale/Link to Restoration

Reduced growth and survival rates could have long-term impacts on populations of Dolly Varden and cutthroat trout in areas exposed to oil. These species may live up to 8 years (Morrow 1980) and the expected persistence of oil in the nearshore environment (Lee et al. 1979) suggests the potential exists for long-term impacts to these species. Decreased survival would have obvious population implications. The extent would depend on population size; smaller populations would be most susceptible to eventual extinction (Rieman et al. 1993). There may be less obvious impacts also. The potential for loss of genetic variability, which is needed for long term adaptation, increases as population size decreases (Nelson and Soule 1987). Reduced growth rates of individuals can lead to increased susceptibility to mortality and decreased reproductive potential (Adams 1990). If any of these impacts were to occur for extended periods, even at low levels, affected populations would face increased probability of extinction.

A course of action to reduce the probability of loss of populations in areas impacted by the oil spill was initiated in FY92. The focus of this recovery efforts was on opening up new areas for rearing and population supplementation. Between FY92 and FY95, $173,000 was expended on these efforts. Monitoring the effectiveness of some of these actions is proposed for FY96-98.

The EVOS Trustee Council calls for an ecosystem approach to restoration. Specifically, they say that restoration "will take an ecosystem approach to better understand what factors control the populations of injured resources" (*Exxon Valdez* Restoration Plan). We define ecosystems in a general sense to include the physical and biological factors that influence a population of organisms. This can include members of its own species as well as other species. Thus, understanding the interaction or potential interaction between and among populations of a species can provide valuable information on developing effective restoration programs.

Collections of interacting populations of the same species can be termed a metapopulation (Hanski and Gilpin 1991). Features of such populations include local populations that are more likely to interbreed and interact among themselves than with other groups, but exchange of individuals occurs through various dispersal mechanisms. There may be local extirpation of populations as a consequence of catastrophic events. Surrounding populations then serve as sources of individuals for recolonization and recovery of impacted populations (Brown and Kodric-Brown 1977, Sjogren 1991). The dynamics of metapopulations are particularly important to the persistence and recovery of populations following catastrophic events (Yount and Niemi 1990).

Metapopulation dynamics are an important consideration in the development of conservation and restoration programs (Murphy and Noon 1992, Noon and McKelvy 1992). Restoration strategies for a metapopulation would differ from those for single populations in regards to such features as recolonization potentials, time to recovery, etc. Importantly, a recovery strategy that considers metapopulations may require less investment of resources than that required for single populations.

Many salmonid populations exist as part of metapopulations. Homing and fidelity to spawning and nursery areas results in some isolation of populations (Ricker 1972). Local adaptations provide further isolation. Dispersal among groups may be maintained through straying of migrating adults (Simon 1972, Labell 1992), density displacement of individuals (McMahon and Tash 1988, Northcote 1992), or maintenance of pioneering or colonizing phenotypes (Northcote 1992).

Results of this study will provide the foundation for the development of proactive, ecologically based restoration strategies and provide valuable information for management of these species in Prince William Sound. Knowledge about the relation of resident and anadromous forms within the same watershed will provide insight into the potential response of a population to any long-term negative impacts of the exposure to oil. For example, if resident forms of a species contribute to the anadromous forms then there may be a buffer against potential long-term declines of anadromous forms. In such a case, the most prudent restoration activity may be to protect these resident populations and their habitat in streams with populations exposed to the oil spill. Knowledge about the relation among populations of each species will provide additional insight into the potential long-term impacts of exposure to oil. If the populations are a metapopulation, any long-term impacts on a population segment could possibly be mitigated by recruitment from other population segments. Conversely, if the populations are unique this indicates that

there is little exchange with nearby populations. Consequently, the ability of surrounding populations to aid a declining population would be reduced. Mitigation measures focused on individual populations would be required in such a case.

C. Location

This study will examine sites located throughout Prince William Sound. Knowledge of the range of diversity within and among populations of each species within Prince William Sound will aid in the development of general management policies and decisions. Benefits should be realized in communities throughout the Prince William Sound.

COMMUNITY INVOLVEMENT

We will quarter out of Cordova, AK for field collections. This will provide a central location from which to access study sites, has good facilities, and allows us access to additional field equipment and persons with knowledge of streams in Prince William Sound. We have communicated with people in Cordova on an individual basis about our work and will make presentations on results when they become available. We enlisted the assistant of a local guide and fisherman in identifying field sites in FY96. We will hire 1part time person to help with field work and will charter planes for transport to field locations, secure lodging, and purchase food and other supplies in Cordova in FY97.

We will be sampling a population of cutthroat trout on native land near Cordova in FY96 and are planning on sampling there again in FY97. We are working with the native corporation to secure necessary permits.

PROJECT DESIGN

A. Objectives

The objectives of this proposed study are to:

1. Determine for both Dolly Varden and cutthroat trout whether anadromous and resident forms in the same watershed are part of one population or different populations.
2. Determine for both Dolly Varden and cutthroat trout whether spawning aggregations in different streams in Prince William Sound are part of one population or different populations of a metapopulation.
3. Develop a restoration strategy for Dolly Varden and cutthroat trout based on the results of this study.

Figure 1 illustrates the relation among the objectives.

We will test the following hypotheses:

1. Resident and anadromous forms of each species from a watershed will exhibit similar genetic and

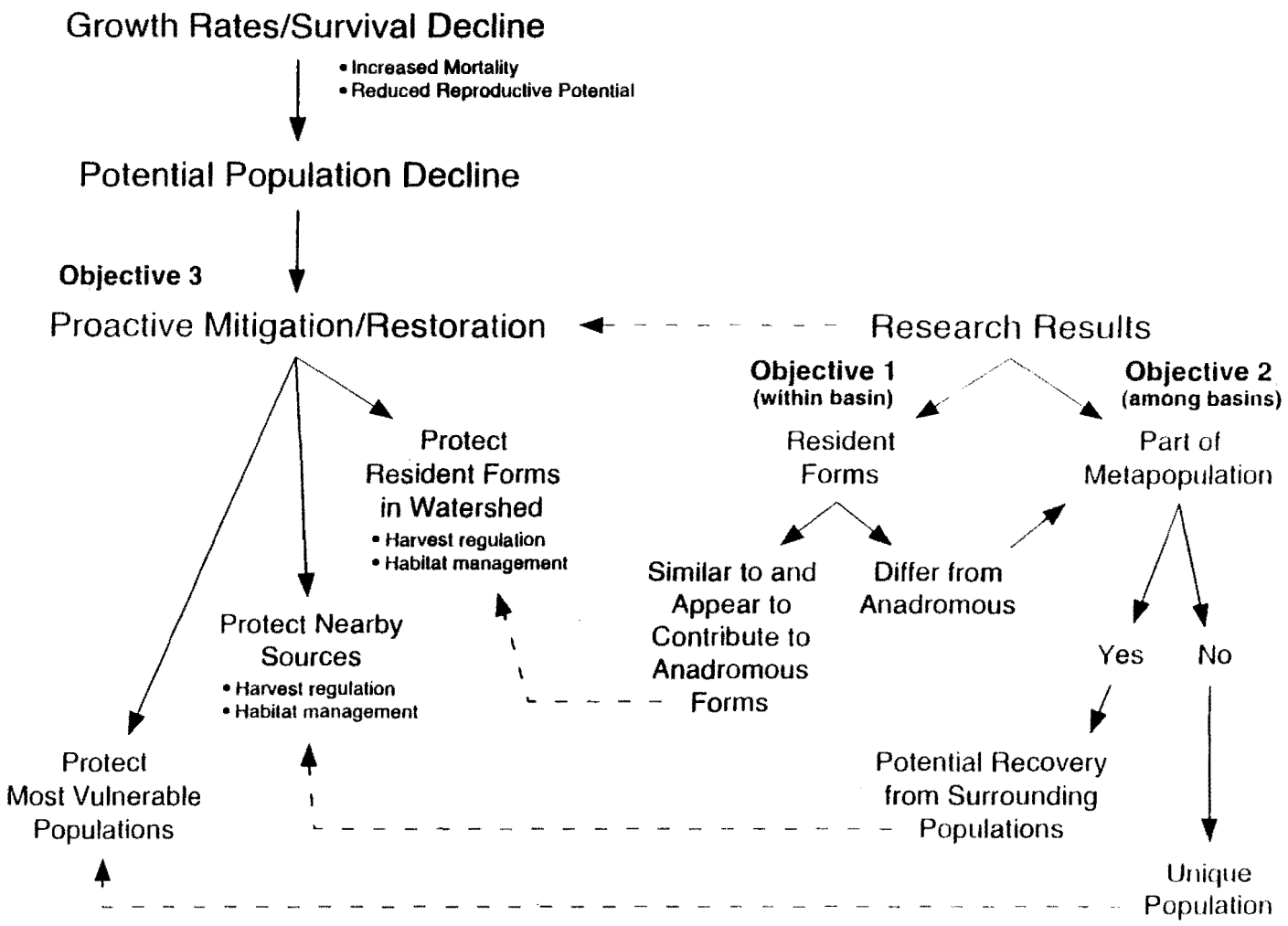

Figure 1. Flow diagram of possible research outcomes and feed back to mitigation and restoration.

meristic features.

Corollaries

1.1 Similarities will be strongest in watersheds where resident forms have been isolated the least amount of time.

1.2 Similarities will be strongest in watersheds where isolating barriers allow a flow of individuals from the resident to the anadromous populations.

2. Populations of each species in Prince William Sound will exhibit similar genetic and meristic features and can be considered a metapopulation.

B. Methods

We will sample 8-10 streams with anadromous populations of each species and 4-5 streams with resident populations. Sites are distributed across Prince William Sound and include areas impacted and not impacted by the oil spill. All sites will be sampled in FY96.

We will collect up to 100 individuals, representing the size distribution of individuals (adult and juveniles) found in a population, from the resident and anadromous populations in each stream. We will take fin punches from all individuals for DNA analysis. We will take 20-40 individuals from each site for meristic and electrophoretic analysis. Anadromous forms of each species will be sampled during their respective spawning periods, spring for cutthroat trout and fall for Dolly Varden. Collection of each species at spawning should insure that individuals are members of a single population rather than a collection from different populations. Fish will be collected by various techniques, including baited minnow traps, seining, and hook and line. All captured fish will be weighed and measured. Those kept for electrophoretic and meristic analysis will have appropriate tissues removed, given an identification number, and frozen immediately on dry ice. Meristic analysis will be conducted in the laboratory. Otoliths will be removed and prepared for microchemistry analysis in the laboratory. We will examine molecular genetic, morphological, and life history variation in resident and anadromous Dolly Varden and cutthroat trout in Prince William Sound using four different techniques: 1) protein electrophoresis; 2) mitochondrial DNA or microsatellite DNA markers; 3) meristic variation; and 4) otolith microchemistry. Each technique has unique advantages for this study.

Very little genetic information is available in the peer-reviewed literature on Dolly Varden in western North America. Consequently, of the three genetic techniques we proposed to use, we will focus on two each in different years. The use of two different techniques will allow independent tests of our hypotheses and maximize the amount of information we can provide. We intend to use protein electrophoresis and one of the two DNA techniques, after we have evaluated their usefulness.

Protein electrophoresis is a reliable, inexpensive, rapid technique for examining geographical or temporal genetic variation in salmonids. It uses the differential migration of different forms of an enzyme encoded by a locus (allozyme) in an electrical field to identify different alleles. Genotype and allelic proportions inferred from different allozymes in different samples can be used to test for nonrandom patterns of variation. However, it may not be precise enough to detect differences among life-history forms or

closely related populations.

We will examine genetic variation at approximately 60 loci. The most complete information is available from examining allozymes in many different tissues (eye. heart, liver, muscle). However, this requires sacrificing the fish. Samples sizes will consist of about 40 resident and 20-40 anadromous fish from each location. We are using this technique currently to examine, in part, the relations of populations of coastal cutthroat trout throughout their distributional range, Prince William Sound to northern California. We have samples from one population in Prince William Sound, Boswell Bay on Hitchenbrook Island. We will use this as one of the unoiled sites in the proposed study. We also have samples from cutthroat trout populations in nearby areas, Martin River on the Copper River Delta and the Gines Creek, near Yakutat. These populations will serve as outgroups for this study. K. Hepler, ADFG in Anchorage, has offered to provide Dolly Varden from a Kodiak Island population as an outgroup for Dolly Varden. Outgroups are samples that we expect to be genetically distinct from the study populations because they are usually selected from geographically distant populations. The genetic divergence of the study populations from the outgroup provides a relative scale for the genetic differences observed in the study populations.

We have also used protein electrophoresis to examine the relation between resident and anadromous forms of cutthroat trout in a basin in southeast Alaska and in southern Oregon (Griswold 1996). Differences among groups were sufficiently large to allow the use of this technique. Results are shown in Fig. 2. This analysis suggests two distinctive patterns of genetic variation among populations and potential relations between the two forms. In the Elk River in Oregon, there was a higher degree of genetic variation among eight sampling locations above and below geologic barriers (Fig. 2a). China Creek is separated from the mainstem of the Elk River by a 4 meter waterfall and was genetically distinct from all other Elk River samples. These results imply that coastal cutthroat trout in China Creek have been isolated from all other Elk River populations long enough for the population to undergo genetic divergence. In contrast to these results, the above and below populations in Anvil Creek show little genetic divergence and there are no statistical differences between the two sites. In this case, either the populations have not been isolated long enough for there to be significant genetic differentiation or the above barrier population is contributing to the below barrier population. There was little genetic variation in sampling locations above and below a barrier in Vixen Inlet in Southeast Alaska (Fig. 2b). These results suggest that the groups have not been isolated long enough to have undergone divergence or that the Second Tributary barrier populations may be contributing to the anadromous populations. These results highlight the varying patterns in genetic variation that can be detected within basins using protein electrophoresis. They also suggest that the relation between resident and anadromous forms depend on local conditions.

Knowledge of this relation between the resident and anadromous forms will be an integral component of any restoration program. Figure 1 illustrates how this information could be used in developing a restoration program for Dolly Varden and cutthroat trout in Prince William Sound.

Although allozyme variation is usually treated as having no selective advantage in population studies, under some conditions, it may be associated with physiological or morphological components of fitness, such as enhanced growth, fecundity, survivorship, and developmental rate and stability (Mitton and Grant 1984, Vrijenhoek 1985, Allendorf and Leary 1986, Zouros and Foltz 1987, Quatro and Vrijenhoek 1989). Where it is possible to appropriately measure altered patterns of growth, fecundity, or

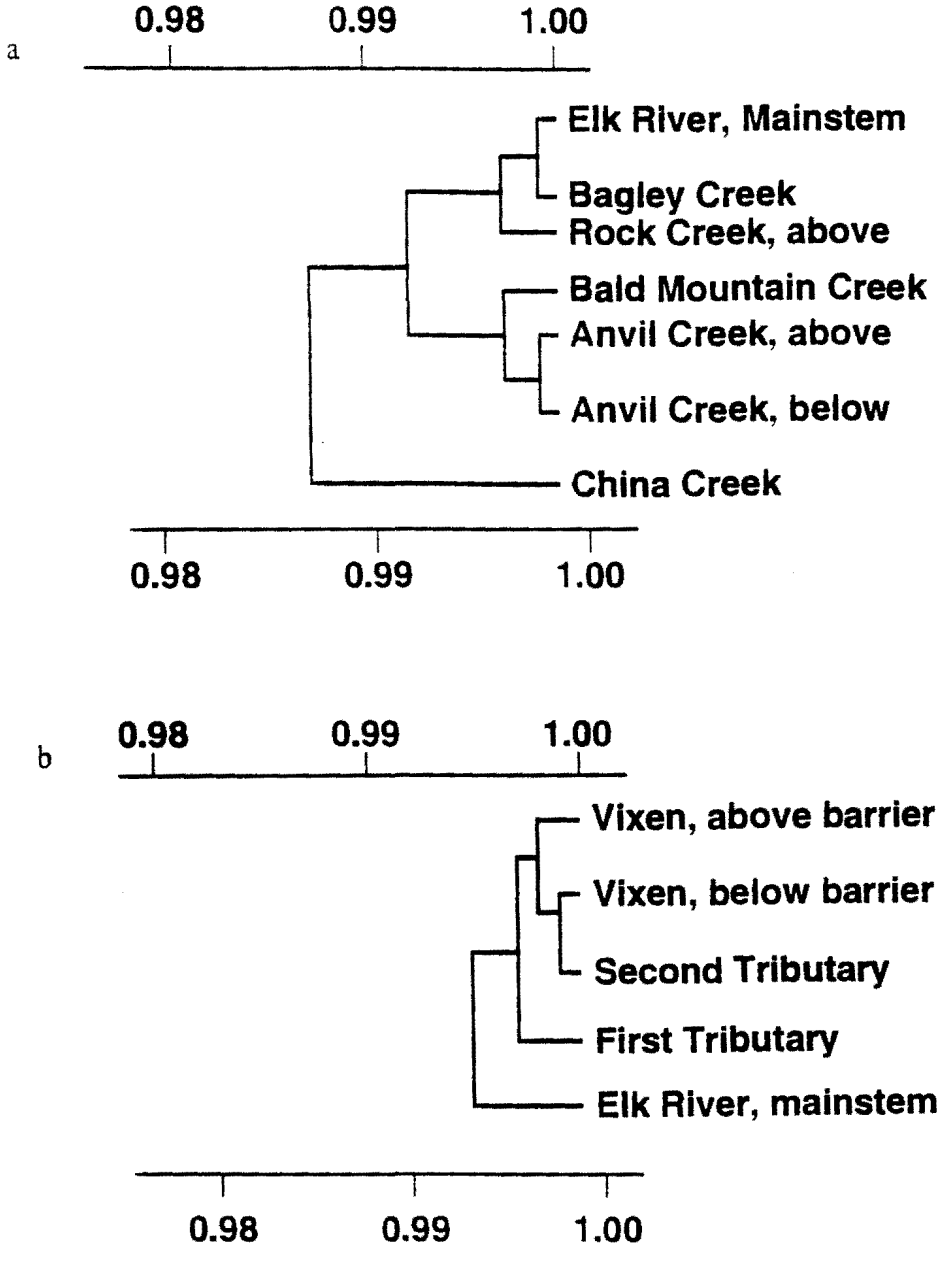

Figure 2. UPGMA dendrogram of Nei's (1972) genetic identity among coastal cutthroat trout from a) Elk River, Oregon and b) Vixen Inlet, Alaska based on 41 loci.

developmental instability as might be caused by exposure to strong environmental stressors - such as oil spills - allozyme variation may also show correlated changes in enzyme heterozygosity.Many different classes of DNA polymorphisms are available for population genetic studies. In FY96, we will have examined two different classes of DNA markers and chosen one to use in FY97. The two kinds of DNA markers we have considered are: 1) mitochondrial DNA (mtDNA) polymorphisms and 2) microsatellite DNA polymorphisms. We will compare the power, reliability, and efficiency of the mtDNA and microsatellite DNA techniques and choose one to complete our study of Dolly Varden and cutthroat trout in Prince William Sound. Mitochondrial DNA variation can potentially show greater genetic structure among populations than allozyme variation, because the mitochondrial genome in vertebrates may evolve more rapidly than many nuclear genes and it is maternally inherited without recombination (Brown et al. 1979, Avise 1986). Analysis of mtDNA is especially appropriate for studying maternal lineages. It uses very little tissue, and consequently, does not require sacrificing fish. In general, DNA techniques provide a greater probability of detecting differences between life-history forms or closely related populations than does protein electrophoresis. However, it is more expensive than protein electrophoresis. We have used it successfully in our laboratory to study geographical genetic differences in rainbow trout (*O. mykiss*), chinook salmon (*O. tshawytscha*), and coho salmon (*O. kisutch*).

The other kind of marker, mircrosatellite DNA polymorphisms, is based on variation in the number of short tandem repeats in nuclear DNA of a core DNA sequence of 2-6 nucleotide based pairs. Like mtDNA, microsatellites can be amplified using small amounts of DNA in a PCR reaction and the different alleles seen directly by electrophoretic separation on an audoradiogram. Because microsatellite loci mutate 3-5 times faster than mtDNA or some nuclear DNA, it is a potentially powerful tool for examining relationships between individuals within and between populations. There have been some recent studies that have employed microsatellites to successfully identify salmonids populations at large (e.g. McConnell et al 1995a, b) and small spatial scales (e.g. Angers 1995). Others (e.g. Dhondt 1996), however, urge caution in using this technique because of the inherent high variability of molecular markers like microsattelites.

Meristic data are based on counts of body parts. Meristic variation reflects both genetic and environmental variation, although the relative contribution of the genetic component is high (Leary et al. 1985a). Analysis of meristic variation has two uses. First, when patterns of geographical meristic variation covary among samples with allozyme or DNA variation, they provide supporting evidence of genetic differentiation among populations or groups of populations. Some meristic features may diverge more rapidly than genetic frequencies in isolated populations (Lewontin 1984) and thus provide additional insight into potential relations among populations. Second, fluctuating asymmetry in meristic traits - the unpredictable differences in a trait between the left and right side of the fish - may be a sensitive indicator of environmental stress or loss of genetic diversity within a population (Leary et al. 1984, 1985a,b).

Individuals for meristic analysis will be randomly selected from collections of each group at a sampling location, preserved in 10% formalin, and stored in 40% isopropanol. Meristic data will be collected on 11 meristic characters: 1) scales above the lateral line (scale rows); 2) scales in the lateral series; 3) proximal pterygiophores of the dorsal fin; 4) proximal pterygiophores of the anal fin; 5) left and right pelvic fin rays; 6) left and right pectoral fin rays; 7) left and right branchiostegal rays; 8) gill rakers on the upper limb of the first, left gill arch; 9) gill rakers on the lower limb of the first, left and right gill arch; 10)

pyloric caeca; 11) vertebrae; and 12) left and right mandibular pores. Two measures of asymmetry will be calculated on the pair counts: the number of asymmetrical characters per individual and total asymmetry (Leary et al. 1984, 1985a,b).

The hypothesis that each collection was drawn from a single, randomly mating group, under assumptions of Hardy-Weinberg equilibrium, will be tested for allozyme and microsatellite genotype data using a log likelihood ratio test (G-test). Interaction between loci, or gametic disequilibrium (Waples and Smouse 1990) will also be calculated. Significance levels for all tests will be adjusted for multiple comparisons (Cooper 1968). Average heterozygosity (percent variation at a locus) will be calculated for each locus using Hardy-Weinberg expectations and averaged over all loci.

Genetic differences within and among populations will be examined using a nested G-test of allelic variation within and among tributaries. Unplanned geographical comparisons, based on hierarchical clustering of fish from different locations by similarity of allele frequencies or mtDNA haplotype, will be examined by G-tests or Chi-square tests (X^2). Because sample sizes for allele or mtDNA haplotype frequencies may be small enough to expect departures from known X^2 distributions in some groups, X^2 analyses will be examined by a Monte Carlo procedure using 1000 randomizations (Roff and Bentzen 1989).

Meristic differences among all possible pairs of samples, among genetically similar groups identified by cluster analysis of allozyme, microsatellite or mtDNA variation, and among different life histories will be examined by analysis of variance (ANOVA) or multivariate analysis of variance (MANOVA).

Patterns of geographical genetic similarity used for unplanned comparisons will be identified by constructing phenograms from cluster analyses of pair-wise estimates of divergence between samples, using the unweighted pair-group method with arithmetic averages (UPGMA) algorithm (Sneath and Sokal 1973). Nei's genetic distance (Nei 1972, 1978), which estimates the number of codon substitutions that have occurred between two populations, and Nei's nucleotide diversity (Nei 1987), which estimates the average number of nucleotide substitutions between DNA haplotypes in two different populations, may be used as measures of genetic differentiation between populations for the allele and mtDNA data, respectively.

Otoliths provide a record of an individual fish's life history. Otoliths are composed of calcium carbonate and other trace elements and are formed by the successive growth of concentric rings around dense primordia. Wave-length dispersive electron microprobe sampling can be used to detect proportions of trace elements in low concentrations in otoliths and can thus provide an environmental history of an individual associated with age and growth (Radtke 1989, Gunn et al 1992). Strontium is freely substituted for calcium during calcium carbonate deposition in bones in proportion to its concentration in the environment. Marine environments have elevated Sr/Ca ratios relative to most freshwater environments. Higher Sr/Ca ratios leave a detectable signature on the otolith which can reflect the movement of an individual from freshwater to saltwater (Kalish 1990). Primordia are deposited from maternally derived nutrients (yolk sac) and reflect the maternal environment during egg development (Kalish 1990). Researchers have been successful in discriminating the origin of resident and anadromous sockeye salmon (*O. nerka*) (Rieman et al. 1994) and brown trout (*Salmo trutta*) (Kalish 1990) in controlled experiments.

Analysis of both coastal cutthroat trout and Dolly Varden otoliths suggest that electron microprobe techniques could provide significant insight to the life history and migration history of these species. Elemental analysis using electron microprobe technology was undertaken for both Dolly Varden from Alaska and coastal cutthroat trout from Oregon. Each otolith was sampled with a transect taken from the primordia to the otolith edge. This allows for reconstruction of the environmental history of the individual from emergence to the point of collection. Preliminary results of this analysis for Dolly Varden from Auke Bay, Alaska suggest that there are two distinctive migration patterns within this population. Initial high levels of Sr/Ca ratios, which are sustained throughout the life history, suggest that the individual moves into saltwater at an early age (Figure 3a). An alternative pattern wherein the Sr/Ca ratios are low followed by a sharp peak suggests that the individual remained in freshwater for an extended period of time and entry into a marine environment was delayed. Preliminary analysis of otoliths from the Elk River, in southern Oregon, shows similar patterns of variation among individuals collected from the mainstem (Figure 3b). Results of transect analysis of otoliths from coastal cutthroat trout from Vixen Inlet, Southeast Alaska suggest that movement into freshwater was delayed (Figure 3c).

Otolith microchemistry analysis provides a powerful tool to reconstruct detailed life history information, potentially including origin of the maternal parent. A low Sr/Ca ratio in the otolith suggests the maternal parent was a resident fish. A high ratio would suggest the maternal parent was anadromous (Fig. 2a). Rieman et al. (1994) used the technique to identify the maternal parent of sockeye salmon smolts migrating from Redfish Lake, Idaho.

Further elemental analysis of Dolly Varden and cutthroat trout otoliths in conjunction with genetic analysis can contribute to the understanding of relationships among populations within the Prince William Sound and ultimately their management and recovery. For instance, within a population that contain two distinctive patterns in age first seaward migration comparisons of the genetic relationship of the two groups can also be made. If, for example, it is found that the groups are genetically distinct as well as possessing unique life history characteristics special attention would have to be focused on each segment of the population to ensure the persistence of the populations in the long-term.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

We will renew our cooperative agreement with the Oregon Fishery Cooperative Unit, Dept. of Fisheries and Wildlife, Oregon State University (OSU), Corvallis, OR for the genetic and otolith microchemistry analysis. We will pursue this avenue to save overhead costs. If the EVOS Trustee Council were to contract the grant directly to the university, overhead would be approximately 40%. The USFS has a cooperative agreement with the university that charges 8% for overhead. The genetic laboratory at OSU has been involved in numerous studies involving a variety of salmonids for more 25 years. They have done a number studies on cutthroat trout and Dolly Varden, including populations from FY96 and from other studies in Alaska. This lab is also one of the few labs that is capable of conducting a comprehensive examination of all aspects of genetics, allozymes and DNA, and meristics.

Analysis of otolith microchemistry will also be part of the cooperative agreement with OSU.

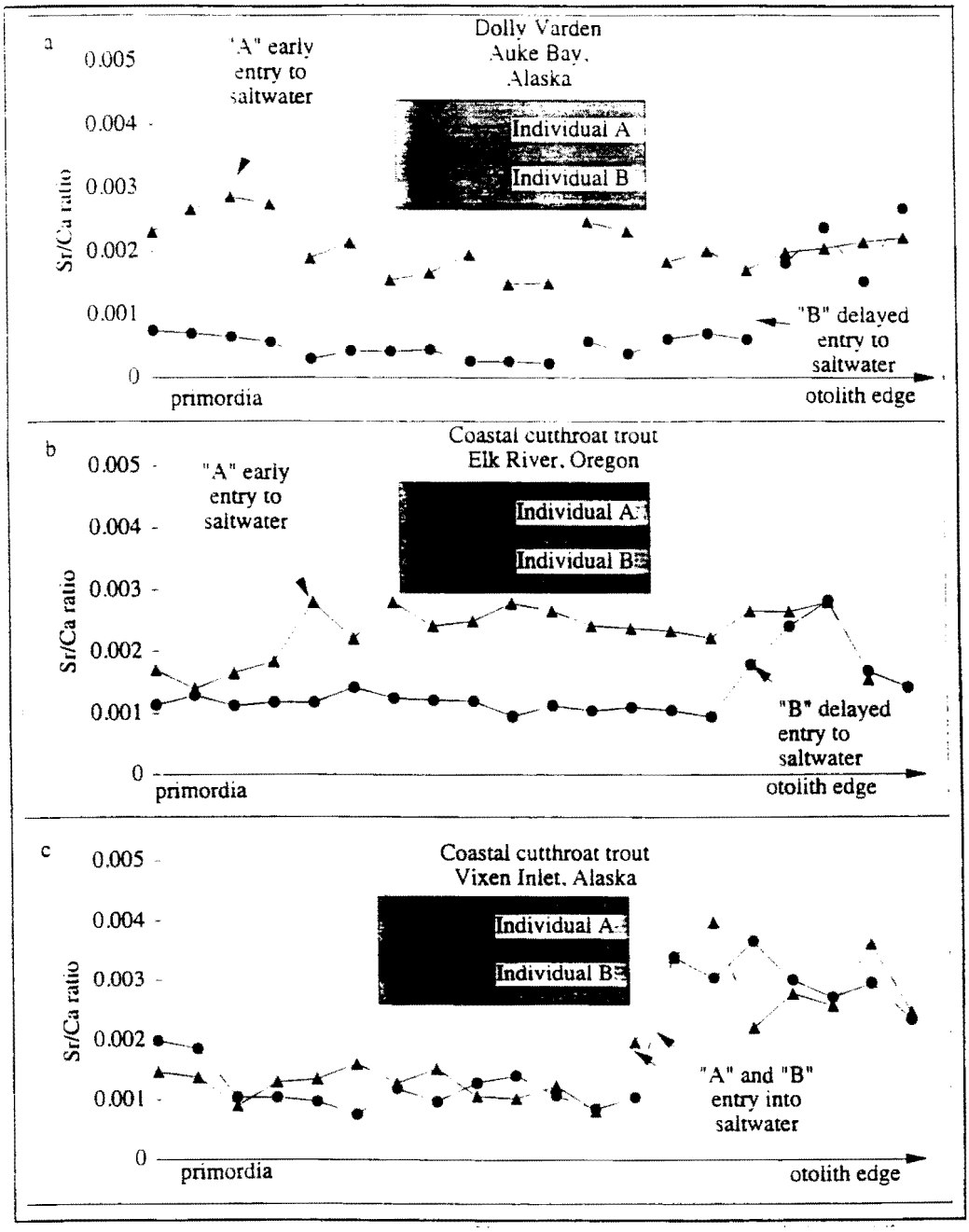

Figure 3. Examples of otolith microchemistry of individuals from the same populations exhibiting different life history patterns. The lines represent transects from the primordia to the edge of otoliths. Elevated Sr/Ca ratios suggest entry into a marine environment. See text for further details.

OSU has one of the only facilities available to do this analysis. The USFS will be responsible for preparing the otoliths for analysis and for data analysis. OSU will run the samples and provide the raw data.

We will need to renew our permit from ADFG that is required to collect for fish from ADFG. Scientific studies of a limited nature, such as this one, can be exempted from NEPA requirements. We will persue this exemption by filing a Catagorical Exclusion. This document will be prepared by the USFS, Cordova District in FY97, as they did in FY96..

SCHEDULE

A. Measureable Project Tasks for Fy 97 (October 1, 1997 - September 30, 1997)

October 1996:	Renew cooperative agreement with OSU
	Evaluate FY96 collections and make appropriate changes in collection sites in cooperation with local USFS and ADFG biologists
	Conduct genetic and meristic analysis of Dolly Varden collected in September, FY96
	Begin otolith microchemistry analysis
November - December:	Continue genetic analysis
	Review field sites
January - February 1997:	Complete genetic screening
	Attend annual workshop
March:	Assemble required field gear and ship to Cordova
April- May:	Collect samples of anadromous cutthroat trout
	Genetic, meristic, and otolith microchemistry analysis
June - August:	Continue genetic, meristic, and otolith microchemistry analysis
	Collect samples of resident cutthroat trout and Dolly Varden
September:	Collect samples of anadromous Dolly Varden at field sites
	Continue genetic and meristic analysis of resident populations and anadromous Dolly Varden populations
	Prepare progress report

B. Project Milestones and Endpoints

Objectives 1 and 2 will be met by the latter part of FY98, following complete analysis of the genetic, meristic, and otolith microchemistry. Objective 3, development of a restoration strategy, will be met by the end of FY98.

Major tasks and dates over the projected duration of the study are as follows:

March 1997:	Prepare report on preliminary analysis of genetic, meristic, and otolith microchemistry from FY96
	Make necessary adjustments in sampling and analysis procedures
March 1998:	Prepare report on preliminary analysis of genetic, meristic, and otolith

	microchemistry from FY96 and FY97
January 1999:	Report final results and articulation of restoration strategy
	Submit papers on results to peer-reviewed journals

C. Completion Date

This project is scheduled to be completed in FY98. At that time, we will provide information on the relations of populations within the same watershed and among populations that will provide the foundation for a prudent recovery program for Dolly Varden and Cutthroat Trout in Prince William Sound impacted by the oil spill.

PUBLICATIONS AND REPORTS

We will not be preparing or submitting any manuscripts to peer-reviewed journals in FY97. We will not have sufficient data collected or analyzed until FY98 for these outlets. We will prepare preliminary data and results for presentation in the Annual Report.

PROFESSIONAL CONFERENCES

Because data collection and analysis will be incomplete, we do not plan to make any presentations on results from the study in FY97.

NORMAL AGENCY MANAGEMENT

Examination of features of and relation among populations of fish (or other organisms), with perhaps the exception of migratory waterfowl, is not required by statute or regulation for management responsibilities of the USDA Forest Service. Consequently, the agency does not normally fund this type of research, even though it is valuable in planning and development of management programs. For this study, the USFS is contributing the salary of one of the principal investigators (G. H. Reeves), and assistance with lab work.

There will be no additional injury to Dolly Varden and cutthroat trout populations from the oil spill itself if this study is not funded. However, there could be potential risks to the populations if some mitigation actions were undertaken without an understanding of the relation among populations that this project will provide. For example, introduction of individuals from outside populations could potentially have detrimental impacts on a populations if the new individuals introduce maladaptive traits into the population of concern. This could exacerbate any potential impacts from the oil spill. An understanding of the relation among and within relations of these fish is essential for the development of a proactive restoration and increases the likelihood of a recovery plan being successful. (Refer to more detailed discussion in Need for the Project, Part B of this proposal for discussion of importance of this project.) While this project has application in applied and basic science arenas, it is not clear what agency or organization would be interested in funding this project or one like it in the near future.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

We have coordinated with ADFG and USFS to identify sampling sites and will review the sites before sampling begins in FY97 to insure that we do not impose unnecessary damage on any population. ADFG has offered to provide Dolly Varden from Kodiak Island as an outgroup (see discussion of these fish on page 7). We have arrangements with the USFS, Cordova Ranger District, for use of boats and other equipment. We also consult with geneticists from ADFG on information and assistance that they could provide. ADFG has focused on commercial salmon and have no study comparable to that being proposed at present.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

There has been changes in some apects of this proposal compared to what was originally proposed in FY96. First, we have reduced the number of resident populations of each species that we will sample. We will sample 4-5 instead of 10. This change was necessary because we were unable to locate an adaquate number of sites where there were barriers between resident and anadromous forms or where the barriers had not been modified. Also, some potential sites were excluded because of small population sizes.

We reduced the number of cutthroat trout that will be used in the electrophoretic and meristic analysis from 40 to 20. This was done because of concerns about potential impacts on small populations. We have thoroughly reviewed all potential sites from which to collect cutthroat trout and after consultation with ADFG and USFS biologists and local residents, identified populations where removal of 20 individuals would have minimal potential impact.

We will make collections at 3 times during the year rather than 2 as proposed in the original proposal. We will collect resident populations of each species in July rather than when we collect anadromous forms in April (cutthroat) and September (Dolly Varden). This change was necessary because lake systems in which the resident fish reside are likely to be frozen when we sample anadromous populations. This would be particularly likely for cutthroat trout.

PROPOSED PRINCIPAL INVESTIGATORS

Gordon H. Reeves
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Kenneth P. Currens
Northwest Indian Fisheries Commission
6730 Martin Way E
Olympia, WA 98516
360-438-1181, ext. 374
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kcurrens@nwifc.wa.gov

PERSONNEL

The core personnel for this proposal are eminently qualified to implement this project. Gordon H. Reeves, Co-principal Investigator, is a research fish biologist with the USFS, Pacific Northwest Research Station, Corvallis, OR. He has been in that capacity for 10 years and has worked on anadromous salmonids research in streams throughout the Pacific Northwest and southeast Alaska. He has been involved with the development of conservation and restoration for anadromous salmonids in the Pacific Northwest. He is currently directing a study that is determining the relation of coastal cutthroat trout populations throughout their distributional range. He has published several articles on the ecology of anadromous salmonids and their freshwater habitat in peer-reviewed journals.

Kenneth P. Currens, the other Co-principal Investigator, was the Genetics Program Leader, Oregon Cooperative Fishery Research Unit, Dept. of Fisheries and Wildlife, Oregon State University from 1992 to 1996. He is currently the geneticist for the Northwest Indian Fisheries Commission. He has been involved in numerous studies examining allozymes, DNA, morphological, and genetic breeding studies of Pacific salmon, including cutthroat trout. He has advised and coordinated with state, federal, and tribal fishery agencies on genetic risk assessment. He has published several articles on genetics of salmon and trout in the peer-reviewed literature. Currens is currently supervising the genetic analysis for this study.

Kitty Griswold is a fish biologist at the USFS, Pacific Northwest Research Station, Corvallis, OR. She will be the research assistant on this project. She will supervise field work and be responsible for the otolith microchemistry analysis. She recently completed a study examining the relation between resident and anadromous cutthroat trout in watersheds in Alaska and in Oregon.

Brief resumes for each of these individuals follow.

GORDON H. REEVES
USDA Forest Service, Pacific Northwest Research Station, Oregon State University, Corvallis, OR 97331.

Education:
B.A. - Biology, State University of New York, Oswego. 1973.
M.S. - Fisheries Science, Humboldt State University. 1978.
Ph.D. - Fisheries Science, Oregon State University. 1985.

Experience:
Assistant Professor, Department of Fisheries and Wildlife, Oregon State University. 1987 to present.
Courtesy Assistant Professor, Department of Fisheries. Humboldt State University. 1986 to present.
Research Fishery Biologist, USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. 1986 to present.
Commercial Fisherman, Trinidad , California. 1978-79.
Research Biologist, New York State Research Foundation. State University of

New York, Oswego. 1973-1976.

Professional Societies:
American Fisheries Society, North American Benthological Society. Sigma Xi National Honor So ciet y

Professional Activities:
President, Oregon Chapter of the American Fisheries Society. 1989.
President-elect, Oregon Chapter of the American Fisheries Society. 1988.

Honors and Awards:
Certificate of Merit, USDA Forest Service. 1984
Certificate of Merit and Quality Step Increase, USDA Forest Service. 1986, 1989, and 1994.
Ethics in Science Award, USDA Forest Service. 1989.
Oldfield Team Award, College of Agriculture, Oregon State University. Award given for outstanding research by the Stream Team. 1991.
USDA Forest Service Rise to the Future Award for outstanding contributions in fishery research. 1991.
Conservationist of the Year Award, Pacific Rivers Council. 1992 and 1994.
USDA Secretary's Award for outstanding contribution to research contributing to understanding of aquatic ecosystems. 1995.

Special Assignments
Member Scientific Panel on Late-Successional Forest Ecosystem - formed by the Agriculture Committee and the Merchant Marine and Fisheries Committee of the U.S. House of Representatives to develop and evaluate alternatives for managing and conserving late-successional forest and aquatic ecosystems on federal lands in northern California and western Oregon and Washington. 1991.
Co-Leader PacFish Team - responsible for developing and evaluating alternatives for managing freshwater habitat of anadromous salmonids on federal lands in northern California, Oregon, Washington, Idaho, and Alaska. 1992-1993.
Member Scientific Assessment Team - develop management strategy for maintaining biodiversity of federal lands in northern California and western Oregon and Washington at request of U.S. Federal Circuit Court Judge. 1992.
Co-leader of Aquatic Group of Forest Ecosystem Management and Assessment Team -responsible for developing and evaluating alternatives for managing federal lands in northern California and western Oregon and Washington. 1993.

Selected Publications
Reeves, G. H., F. H. Everest, and J. D. Hall. 1987. Influence of water temperature on interactions between the redside shiner (*Richardsonius balteatus*) and the steelhead trout (*Salmo gairdneri*). Canadian Journal of Fisheries and Aquatic Sciences 44:1603-1613.
Hankin, D. G. and G. H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. Canadian Journal of Fisheries and Aquatic

Sciences 45:833-844.
Dolloff, C. A. and G. H. Reeves. 1990. Microhabitat partitioning among stream-dwelling juvenile coho salmon, *Oncorhynchus kisutch*, and Dolly Varden, *Salvelinus malma*. Canadian Journal of Fisheries and Aquatic Sciences 47:2297-2306.
Sedell, J. R., G. H. Reeves, F. R. Hauer, J. A. Stanford, and C. P. Hawkins. 1990. Role of refugia in recovery from disturbances: modern fragmented and disconnected river systems. Environmental Management 14:711-724.
Reeves, G. H., J. D. Hall, T. D. Roelofs, C. O. Baker, and T. Hickman. 1991. Habitat enhancement and rehabilitation for anadromous salmonids. Pages 519-557. American Fisheries Society Publication No. 19.
Bisson, P. A., T. P.Quinn, G. H. Reeves, and S. V. Gregory. 1992. Best management practices, cumulative effects, and long-term trends in fish abundance in Pacific Northwest river systems. Pages 189-232. in R.J. Naiman, editor. Watershed management: balancing sustainability and environmental change. Springer-Verlag, New York.
Reeves, G. H. and J. R. Sedell. 1992. An ecosystem approach to the conservation and management of freshwater habitat for anadromous salmonids in the Pacific Northwest. Transactions of the 57th North American Wildlife and Natural Resources Conference 1992:408-415.
Thomas, J. W. , G. H. Reeves, and others. 1993. Viability assessments and management considerations for species associated with late-successional and old-growth forests of the Pacific Northwest: the report of the Scientific Analysis Team. USDA Forest Service, Portland, OR 530 p.
Reeves, G. H., F. H. Everest, and J. R. Sedell. 1993. Diversity of juvenile anadromous salmonid assemblages in basins in coastal Oregon with different levels of timber harvest activities. Transactions of the American Fisheries Society 122:309-317.
Thomas, J. W., G. H. Reeves, and others. 1993. Forest ecosystem management: an ecological, economic, and social assessment. Report of the Forest Ecosystem Management Assessment Team. USDA Forest Service, Portland, OR
Hicks, B. J. and G. H. Reeves. 1994. Restoration of stream habitat for fish using in-stream structures. Pages 67-92. in K. J. Collier, editor. Restoration of aquatic habitats. Selected papers from the second day of the New Zealand Limnological Society 1993 Annual Conference. New Zealand Department of Conservation, Wellington, New Zealand.
Reeves, G. H., L. E. Benda, P. A. Bisson, and J. R. Sedell. 1995. A disturbance-based ecosystem approach to maintaining and restoring freshwater habitats of evolutionary significant units of anadromous salmonids in the Pacific Northwest. Pages 334-349. *in* J. L. Nielsen, ed. Evolution and the aquatic ecosytem: defining unique units in population conservation. American Fisheries Society Symposium 17.

KENNETH P. CURRENS
Northwest Indian Fisheries Commission, 6730 Martin Way E, Olympia, WA 98516

Education

Ph.D. Oregon State University (1995). Conservation Genetics and Risk Assessment in Management of Hatchery and Wild Rainbow Trout Populations.
M.S. Fishery Science. Oregon State University (1987). Genetic Differentiation of Resident and

Anadromous Rainbow Trout in the Deschutes River Basin, Oregon.
B.S. Fishery Science (with High Scholarship). Oregon State University (1983).
B.A. English. University of Oregon, Eugene, Oregon (1979).

Experience
Conservation Geneticist for the Northwest Indian Fisheries Commission (1995-present)
Conservation Geneticist for U.S. Fish and Wildlife Service endangered salmon issues (1992-1995).
Genetics Program Leader, Oregon Cooperative Fishery Research Unit (1992-present).
Analysis of allozyme, DNA, morphological, and genetic breeding studies of Pacific salmon
Advising and coordination with state, federal, and Tribal fishery agencies, and private groups Genetic risk assessment.
Fishery Biologist. Represented Oregon State University in the Sea of Cortez, Mexico (1987).
Graduate Research Assistant (1983-1986). Genetic analysis of Columbia River chinook salmon and steelhead.
Teaching Assistant. Economic Ichthyology. Oregon State University (1983).
Technician. Oregon State University Fish Museum (1982-1983).
Chemist. Winter Products Company, Portland, Oregon (1979-1981).
Mathematics and Language Arts Tutor. Canby Union High School, Canby, Oregon (1978-1979).

Honorary Societies and Awards
Walter Jones Certificate of Excellence in Fisheries Development (1987).
SOLMAREX Graduate Research Opportunity Award (1987).
Masters Student of Excellence in Fisheries and Wildlife (1985).
Phi Kappa Phi (1984).

Professional Organizations
American Association for the Advancement of Science
The American Fisheries Society
The American Society of Ichthyologists and Herpetologists
The Gilbert Ichthyological Society
Society for Conservation Biology
Society for the Study of Evolution

Professional and University Service
Scientific Reviewer for the *Transactions of the American Fisheries Society*, *Journal of Great Lakes Research*, *Conservation Biology*, *Aquaculture*, National Geographic Society, Research and Exploration, National Marine Fishery Service Saltonstall-Kennedy Grants (1992, 1993, 1995), NMFS Endangered Species Act Status Reviews (1995), Washington Sea Grant Program (1994), Washington Department of Fish and Wildlife, OS Extension Service (1991).

Genetic Consulting, Education and Policy Reviews:
Northwest Power Planning Council - chaired geneticist committee at two symposia.
Oregon Department of Fisheries and Wildlife
Oregon State University, Department of Fisheries and Wildlife - Guest lecturer: Genetics in Fisheries and Aquaculture Short Course (1988, 1990), Fishery Management (1992), Ecological Aspects of Park Management (1993), Wildlife Techniques (1994) - Conservation Biology Committee (1991), Promotion and Tenure Committee (1989-1990), Graduate Committee (1988-1989).
Oregon Trout

Oregon Aqua-Foods, Inc.
Pacific Rivers Council

Selected Publications

Currens, K.P., C.B. Schreck and H.W. Li. 1988. Reexamination of the use of otolith nuclear dimensions to identify juvenile anadromous and nonanadromous rainbow trout, Salmo gairdneri. Fish. Bull., U.S. 86:160-163.

Currens, K.P., C.S. Sharpe, R. Hjort, C.B. Schreck and H.W. Li. 1989. Effects of different feeding regimes on the morphometrics of chinook salmon (Oncorhynchus tshawytscha) and rainbow trout (O. mykiss). Copeia 1989(3):689-695.

Currens, K.P., C.B. Schreck and H.W. Li. 1990. Allozyme and morphological divergence of rainbow trout (Oncorhynchus mykiss) above and below waterfalls in the Deschutes River, Oregon. Copeia 1990(3):730-746.

Currens, K.P. 1991. Rangeland redbands – trout of the desert. Oregon's Wildlife Resources 1(4):1-2

Schreck, C.B., M.S. Fitzpatrick and K.P. Currens. 1995. Pacific salmon (Oncorhynchus sp.). Pages 197-219 in N.R. Bromage and R.J. Roberts (eds.). Broodstock Management and Egg and Larval Quality, Blackwell Science Ltd., University Press, Cambridge.

Busack, C.A., and K.P. Currens. In Press. Genetic risks and hazards in hatchery operations: fundamental concepts and issues. Uses and Effects of Cultured Fishes in Aquatic Ecosystems. American Fisheries Society Special Publication XX.

Currens, K.P. In Press. What is a wild trout? A Population Geneticist's Perspective. Wild Trout V. Trout Unlimited, Inc. and the United States Fish and Wildlife Service, Denver, Colorado.

Adams, N.S., W.J. Spearman, C.V. Burger, K.P. Currens, C.B. Schreck, and H.W. Li. In Press. Variation in mitochondrial DNA and allozymes discriminates early and late forms of chinook salmon (Oncorhynchus tshawytscha) in the Kenai and Kasilof rivers, Alaska. Can. J. Fish. Aquat. Sci.

Li, H.W., K.P. Currens, D. Bottom, S. Clarke, J. Dambacher, C. Frissell, P. Harris, R.M. Hughes, D. McCullough, A. McGie, K. Moore, R. Nawa, and S. Thiele. In Press. Safe Havens: refuges and evolutionary significant units. Evolution and the Aquatic Ecosystem. American Fisheries Society Special Publication

Currens, K.P, and C.A. Busack. (Accepted). Genetic risk assessment. Fisheries.

Currens, K.P., C.A. Busack, G.K. Meffe, D.P. Philipp, E.P. Pister, F.M. Utter and S. Yundt. (Accepted). A hierarchical approach to conservation genetics and production of anadromous salmonids in the Columbia River Basin. NOAA Technical Reports NMFS.

In preparation

Currens, K.P., C.B. Schreck, and H.W. Li. Mitochondrial DNA Variation in Oregon coho salmon (Oncorhynchus kisutch). Can. J. Fish. Aquat. Sci.

Currens, K.P., C.B. Schreck, and H.W. Li. Genetic variation of rainbow trout in the Columbia River and northern Great Basin. Copiea.

Currens, K.P., C.B. Schreck, and H.W. Li. Meristic variation in rainbow trout of the Columbia River. Fishery Bulletin.

Currens, K.P., A.R. Hemmingsen, D.V. Buchanan, C.B. Schreck and H.W. Li. Genetic and zoogeographical implications of allozyme divergence and resistance to a microparasite in rainbow trout (Oncorhynchus mykiss). Evolution.

Currens, K.P., A.R. Hemmingsen, D.V. Buchanan, C.B. Schreck and H.W. Li. Allozyme, meristic, and parasitological evidence of introgression between wild and hatchery rainbow trout (Oncorhynchus mykiss). Trans. Amer. Fish. Soc.

Currens, K.P., C.B. Schreck, and H.W. Li. Genetic variation of coastal cutthroat trout (Oncorhynchus

clarki clarki) within an Oregon river basin. Trans. Amer. Fish. Soc.
Currens, K.P., C.B. Schreck and H.W. Li. Variation in heritability of hatching time in populations of rainbow trout (Oncorhynchus mykiss) within a river basin. Trans. Amer. Fish. Soc.
Currens, K.P., C.B. Schreck and H.W. Li. Genetic variation and responses to stress in rainbow trout (Oncorhynchus mykiss). Can. J. Fish. Aquat. Sci.
Nehlsen, W., F.W. Allendorf, D. Bayles, D. Bottom, K.P. Currens, C.A. Frissell, D. Hankin, J.A. Lichatowich, P.C. Trotter, and T. Williams. Criteria for prioritizing at-risk stocks of Pacific salmon for conservation and recovery actions. Conservation Biology.

KITTY GRISWOLD
USDA Forest Service, Pacific Northwest Research Station, Oregon State University, Corvallis, OR 97331.

Education
B.A. English Literature, Reed College, Portland, Oregon, January, 1988.
M.S. Fisheries, Oregon State University, April, 1996.
Ph.D. candidate, Oregon State University

Professional Experience
Research Biologist, USDA Forest Service, Pacific Northwest Research Station, Oregon State University, Corvallis, OR. November 1995-present
Graduate Research Assistant, Department of Fisheries and Wildlife, Oregon State University. March 1995 to November 1995.
Teaching Assistant, Department of Fisheries and Wildlife, Oregon State University. January, 1995-March 1995. "Multicultural Perspectives of Natural Resources" FW 240.
Graduate Research Assistant, Department of Fisheries and Wildlife, Oregon State University. Conducted research on the genetic relationships and life histories of coastal cutthroat trout in two basins.
Biological Technician, U.S.F.S., PNW Research Station. June 1991-February 1992.
Data Entry, U.S.F.S., PNW Research Station, Corvallis, OR. March, 1991-June, 1991.
Biological Aid, U.S.F.S., Waldport District, Waldport, OR. June, 1990-September, 1990.

Presentations
Stream Team, Oregon State University. October, 1992. Presented conceptual framework and methods for M.S. research.
Fishery Biology, Department of Fisheries and Wildlife, Oregon State University. November, 1993 and 1994. Guest lecturer "Genetics and Stock Identification".
Stream Team, Oregon State University. December, 1994. Genetic variation of cutthroat trout within two coastal basins.
American Fisheries Society, Ashland, Oregon. February, 1995. Genetic relationships of resident and anadromous coastal cutthroat trout.

Awards
Oregon Federation of Fly fishers Scholarship 1992.
Oregon State University College of Agricultural Sciences Registry of Distinguished Graduate Students 1995.

Professional Societies
American Fisheries Society, Gilbert Ichthyological Society

Selected Publications
Griswold K.E. 1996. Genetic and meristic relationships of coastal cutthroat trout (*Oncorhynchus clarki clarki*) residing above and below barriers in two coastal basins. M.S. Thesis. Oregon State University, Corvallis, Oregon

In Preparation
Griswold K.E., K. P. Currens, and G. H. Reeves. Genetic and meristic relationships of coastal cutthroat trout (*Oncorhynchus clarki clarki*) residing above and below barriers in two coastal basins. Can. J. Fish. Aquat. Sci.

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Angers, B., L. Bernatchez, A. Angers, and L.Desgroseillers. 1995. Specific microsatellite loci for brook charr reveal strong population subdivision on a microgeographic scale. Journal of Fish Biology 47: 177-185.

Armstrong, R. H. 1971. Age, food, and migration of sea-run cutthroat trout, *Salmo clarki,* at Eva Lake, Southeastern Alaska. Transactions of the American Fisheries Society 100:302-306.

Avise, J.C. 1986. Mitochondrial DNA and the evolutionary genetics of higher animals. Transactions of the Royal Society of London. B. 312:325-342.

Brown, J. H. and A. Kodric-Brown. 1977. Turnover rates in insular biogeography: effect of immigration on extinction. Ecology 58:445-449.

Brown, W.M., M. George, Jr., and A.C. Wilson. 1979. Rapid evolution of animal mitochondrial DNA. Proceedings of the National Academy of Science USA 76:1967-1972.

Cooper, D.W. 1968. The significance level in multiple tests made simultaneously. Heredity 23:614-

Griswold K.E. 1996. Genetic and meristic relationships of coastal cutthroat trout (*Oncorhynchus clarki clarki*) residing above and below barriers in two coastal basins. M.S. Thesis. Oregon State University, Corvallis, Oregon.

Gunn, J.S., I.R. Harrowfield, C.H. Proctor and R.E. Thresher. 1992. Electron probe microanalysis of fish otoliths-evaluation of techniques for studying age and stock discrimination. Journal of Marine Biology and Ecology 158:1-36.

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1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1996	Proposed FFY 1997	LONG RANGE FUNDING REQUIREMENTS					
Personnel		$58.8						
Travel		$36.6						
Contractual		$114.5						
Commodities		$2.0						
Equipment		$1.0						
Subtotal	$0.0	$212.9	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	
General Administration		$16.8						
Project Total	$0.0	$229.7	$100.0					
Full-time Equivalents (FTE)		2.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: Please note: (1) I was sent the incorrect file and did not have access to form 4A
(2) This budget is higher that projected in FY96 primarily because of the need for an additional sampling trip (See proposal for more detail explanation)

1997

Prepared: G. Reeves

Project Number: 97145
Project Title: Cutthroat trout and Dolly Varden in Prince William Sound, Alaska: the relation among and within populations of anadromous and resident forms
Agency: USFS

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/13/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1997
K. Griswold	Research Assitant/Fish Biologist	5	12.0	3.3		39.6
						0.0
	Lab and Field Technicians	5	12.0	1.6		19.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		24.0	4.9	0.0	
					Personnel Total	$58.8

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
Corvallis, OR to Anchorage, AK to attend EVOS workshop	0.8	2	8	0.1	2.4
(K. Griswold and K. Currens)					0.0
					0.0
Corvallis, OR to Cordova, AK for field collections	1.0	9	126	0.2	34.2
(G. Reeves - 3 , K. Griswold -3, Technician -3)					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$36.6

1997

Prepared: G. Reeves

Project Number: 97145
Project Title: Cutthroat trout and Dolly Varden in Prince William Sound, Alaska: the relation among and within populations of anadromous and resident forms
Agency: USFS

FORM 3B
Personnel
& Travel
DETAIL

4/13/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Contractual Costs:		Proposed
Description		FFY 1997
Air Charter - Cordova to field sites	30 hours @ $350/hour	10.5
Boat Charter Boat Charter - Cordova to field sites	40 ays @ $600/day	24.0
Genetic & Meristic Analysis - Oregon State University	(1400 fish)	75.0
Otolith Microchemistry - Oregon State University	(200 fish)	5.0
When a non-trustee organization is used, the form 4A is required.	Contractual Total	$114.5

Commodities Costs:	Proposed
Description	FFY 1997
Dry Ice (including shipment from Seattle t o Cordova	2.0
Commodities Total	$2.0

1997

Prepared: G. Reeves

Project Number: 97145
Project Number:
Project Title: Cutthroat trout and Dolly Varden in Prince William Sound, Alaska: the relation among and within populations of anadromous and resident forms
Agency:
Agency: USFS

FORM 3B
Contractual & Commodities DETAIL

4/12/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
Misc.			1.0
			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	$1.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1997

Prepared: G. Reeves

Project Number: 97145
Project Title: Cutthroat trout and Dolly Varden in Prince William Sound, Alaska: the relation among and within populations of anadromous and resident forms
Agency: USFS

FORM 3B
Equipment
DETAIL

4/12/96

Archaeological Site Stewardship

Project Number:	97149
Restoration Category:	Monitoring
Proposer:	ADNR- Alaska Office of History and Archaeology
Lead Trustee Agency:	ADNR
Cooperating Agency:	DOI- U.S. Fish and Wildlife Service
Alaska SeaLife Center:	
Duration:	2nd year, 3 year project
Cost FY 97:	$95,300
Cost FY 98:	$60,000
Geographic Area:	Kenai Peninsula, Kodiak Island, Alaska Peninsula
Injured Resource:	Archaeological Resources

ABSTRACT

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

INTRODUCTION

An important key to saving Alaska's cultural heritage sites from continuing loss is promotion of local stewardship of historic and prehistoric sites. The idea of site stewardship is to get local people to take an interest in sites and the information they contain and to convince people to report site destruction or damage to sites. Other states, notably Arizona and Texas, have created organizations in which people with interest in archaeology but with very little training can cooperate with professional archaeologists in monitoring sites. The Arizona program links a system of volunteer site stewards with governmental archaeologists. The system involves stewards in monitoring selected sites in danger of looting. In return, the stewards receive schooling in the history and prehistory of the state and training in data collection. A successful site stewardship program must depend very heavily on interest, education and active involvement of the public.

An attempt was made to start a stewardship program in Southcentral Alaska during 1992, when the Exxon Valdez Oil Spill Trustee Council funded development of a manual and fieldbook suitable for beginning a program in the spill area. A first draft of the manual and fieldbook were written with the intent of revising them to fit specific situations in different areas. The manual and fieldbook have been modified during FY 96 and training materials specific to each program area have been compiled. Sites to be monitored by the stewards enlisted are being selected and the program implemented during FY 96.

Archaeologists from the U.S. Fish and Wildlife Service have been actively working with interested residents of the Chignik area to educate local students about the value of protecting sites. A network of stewards and their training is being developed under the FY 96 project.

Resident fishermen in the areas of Uganik Bay and Uyak Bay on Kodiak Island have expressed to U.S. Fish and Wildlife Service archaeologists interest in monitoring sites near their setnet locations. Those sites have suffered depredations from vandals. Interested local residents are being identified and sites selected for monitoring.

The Office of History and Archaeology met with archaeologists in Homer and the Kenai-Soldotna area during 1994 to develop a site monitoring program. Sites selected in the central part of the Kenai Peninsula include prehistoric sites eroding from natural and human causes and a historic cabin which has frequently been used for shelter by transient visitors. The latter attempts were developed with University of Alaska, Anchorage, Kenai campus staff and student volunteers. Representatives from a local Native organization have voiced interest in the program and negotiations are beginning with those groups.

The Kachemak Bay area which contains many sites rich in valuable artifacts also has many people interested in seeing the sites protected from vandals and erosion. Two residents of Homer trained as archaeologists have agreed to serve as regional coordinators for the program. Plans to coordinate the program with the Pratt Museum in Homer are also underway.

The basis of a site stewardship program is effective creation of a partnership between interested individuals of the general public, professional archaeologists and historians, and government responsible for protecting those resources. Successful stewardship depends on close cooperation and identifiable benefit to all participants. Because of the remote location of many Alaskan sites and lack of funding to protect them, education of the public and recruitment of their help may be the best chance to protect Alaska's heritage in the future.

NEED FOR THE PROJECT

A. Statement of Problem

Vandalism of archeological sites during the cleanup phase of the Exxon Valdez Oil Spill was well documented in the Oil Spill area, particularly in Prince William Sound and the Kodiak Island area. Vandalism during cleanup appears to have been associated with people placed near sites while living on chartered boats. Many of the boats working on the cleanup effort were from local coastal communities and crews were local residents. Circumstantial evidence indicates that some crew members were involved in the looting of sites. The fear among cultural resource managers is that knowledge about site locations and the practice of site looting accelerated during oil spill cleanup, continued and spread outside the oil spill area. Recent events of site looting by crew members from Gulf of Alaska herring fishing boats at the Old Togiak Site indicate the pattern has continued, very probably at a more intensive rate. The Alaska Office of History and Archaeology and the National Park Service recently sent a joint letter to fishermen active in the Bristol Bay herring fishery which states the case against and legal penalties for looting sites.

B. Rationale

Continuing loss of sites and data to vandals reduces the finite number of sites which exist in the spill area. Unless a means to stop the destruction is found, the ability of the archaeological resources to address questions important to the cultural heritage of Alaskans will be diminished beyond the ability to achieve answers. Agencies concerned with archaeological sites have attempted to monitor damaged sites but with little success due to lack of sufficient personnel for the work load. Other duties of the agency employees do not allow adequate time to be spent monitoring and protecting damaged sites.

C. Location

The project occurs in the Chignik, Kodiak Island, Kachemak Bay and Kenai areas. Overall coordination will occur in Anchorage with local coordinators and participants. The communities of Chignik, Kodiak, Homer, Seldovia, Kenai, and Soldotna will be affected by the project.

COMMUNITY INVOLVEMENT

The archaeological site stewardship project is based on involvement of individuals in Homer and Chignik and in remote areas of Uyak and Uganik Bays on Kodiak Island. Site stewards recruited in and around those communities will be provided some material and logistic support. The project will depend on the interest and cooperation of the local stewards in providing their time and knowledge. The agency archaeologists are meeting singly and with groups of local stewards for training and providing materials needed for site monitoring.

PROJECT DESIGN

A. Objectives

The basic aim of this stewardship project is protection of sites being destroyed by vandals. The immediate objectives are:

1: Identify sites needing monitoring and stewards willing to track status of the sites, and train the stewards in the procedures of effective monitoring.

2. Implement the field and reporting procedures which will allow land owner\managers to know what impacts are occurring on the sites and devise a response to damaging activities

B. Methods

The site stewardship program is an extension of agency monitoring efforts aimed at tracking vandalized sites in locations easily accessible to vandals but where agency personnel are not able to visit. Effectiveness of the program will be judged in the lack of continuing damage and in the natural stabilization of the exposed site deposits. A second gauge of positive program results will be increased local recognition of the harm from site looting as a result of local public advocacy by the stewards. Another, although secondary, gauge for the efficiency of the effort will be identification and investigation by agency investigators of site looters.

Site stewards are identified from past expressions of interest and trained in proper note recording, use of cameras to record site status, and procedures for reporting to the area coordinator. Specific training will be provided to make initial site maps and detailed descriptions. Permanent reference points for observation over several seasons will be established to insure comparable information over time. Visits to target sites by stewards and program supervisors several times in the first year will help encourage and train the stewards for working by themselves. No collecting of surface artifacts or testing, except as specifically authorized by site owners, will be a part of the program.

Information provided by the stewards to program supervisors and the overall coordinator will then be forwarded to the appropriate land manager\owner for action as necessary. Coordination of findings over the entire area of the stewardship program will allow increases

or declines in site vandalism to be identified. Hotspots of looter activity will be documented thereby allowing agency defense against the looters to begin in an effective manner.

C. Cooperating Agencies, Contracts and Other Agency Assistance

No major contracts are anticipated in this project. The contractual activity will be aircraft or boat charters on an hourly basis. Other agency assistance will be in coordination of transportation and field housing by agency training personnel. Such coordination will be developed as necessary as specific activities allow.

SCHEDULE

A. Measurable Project Tasks for FY 97 (October 1, 1996 - September 30, 1997)

The steps to be accomplished during the second year of this project will be:

October 1 - December 31, 1996:	Beginning of FY 97, completion of all NEPA requirements, FONSI expected.
January 31, 1997:	Compile steward reports, process film, and begin annual report.
April 15, 1997:	Completion of annual report for FY 96 project year.
May 15, 1997:	Complete review of site selection from FY 96, new site selection, review and training of stewards.
June 30, 1997:	Complete site visits and steward training.
September 30, 1997:	Complete steward monitoring of sites for season.

B. Project Milestones and Endpoints

The schedule and milestones listed in the above section will continue through the next fiscal year as well. The project is planned for a three year Trustee funded life. The project is expected to continue without Trustee funding but with similar milestones. The third year report will include a summary of the entire program, review of findings, and identification of local trends in vandal activity.

C. Completion Date

The third annual report will constitute the final report for the project to be completed by December 31, 1998 (FY 99).

PUBLICATIONS AND REPORTS

The only report to be produced during FY 97 will be the annual report of project activities

during FY 96. No manuscript publishable in a peer reviewed publication is anticipated.

PROFESSIONAL CONFERENCES

No professional conference presentations are anticipated.

NORMAL AGENCY MANAGEMENT

Federal and state laws assign general responsibility for dealing with cultural resource matters to the various land managing agencies. None of the agencies cooperating in the site stewardship project has ever funded such a program. The project has been linked to expected increases in vandalism due to cleanup associated vandalism.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Because monitoring of sites are for specific locations for short periods, chances of coordinating travel or facilities with other restoration projects is very limited. One of the reasons for effectiveness of site stewardship is that stewards are able to visit sites at irregular intervals when agencies are unable to do so. That irregular schedule makes coordination of transportation and facility use extremely difficult. Where possible, sharing of boat and airplane charters will be coordinated with other restoration projects within agencies.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

No major changes in methodology have been proposed from the 96149 detailed project description. The sites selected for steward attention and the individual stewards will vary but remain largely the same.

PROPOSED PRINCIPAL INVESTIGATOR

Douglas R. Reger
Office of History and Archaeology
Alaska Department of Natural Resources
3601 C Street, Suite 1278
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(907) 269-8725
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PERSONNEL

Douglas R. Reger
Archaeologist II
Office of History and Archaeology
Alaska Division of Parks and Outdoor Recreation
3601 C Street, Suite 1278
Anchorage, AK 99510-7001

1981 PhD.- Anthropology, Washington State University

PROFESSIONAL EXPERIENCE:

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

PUBLICATIONS/REPORTS:

1972	*An archaeological survey in the Utopia area, Alaska,* **Anthropological Papers of the University of Alaska**, 15(2), with R.D. Reger
1974	*Prehistory of the northern Kenai Peninsula*, In **Prehistory of the North American Subarctic: the Athapaskan Question**, edited by J.W. Helmer, S. VanDyke, and F.J. Kense, Univ. of Calgary, p. 16-21
1977	*An Eskimo Site near Kenai, Alaska*, **Anthropological Papers of the University of Alaska**, 18(2): 37-52
1983	*Norton: a changing southeastern boundary*, **Arctic Anthropology** 19(2): 93-99, with Joan B. Townsend
1987	*Archaeology of a late prehistoric subsistence locality, the Clam Gulch Site (49KEN-045)*, **Anthropological Papers of the University of Alaska** 21:89-103
1992	Effect of crude oil contamination on some archaeological sites in the Gulf of Alaska, 1991 investigations. Office of History and Archaeology Report No. 30.

Alaska Division of Parks and Outdoor Recreation, with J. David McMahan and C. E. Holmes.

Debra G. Corbett
Archaeologist
U.S. Fish and Wildlife Service
1011 E. Tudor Road
Anchorage, AK 99503

1980 BA- Anthropology, University of Arizona
1992 MA- Anthropology, University of Alaska, Fairbanks

PROFESSIONAL EXPERIENCE

1980	Survey and project clearance, Bureau of Land Management, Idaho Falls District, Idaho
1981	Survey and project clearance, Bureau of Land Management, Salmon District, Idaho
1982	Survey and project clearance, Bureau of Land Management, Phoenix District, Arizona
1983	Excavation, La Ciudad village, Papago Freeway Project, Phoenix, Arizona
1983-89	ANCSA 14(1) investigations, Bureau of Indian Affairs, Anchorage, Alaska. Projects in the Aleutians, Yukon Delta and Kobuk River areas.
1991	Survey and Project clearances, U.S. Fish and Wildlife Service, wildlife refuges throughout Alaska.

Professional Affiliations: Alaska Anthropological Association

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1996	Proposed FFY 1997	PROPOSED FFY 1997 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
					$65.8		$29.5	
Personnel	$50.8	$64.4						
Travel	$8.0	$10.2						
Contractual	$4.7	$7.5						
Commodities	$3.0	$3.0						
Equipment	$0.0	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$66.5	$85.1	Estimated	Estimated	Estimated	Estimated	Estimated	
General Administration	$7.9	$10.2	FFY 1998	FFY 1999	FFY 2000	FFY 2001	FFY 2002	
Project Total	$74.4	$95.3	$71.0	$40.0	$0.0	$0.0	$0.0	$0.0
Full-time Equivalents (FTE)	0.7	1.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Comments: This project is a continuation of Project 96149.

Project Number: 97149
Project Title: Archaeological Site Stewardship
Lead Agency: AK Department of Natural Resources

FORM 2A
MULTI-TRUSTEE
AGENCY
SUMMARY

1997 EXXON VALDEZ TRUSTE_ _ OUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1996	Proposed FFY 1997	LONG RANGE FUNDING REQUIREMENTS					
Personnel	$39.6	$46.4						
Travel	$3.7	$5.1						
Contractual	$2.7	$5.0						
Commodities	$2.0	$2.0						
Equipment		$0.0						
Subtotal	$48.0	$58.5	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	
General Administration	$6.1	$7.3						
Project Total	$54.1	$65.8	$51.0	$40.0	$0.0	$0.0	$0.0	
Full-time Equivalents (FTE)	0.5	0.6						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1997

Project Number: 97149
Project Title: Archaeological Site Stewardship
Agency: AK Department of Natural Resources

FORM 3A
TRUSTEE
AGENCY
SUMMARY

Prepared: 2 of 9

4/10/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1997
Douglas Reger	Archaeologist	18M	6.0	6.5		39.0
Judith Bittner	Chief, History and Archaeology	21K	1.0	7.4		7.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		7.0	13.9	0.0	
					Personnel Total	$46.4

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
Travel to Kodiak to monitor sites	0.400	4	8	0.115	2.5
Travel to Homer to monitor sites	0.200	6	12	0.115	2.6
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$5.1

1997

Prepared:

Project Number: 97149
Project Title: Archaeological Site Stewardship
Agency: AK Department of Natural Resources

FORM 3B
Personnel
& Travel
DETAIL

4/10/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Contractual Costs:	Proposed
Description	FFY 1997
Air charter to visit archaeological sites and site stewards (16 hours @ $275/hour)	4.4
Film processing	0.6
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$5.0

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

1997

Project Number: 97149
Project Title: Archaeological Site Stewardship
Agency: AK Department of Natural Resources

FORM 3B
Contractual & Commodities DETAIL

Prepared:
4 of 9

4/10/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
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

1997

Project Number: 97149
Project Title: Archaeological Site Stewardship
Agency: AK Department of Natural Resources

FORM 3B
Equipment
DETAIL

Prepared: 5 of 9

4/10/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1996	Proposed FFY 1997	LONG RANGE FUNDING REQUIREMENTS					
Personnel	$11.2	$18.0						
Travel	$4.3	$5.1						
Contractual	$2.0	$2.5						
Commodities	$1.0	$1.0						
Equipment		$0.0						
Subtotal	$18.5	$26.6	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	
General Administration	$1.8	$2.9						
Project Total	$20.3	$29.5	$20.0	$0.0	$0.0	$0.0	$0.0	
Full-time Equivalents (FTE)	0.2	0.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1997

Prepared: 6 of 9

Project Number: 97149
Project Title: Archaeological Site Stewardship
Agency: DOI- Fish and Wildlife Service

FORM 3A
TRUSTEE
AGENCY
SUMMARY

4/10/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Personnel Costs:		GS/Range/	Months	Monthly		Proposed
Name	Position Description	Step	Budgeted	Costs	Overtime	FFY 1997
Debra Corbett	Archaeologist	GS-9	5.0	3.6		18.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		5.0	3.6	0.0	
					Personnel Total	$18.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1997
Travel to Kodiak to monitor sites	0.400	6	12	0.225	5.1
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$5.1

1997

Prepared:

Project Number: 97149
Project Title: Archaeological Site Stewardship
Agency: DOI- Fish and Wildlife Service

FORM 3B
Personnel
& Travel
DETAIL

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Contractual Costs:	Proposed
Description	FFY 1997
Air charters to visit archaeological sites and site stewards (8 hours @ $275/hour)	2.2
Film processing	0.3
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$2.5

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

1997

Project Number: 97149
Project Title: Archaeological Site Stewardship
Agency: DOI- Fish and Wildlife Service

FORM 3B
Contractual & Commodities DETAIL

Prepared:

4/10/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
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

1997

Project Number: 97149
Project Title: Archaeological Site Stewardship
Agency: DOI- Fish and Wildlife Service

FORM 3B
Equipment
DETAIL

Prepared: 9 of 9

4/10/96

Facilities improvement to the Prince William Sound Science Center.
Submitted under the BAA

Project Number:	97151-BAA
Restoration Category:	Research Facilities
Proposer:	Prince William Sound Science Center
Lead Trustee Agency:	NOAA
Cooperating Agencies:	
Alaska SeaLife Center:	
Duration:	Three years
Cost FY 97:	$514.8 K
Cost FY 98:	$3,500.0 K
Cost FY 99:	$5,000.0 K
Geographic Area:	Prince William Sound
Injured Resource/Service:	Basic marine research infrastructure important to the long term restoration effort.

ABSTRACT

The Prince William Sound Science Center seeks a grant of $514,800 from the Exxon Valdez Trustee Council for expansion of its physical facilities. Programs housed at the Prince William Sound Science Center include state-of-the-art marine research, a community-based science education program and the initial elements of the Congressionally-authorized Oil Spill Recovery Institute. Altogether, we have 27 people working at three different sites in Cordova. Organizational efficiency and annual operating costs are impaired by this fragmentation.

We propose to expand our facility to include more office and laboratory space, and additional rooms for education activities. A two-phase expansion plan is the basis for this proposal. Phase I will result in consolidation of all current staff in one building and can be completed by the end of 1997. Phase II of the expansion will enhance the facilities to meet the needs of the Oil Spill Recovery Institute.

INTRODUCTION

The Prince William Sound Science Center was established in 1989 as an independent research, monitoring and educational institution. Its mission is to contribute to the comprehensive description, sustained monitoring and ecological understanding of Prince William Sound, the Copper River, and their wetlands, river systems and drainage basin. A primary goal is to maintain a comprehensive database on the natural resources in the region and provide this information to resource users, managers, and the general public through education and outreach programs.

Grants funds for general operating and capital needs of the PWS Science Center were awarded by the Murdock Charitable Trusts, Pew Charitable Trusts, Conservational International, Ecotrust, the Alaska State Legislature, the City of Cordova and private corporations. Support monies have also been received through private donations for individuals and businesses in Prince William Sound. The Center's research staff work on projects through state, federal and industry contracts. To date, the Center is working on or has completed contracts for the U.S. Fish and Wildlife Service, the *Exxon Valdez* oil spill (EVOS) Trustee Council, ARCO Marine, Inc., the Alaska Department of Fish and Game, the Alaska Science and Technology Foundation, and the City of Cordova.

The City of Cordova was the Center's first major supporter, giving it $100,000 in loan start-up funding and awarding it a 10-year lease on its current building at a $1/year rate. The loan was forgiven in 1993 after the Center raised more than $250,000 for renovation of the facility which had last been used as a fish processing ice-house. Located on pilings at the entrance to the Cordova boat harbor, the 4,000 square foot building is on an ideal site for a marine research center. Substantial renovations were completed between 1991 and 1993 with the support of $577,000 in capital funds from the Alaska Legislature. The work transformed the former cannery into a two-story office complex with a small bunkhouse. In 1994, a laboratory was added in collaboration with the Prince William Sound Community College.

Currently, the Science Center's largest research projects comprise a part of the *Sound Ecosystem Assessment (SEA),* a mutli-disciplinary program funded entirely by the *Exxon Valdez* oil spill (EVOS) Trustee Council. The SEA program is designed to create a comprehensive database of the physical ocean and biological processes of Prince William Sound. Data are analyzed for broad application to restoration of species injured by the *Exxon Valdez* oil spill. This year, four of the 11 SEA projects are conducted by Science Center researchers. These projects cover the ocean environment, nekton and plankton acoustics, data management and modelling and food web analysis using stable isotopes.

The Science Center also conducts other biological and fishery research projects and, in partnership with the U.S. Forest Service, provides an award winning science education program that reaches more than 400 elementary school age children in Cordova, Tatitlek, Chenega Bay and Whittier. The Center's staff specialize in the use of data visualization tools which help make scientific information easily understood and "user-friendly." Complex ecosystem processes are displayed with these tools in an animated yet simple format that does not sacrifice the quantitative quality of the data.

In 1990, the United States Congress passed legislation establishing the Prince William Sound Oil Spill Recovery Institute and directed that this institute be administered through the Prince William Sound Science Center and located in Cordova. The Oil Spill Recovery Institute's (OSRI) mission is to identify and develop the best available technologies for prevention and response to oil spills in the Arctic and Sub-Arctic marine environment; and also to complement federal and state efforts to assess the long-term effects of the *Exxon Valdez* oil spill on the environment and people of the region. The Science Center and the OSRI share staff and other resources.

The OSRI published a research and technology plan in 1995 with assistance from a wide variety of experts in state and federal agencies, as well as the oil industry. Alaska's Hazardous Substance Spill Technology Review Council was a cooperator in this publication. The **Oil Pollution Research and Technology Plan for the Arctic and Subarctic** is the first step in identifying research priorities to attain the most efficient and effective technologies and methods for preventing and responding to oil spills in cold water environments. Implementation of this research plan will occur as soon as pending legislation in Congress is finalized and additional funding for the OSRI program is received.

Facility and staff resources of the Science Center are used by state and federal agencies. The Center's laboratory, library and bunkhouse are available to any scientific researcher (private, university or government affiliated). To date, the laboratory has been shared, at no cost, with collaborating staff of the SEA program from the ADF&G. The Center's bunkhouse, conference room, laboratory, freezer and short-term office space have been used by a wide variety of organizations and individuals, many of which are working on restoration and research projects for the *Exxon Valdez* Trustee Council. A sample list of these groups include the state's Hazardous Substance Spill Technology Council, the Regional Citizens Advisory Council, the Prince William Sound Community College, the U.S. Forest Service, the National Marine Fisheries Service, and university researchers from Alaska, New York, Pennsylvania, Alabama, Washington, and several foreign countries.

In 1996, the Science Center was awarded a $300,000 grant from the Alaska Legislature to plan and begin to implement a two-phased expansion of its facility (see Exhibit 1, Proposal to Dept. of Community & Regional Affairs). Phase I is intended to meet the immediate short-term needs while Phase II focuses on planning for future additions which will be dependent on development of the Oil Spill Recovery Institute and other research programs.

The preliminary cost estimate to complete Phase I is $650,000 (per draft memo 3/11/96 from Minch, Ritter, Voelckers Architects, Juneau). $211,000 of the $300,000 state grant is budgeted for Phase I; this leaves us a deficit for $429,000 to complete Phase I.

NEED FOR THE PROJECT

A. Statement of the Problem

The rapid growth of the Prince William Sound Science Center's programs and staff between 1992 and 1995 forced a division of the research staff into two offices separated by 2.5 miles. The

Center's main offices are centrally located while the "satellite" office is at the end of a poorly maintained road which is sometimes impassable in icy, windy conditions. This division of the staff was intended to be a temporary condition when the satellite office was leased in 1994. It has proved ineffective for teamwork and has sometimes slowed data analysis and preparation for field work. Regular communication is hampered and the overall cost of work is increased by additional phone lines and other expenses to connect the satellite office to the Internet.

In addition, offices at the Center's main building are overcrowded and lack privacy needed, particularly by the project leaders. These staff members work extensively on data analysis, publications and technical reports which require quiet office space for efficient production. Expansion of the Center's main offices was always planned but was dependent on development of the Oil Spill Recovery Institute and the Science Center's other programs.

The PWS Science Center's staff numbers 27 full and part-time in Cordova. This staff size will not decline, based on current grant and project funding. An increase in the staff size is possible through the pending programs of the Oil Spill Recovery Institute. However, there is an immediate need for additional office space at the Center's main office site. According to an architect consulted by the Center, approximately 250-300 square feet per occupant is required in total space for a general office building. The Center currently has only 180 square feet per occupant for the staff now housed in its main office building. With the proposed addition, we would have 244 sq. ft./staff member which is at the low end of the industry standard.

In the short term, a 2,500 square foot two-story addition will ease the immediate stress on facility resources by providing:

- six - eight individual offices (for more effective quiet work),
- a larger reception area that can accommodate small research and education exhibits, and
- a larger public conference room with audio-visual equipment that will assist researchers in sharing their results with the public.

Good meeting room space does not exist in Cordova. The city's public meeting room has recently been renovated into a city council chambers and can no longer accommodate more than 40 people; scheduling in that room is difficult because of city commission and council meetings. Other meeting rooms are also often booked and do not have even the simplest audio-visual equipment (i.e., screen, projector).

The PWS Science Center's *Science of the Sound* education program is located in two small rooms of the Prince William Sound Community College. While this site is convenient to the grade school (across the street), it limits the regular interactions of the Center's research staff with students and education program activities. The program is also rapidly outgrowing the space the community college can afford to offer it. Access to touch tanks and larger rooms for teaching and putting up displays are improvements the program is seeking.

The long-term plans for expansion are dependent on development of the OSRI program. When Congressional funding is received to implement the program, additional laboratory facilities, meeting and office space will be required.

The $300,000 grant from the state is insufficient to meet the costs for Phase I and Phase II.

B. Rationale/Link to Restoration

The PWS Science Center is working with local residents, government officials, resource managers and the Trustee Council in the development and implementation of marine ecosystem research linked to restoration in Prince William Sound. The central focus of that research is the Sound Ecosystem Assessment (SEA) program, supported entirely by the Trustee Council. Four SEA research projects are based at the PWS Science Center and depend on adequate facilities. The Trustee Council has authorized funding to support the construction of research facilities in coastal communities affected by the *Exxon Valdez* oil spill (EVOS).

Cordova was one of the most severely impacted communities in the EVOS region, largely because of its dependence upon the fishery resources in the Sound. The growth in programs of the PWS Science Center is the result of support by the Trustee Council and local support from residents in the region who want more scientific information about local resources. Residents depend on the fish and other natural resources in the area, many of which are species injured by the *Exxon Valdez* oil spill. They also want access to scientists and others involved in the research programs.

Inquiries to the Center about the status of the herring, pollock, cod, salmon and other marine populations are increasing as residents and others became aware of our products. Maintenance of a scientific library for use by both staff and local residents is a part of the PWS Science Center's mission. Our library includes scientific journals, peer reviewed papers and other unpublished and published materials focused on Prince William Sound and the *Exxon Valdez* oil spill. It is complementary to other libraries in the state (such as the Oil Spill Public Information Center, the Alaska State Library and the Rasmuson Library at the University of Alaska Fairbanks). Our collection is documented in a library database also used by the Cordova office of the Alaska Dept. of Fish & Game office and the Copper River Delta Institute/U.S. Forest Service; this allows us to swap disks and share our local resources so we can extend our library budgets, and also sometimes avoid waiting for library materials to be sent from other libraries through the Inter-Library loan service.

The PWS Science Center is unique among research institutions in the state. It is specializing in the development of remote sensing and data visualization tools to improve measurements and our understanding of marine species. The Center is filling a void by working to transfer and apply research technologies that can improve long term monitoring of aquatic resources.

In contrast, the Alaska SeaLife Center is focusing its infrastructure development on research related to marine mammals, sea birds and fishery genetics. Its laboratories will be used for experiments not able to be done in the wild. Some of these lab experiments have and will contribute data needed by Science Center researchers working on predictive models for specific animal populations. For example, the SEA program is currently working with Dr. A.J. Paul (Director, Seward Marine Center) in development of a bioenergetics model for the Pacific herring population.

C. Location

The Prince William Sound Science Center is located in a building owned by the City of Cordova and set on pilings at the entrance to Cordova's boat harbor, in eastern Prince William Sound. The city, which was and remains one of the most heavily impacted communities in the oil spill impacted region, will benefit from this development. Cordova is an ideal location for the logistics of research work in Prince William Sound. It is accessible by jet service from Anchorage and Seattle on a daily basis. Its location is protected from the severe winter wind storms and it offers direct access to Prince William Sound. The majority of the Sound's commercial fishing fleet is based in Cordova because of the harbor and boat repair facilities. The local knowledge offered by residents and fishermen is also extremely important to the PWS Science Center's programs.

COMMUNITY INVOLVEMENT

Having successfully built a high caliber research platform, we are now focusing on putting the research to use. We are committed to putting research results into the hands of PWS residents who can use the information to participate more effectively in the dialogue on PWS natural resources. We thus are using our research findings to further develop a two-way system of technology and information transfer: (1) the Prince William Sound Science Center will continue to disseminate information on research activities and results to PWS residents; and (2) we will facilitate citizens' participation in the goals programming process for sustaining the bioregion's natural resources.

Reaching a wide range of audiences requires multiple types of communications media. We distribute scientific information about the PWS ecosystem several ways:

- a public access computer terminal is available for use at the PWS Science Center; Cordova residents can log on and connect to the Internet, and thus also to several other Internet users in the PWS region and other scientists; the SEA research program has a World Wide Web home page, and users can gain access to many other sources of scientific information (see Exhibit 2);

- we offer an award-winning education program, *Science of the Sound*, for elementary school students in Cordova and K - 12 students of the Chugach School District;

- we organize a series of talks called Notes from the Field, in which scientists studying the Prince William Sound/Copper River region make presentations on what they're discovering in their field work; and

- we developed a series of radio broadcasts called Sound Waves; the series consists of one to two minute features that are aired several times per week. SoundWaves presents information about research projects, technology and research methods, and basic biological and ecological topics.

At the beginning of the facilities expansion planning process, in the winter of 1994-95, we

organized a community meeting to discuss the PWS Science Center's plans and solicit recommendations from local residents on how to proceed. More than 20 representatives from city commissions, other non-profit organizations, Native corporations, and several state and federal agencies were invited to this meeting, which was also attended by architects employed by the PWS Science Center and several members of our Board of Directors. Meeting participants generally supported the concept of a larger facility at the Center's present site. Suggestions targeted adequate parking for harbor users and complementing efforts by Native groups working to develop a community center with a meeting room.

Presentations regarding the Center's plans were also made at meetings of the city's Harbor Commission and the Planning Commission in early 1995. Both commissions endorsed a harbor land use plan dedicating the undeveloped harbor area surrounding the PWS Science Center's building for expansion of its facilities. The Cordova City Council also approved this plan and encouraged the Center to further develop the building and surrounding area.

A conceptual drawing for a large expansion (50,000 square feet) was completed after the community meetings (Exhibit 3). Cost estimates for that facility exceeded the initial plans, largely because of extensive site preparation work and additional parking that would be required for the harbor users. The PWS Science Center's facilities expansion committee took another look at the Center's needs and recommended a two-phase approach to meet the short and long-term requirements. Although the larger facility is still a possibility for the Center's long term future, the immediate needs are for a smaller expansion.

We have spoken with Cordova's City Manager and Planning Director about the short-term expansion plans and they approve of these plans to construct a two-story addition. As the long-term planning proceeds, the PWS Science Center will work with commissions and other organizations to ensure plans continue to meet with the community's desires.

PROJECT DESIGN

A. Objectives

The primary objective is to renovate and expand an existing community research and education facility so that it can more effectively house our existing staff and provide space for:

- four projects of the Sound Ecosystem Assessment program, funded by the *Exxon Valdez* Oil Spill Trustee Council,
- the *Science of the Sound* education and outreach program, and
- planning and design work for office and laboratory expansion that will assist development of the Oil Spill Recovery Institute.

This support will allow us to continue to collect information valuable to the management, restoration and ecological understanding of Prince William Sound's vital resources.

B. Methods

Phase I

1) Hire a contractor to complete recommended repair work on the dock (see Exhibit 4).
2) Work with an architect and contractor to refine the preliminary designs for a two-story addition at the PWS Science Center's main office building. Included in the addition will be 6-8 small offices, a modestly sized reception area with space for small exhibits on the SEA project and education programs, and a conference/meeting room to comfortably seat approximately 40 people.
3) Prepare floor plans and construction blueprints.
4) Hire a contractor to complete the construction phase.

Phase II

Planning and design work for the future expansion of research facilities in Cordova will be accomplished in this phase. Approximately $100,000 of the $300,000 state grant funds are budgeted for use in this phase.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Architectural and design services will be contracted to the private sector. These contracts will be completed through the State of Alaska grant monies. The construction phase will be also contracted to private industry. It will be completed through a combination of state grant funds and other sources including the Trustee Council funds.

SCHEDULE

A. Measurable Project Tasks for FY 97 (October 1, 1996 - September 30, 1997)

Design work and all other pre-construction details will be completed during the summer of 1996 and will be funded through the State of Alaska grant. Construction documents will be released and bids solicited from contractors by September 1996.

Oct. 1 - November 15	Construction contract awarded and work completed on the building shell (exterior)
Nov. 15 - Jan. 30	Interior construction completed of the two-story addition
Oct. 1 - June 30	Phase II planning

B. Project Milestones and Endpoints

Phase I will be complete when the two-story addition is finished. This is projected at Jan. 30, 1997.

Phase II completion is dependent on Congressional actions regarding the Oil Spill Recovery Institute. Planning for the specific facilities required for development of the OSRI will proceed during FY97.

C. Completion Date

Phase I projected completion date: January 30, 1997

Phase II projected completion date: September 30, 2000

PUBLICATIONS AND REPORTS

There will not be any publications in peer-reviewed journals as a direct result of this project. An annual report will be prepared for the Trustee Council office.

PROFESSIONAL CONFERENCES

There are not professional conferences related to this project.

NORMAL AGENCY MANAGEMENT

This section is not applicable because the Prince William Sound Science Center is not a government agency.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The PWS Science Center has served as a coordinating base for the SEA research study since its inception. In addition, one of the SEA sub-projects, SEA-Data, is the functional linchpin that integrates all SEA sub-projects' data into one database. SEA scientists use a radio repeater network for remote sensing and field survey data collection. This network and the PWS Science Center's Internet connection were engineered by our information systems staff.

Laboratory space will be used by Science Center staff, ADF&G staff, and local and visiting scientists. The PWS Science Center library and other office resources are also used in restoration projects for Prince William Sound.

We plan to integrate our work with yet another EVOS-funded project, the Youth Area Watch (Project #96210). We are seeking funding to connect the Chugach School District community schools to the Internet. Youth Area Watch (YAW) students would then be able to submit their data electronically, analyze it in the context of other SEA and YAW data to which they would have access, communicate more frequently with scientists, and monitor conditions in the Sound on a real-time, continuous basis.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

This is not a continuing project so this section is not applicable.

PROPOSED PRINCIPAL INVESTIGATOR, IF KNOWN

G.L. Thomas, Ph.D., President, Prince William Sound Science Center

PERSONNEL

G.L. Thomas, Ph.D. will supervise this project.

LITERATURE CITED

Not applicable.

CURRICULUM VITAE

G.L. Thomas. Ph.D.
P.O. Box 1331
Cordova, Alaska 99574
(907) 424-3117, -5800 (work), -5820 (fax)

Education

B.A., 1970, California Western University, San Diego, CA.
M.S., 1973, California State University, San Diego, CA.
Ph.D., 1978, University of Washington, Seattle, WA.

Professional Experience

1990 to present - Prince William Sound Science Center (President and Director)
1992 to present - Oil Spill Recovery Institute (Director)
1992 to present - University of Alaska (Affiliate Faculty
1973 to 1990 - University of Washington (Research Staff and Faculty)
1971 to 1973 - Scripps Institute of Oceanography (Research Associate)

Academic Honors

1974 - Tacoma Sportsmen's Scholarship
1976 - Ellis Memorial Scholarship
1986 - Outstanding Service Award, North Pacific
International Chapter of the American Fisheries Society
1990 - Outstanding Service Award
Region 1, U.S. Fish and Wildlife Service

Professional Memberships

American Fisheries Society (life member)
American Institute of Fisheries Research Biologists
American Association for the Advancement of Science

Personal

Married 25 years: Mariola, career volunteer
Children: Melanie, Jeremy, Emily and Heather

Publications

Editorships, books, special publications

Thomas, G.L. and Ole Mathisen (Guest Editors). 1993. Special Issue: Biological interactions between enhanced and wild salmon in Alaska. Fisheries Research. 18(1-2):1-159.

Thomas, G.L. (Guest Editor) 1992. Special Issue: Successes and Failures of Fisheries Acoustics: An International, National, and Regional Perspectives. Fish. Res. 14 (2-3):91-250.

Thomas, G.L., E. Backus, H.H. Christensen, and J. Weigand. 1991. The Prince William Sound/Copper River Delta/Gulf of Alaska Ecosystem. Dobbin & Associates Press, Washington, D.C. 15 pages.

Refereed journal papers, book chapters and proceeding articles

Bonar, Scott A., G.L. Thomas, and Gilbert B. Pauley. Effects of grazing by triploid white amur (Ctenopharyngodon idella) on the aquatic macrophytes in small lakes in the Pacific Northwest. Accepted. Transactions of the American Fisheries Society.

Bonar, Scott A., Sharon Vecht, Camille Bennett, Gibert B. Pauley and G.L. Thomas. Techniques to capture of stocked white amur for population assessment in small lakes. Accepted. Journal of Aquatic Botany.

Beauchamp, M.G. LaRiviere, and G.L. Thomas. 1995. Evaluation of Competition and predation as limits ot juvenile kokanee and sockeye salmon production in Lake Ozette, Washington. North American Journal of Fisheries Management. 15(1): 193-207.

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Crittenden, Robert, and G.L. Thomas. 1992. The importance of statistical analysis to determining the accuracy and precision of acoustical estimates of fish abundance. In press. Fisheries Research. 14:197-208.

Bonar, S.C., G.B. Pauley, and G.L. Thomas. 1988. Species Profiles: Life histories and environmental requirements (Pacific Northwest) - Pink Salmon. U.S. Fish and Wildlife Biological Report 82(11.84).

Pauley, Gilbert B., Ron Risher, and G.L. Thomas. 1988. Species Profiles: Life histories and environmental requirements (Pacific Northwest) - Sockeye Salmon. U.S. Fish and Wildlife Biological Report 82(11.83).

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Thiesfeld, Steven L., G.L. Thomas, and Michael A. Wert. 1985. The Sultan River steelhead sport fishery as related to hydroelectric operation. Washington Cooperative Fishery Research Unit. University of Washington, Seattle, WA.

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Thomas, G. L. 1978. The comparative responses of kokanee, lake whitefish, and yellow perch to hydrological perturbations in Banks Lake, Grant County, Eastern Washington. Ph.D. dissertation, College of Fisheries, University of Washington, Seattle, WA.

Acker, W.C., R.E. Thorne, and G.L. Thomas. 1977. Results of acoustic and temperature measurements taken 30 August - 3 September 1976 at the San Onofre Nuclear Power Generating Station. Applied Physics Laboratory, University of Washington, Seattle, WA.

Carlson, T.J., R.E. Thorne, W.C. Acker, and G.L. Thomas. 1977. Results of acoustic and temperature measurements taken between 25-28 January 1977 at the San Onofre Nuclear Generating Station. Applied Physics Laboratory. University of Washington, Seattle, WA.

Thomas, G.L., R.E. Thorne, and W.E. Acker. 1977. Results of acoustic and temperature measurements taken between 7 and 10 February 1977 at the San Onofre Nuclear Generating station. Applied Physics Laboratory. University of Washington, Seattle, WA.

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1988-1989, Lawrence Lake Research, $110,000/yr, Washington Department of Ecology and Thurston County.
1988-1990, Eel Grass Habitat, $45,000/yr., U.S. Navy.
1991-1992, Pipers creek rehabilitation. Municipality of Metropolitan Seattle. $30,000/yr.
1990-1991, PWS Ecosystem Assessment. Conservation International Fellowship, $25,000.
1991-1992, Ecosystem Workshops. Pew Charitable Trust and over 20 organizations for matching funds, $120,000.
1992-1995, PWS Ecosystem Gatekeeper program. Murdock Charitable Trust, $300,000.
1990-93, PWS Science Center Building Project. Alaska State Legislature, $577,000.
1992, Acoustic assessment of Kenai River smolts, Commercial Fishermen, $30K.
1992, Acoustic assessment of Anchor Point Adult Sockeye, ADF&G, $11K.
1992-93, Acoustic assessment of pink salmon predators, PWSAC and ASTF, $36K.
1991-present, PWS Ecosystem Program Development - the Science Center, indirect costs, $3.5M/yr.
1991-present, PWS Oil Spill Recovery Institute, NOAA, $100K/yr.
1993-present, Acoustic assessment of overwintering herring, CDFU, $50K/yr.
1993-present, HSSTRC Oil spill R&D planning, ADEC, $125K/yr.
1994-present, Sound Ecosystem Assessment, Nearshore Fishes, EVOSTC, $550K/yr.
1995- present, Walleye Pollock Stock Assessment in PWS. ADA. $25K/yr.

as a researcher:

1971-1973, Northern Anchovy larvae behavior, Research Associate, NMFS and University of California, San Diego, Scipps Institute of Oceanography, Sea Grant, San Diego, California.
1973-1976, Effects of Irrigation Drawdown and Pumped Storage on the Population Ecology of Banks Lake Fishes. Research Associate. Bureau of Reclamation.
1976-1977, Entrapment of Fishes in Coastal Sited Cooling Water Intakes, Leader, MRC, University of California Santa Barbara, Santa Barbara, California.
1977-1980, Target Strength of Pelagic Fish Schools, Research Scientist, Applied Physics Laboratory, U.S. Navy.
1981-1984, Marine Acoustics, Research Scientist, Wash. Sea Grant. 1983-1985, Environmental Impact Monitoring Evaluations, Research Scientist, Department of Civil Engineering, EPRI.
1983-1984, Technology transfer, Indonesia. Fisheries Research Institute, Technology Transfer, U.S. AID, $1M.
1984, Fish Migrations in the Beaufort Sea, Consulting Scientist, Biosonics Inc, $1.5M.
1990-1992, PWS Geographic Information System. Conservation International, Murdock Charitable Trust, $300K.

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Budget Category:	Authorized FFY 1996	Proposed FFY 1997						
Personnel		$0.0						
Travel		$0.0						
Contractual		$429.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$429.0	Estimated FFY 1998	Estimated FFY 1999	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	
Indirect		$85.8						
Project Total	$0.0	$514.8	$3,500.0	$5,000.0				
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

1997

Prepared:

Project Number: 97151-BAA
Project Title: Facilities Improvements/PWS Science Center
Name: Prince William Sound Science Center

FORM 4A
Non-Trustee
SUMMARY

4/12/96

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1996 - September 30, 1997

Personnel Costs:			Months	Monthly		Proposed
	Name	Position Description	Budgeted	Costs	Overtime	FFY 1997
						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	FFY 1997
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.0

1997

Prepared:

Project Number: 97__
Project Title: Facilities Improvements/PWS Science Center
Name: Prince William Sound Science Center

FORM 4B
Personnel
& Travel
DETAIL

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

Contractual Costs:	Proposed
Description	FFY 1997
Subcontract - Building Construction /Site Preparation	429.0
Contractual Total	$429.0

Commodities Costs:	Proposed
Description	FFY 1997
Commodities Total	$0.0

1997

Prepared:

Project Number: 97__
Project Title: Facilities Improvements/PWS Science Center
Name: Prince William Sound Science Center

FORM 4B
Contractual & Commodities DETAIL

1997 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1996 - September 30, 1997

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1997
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
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	

1997

Prepared:

Project Number: 97__
Project Title: Facilities Improvements/PWS Science Center
Name: Prince William Sound Science Center

FORM 4B
Equipment
DETAIL

EXHIBIT 1

Proposal for facilities expansion submitted to Dept. of Community & Regional Affairs, State of Alaska

Exhibit 1

Prince William Sound Science Center

Proposal Cover Page

December 1995

To: State of Alaska, Department Community and Regional Affairs

Title: Expansion of the Prince William Sound Science Center

Principal Investigator: G.L. Thomas, Ph.D., President

Address: 300 Breakwater Avenue, P.O. Box 705, Cordova 99574,
telephone: (907) 424-5800, facsimile: (907) 424-5820,
email: loon@ grizzly.pwssc.gen.ak.us

Desired Grant Period: January 1, 1996 to June 30, 1998

Total Amount Requested: $300,000

Authorization: G.L. Thomas (by N Bird) 12-95

G.L. Thomas, Ph.D., President — Date

Prince William Sound Science Center

Facilities Expansion Plan

I. ABSTRACT

Over the past five years, the Science Center has outgrown its facilities, despite an investment of over $500,000 by the State of Alaska, the City of Cordova and private donations. Today, overcrowding is hindering productivity and important opportunities for research are being bypassed. Therefore, we plan to initiate a two-phased expansion of current facilities, first to remedy existing constraints, and second to develop an appropriate building complex to accommodate the continued growth of the Center's community-based science and education programs.

II. INTRODUCTION

Background

The Prince William Sound Science Center is housed in a city-owned building on pilings at the entrance to Cordova's boat harbor. This 4,100 sq. ft. facility was constructed as a cannery in the mid 1950's. In 1990, the Science Center was given a 10-year lease for $1 per year from the City of Cordova. A two-phased renovation project was also initiated that year with a $250,000 grant from the State of Alaska.

Phase I of the renovation was to develop plans, fortify the piling foundation and rebuild the frame, roof and walls and finish the offices to support ongoing operations. This effort was supplemented by a second state grant of $100,000 in 1991.

Phase II was to finish the interior of the building including the installation of a functional laboratory. In 1994, a third state grant of $227,000 and a donation of $50,000 of laboratory equipment from the Prince William Sound Community College paid for these improvements.

Subsequent to the renovation project has been a rapid expansion of the Center's scientific infrastructure. This consisted of computer-communications, remote sensing/signal processing and biochemical laboratories. In 1994-95, this infrastructure was funded primarily through research contracts from the Trustee Council for the EXXON VALDEZ oil spill (internal computer network, local area network, regional communications network, Internet, remote sensing/signal processing laboratory with acoustics, optics, etc./ESP, IDL, AVS, ARCINFO, etc., biochemical laboratory for stable isotope analysis, biopsy, water chemistry, etc.).

During renovation, the Science Center experienced rapid growth in terms of staff, budget and programs. The staff expanded from three to 20+ employees, the annual budget from $150,000 to

over $2,000,000 and research and education programs from three to over a dozen which are supported by a number of grants, contracts and donations. To accommodate staff and program expansion, additional facilities were leased or donated to us at the Orca Cannery, Bidarki Recreation Center, Prince William Sound Community College and the Bayside storage facility. However, even with these acquisitions there remains a need to acquire more office space to reduce overcrowding. Ideally, the acquisition of new space will consolidate staff who are presently spread out between facilities.

Objectives

Today, our ability to expand and diversify the research and education program is constrained because of limited facilities. We propose the initiation of a two phased expansion plan.

Phase I of the plan is to expand our building by 2,500 sq. ft. to accommodate the present staff and a provide for some growth in the future. The time frame for phase I is two years and the cost to this grant is $207,423. Additional funds will be raised to finish the interior of the Phase I addition.

Phase II of the plan is the construction of a 50,000 sq. ft. Science-Community Center campus. The time frame and costs for phase II are 10 years and about $30,000,000. This proposal will initiate planning and fundraising for the ten year development plan.

II. METHODS

Description of Phase I Expansion Plans

Phase I of Facilities Expansion Plan

Task 1: In 1989 prior to renovation, the pilings and foundation of the Harbormaster Building were inspected for load bearing capacity. The inspection found the pilings to be in good shape but the pilings were cross-braced before initiating renovation activities. We will contract for another engineering inspection of pilings to evaluate the load bearing capacity of the existing dock for the additional weight of the building expansion, snow and wind load and earthquake resistance. We anticipate the addition of more cross-bracing and encapsulating many of the load bearing pilings in concrete prior to construction. Costs for the survey, cross-bracing and encasement of the pilings will be about $25,000 and be completed in the summer of 1996.

Task 2: Second, we will contract with an architect to provide a set of construction documents and specifications for the expansion of the existing building. The construction will be broken down into two stages: (a) building the shell and (b) finishing the interior. This will allow us flexibility if bids for the construction are above budget. Costs for this design task will be about 7-10% of construction costs and will be completed in the spring of 1996.

Task 3: Third, we will advertise for bids to be submitted by bonded contractors for the construction in accordance to the two stage set of construction documents. Costs budgeted for the first stage of this task are about $120,000 and construction will be completed by the fall of 1996. Costs for finishing the interior will require additional fundraising to complete.

Task 4: Fourth, we will hire a project manager to oversee construction. This person will coordinate construction activities and material to ensure that they comply with the documents provided by the architect. Costs for this will be about $10,000 and parallel construction schedules.

Task 5: The final task will be planning and fundraising. Given the budget of $170,000 for tasks 1, 2, 3 and 4, we will dedicate about $20,000 to raising matching funds from private foundations and other sources to finish the interior of the building expansion.

Description of Phase II Expansion Plans

The major work to be accomplished under this phase of the grant will be assigned to a team including an architect, engineer (A/E) and planner-fundraiser. The goal of this part of the proposal is to carry out the planning, development and fundraising for the new facilities through the schematic design stage. An architect and engineer will be contracted for this phase of the project. Estimated costs for this task are $50,000 and will be completed in the spring of 1996. Should the project proceed to the construction document phase, the Center will open the selection process through the issuance of a request for proposals (RFP) for design development, construction documents and construction administration.

A/E Scope of Work:

Task 1 - Finalization of the Program of requirements: This task involves developing a program of requirements that include site selection criteria and detail design criteria for building systems.

Task 2 - Develop project schedule: This task involves the development of a design and construction schedule with bid packages for site preparation and building construction that is consistent with favorable weather conditions. Identification of the list of long lead items is a product of this task.

Task 3 - Site Analysis: This task involves the evaluation of alternate sites including site preparation, geotechnical possibilities, site utilities extension and strategic placement relative to long- term scientific, social and economic concerns.

Task 4 - Preliminary schematic design and outline specification: This task involves the development of the complete schematic package on the selected site, including site development, building floor plate, stacking plan and outline specifications

Task 5 - Construction Feasibility Review: An independent contractor who is familiar with construction in the Cordova area will be hired to review the schematic design and outline specifications for their feasibility to local weather conditions.

Task 6 - Schematic level construction cost estimate: This task involves estimating the steps of construction from site preparation through finishing the interior of the building.

Task 7 - Project cost estimate. This task involves estimating the fees, taxes permits contingency and construction management costs.

Task 8 - Financial feasibility study: This task is to develop a plan that addresses operations and maintenance (O&M) of the facilities and demonstrates how those costs are to be recovered for a 25 year life-cycle.

Project manager-planner-fundraiser scope of work:

The project manager, planner and fundraiser will report to the Center's president and will act as the owner's representative through the programming, design and fundraising phases of the facilities development process. These individuals will also represent the Center in all relations with private citizens, businesses, organizations and city, state and federal agencies. These individuals will meet with the Board of Directors to keep them informed of the progress. The costs for this effort will be about $20,000 and will continue through the duration of this grant.

Indirect costs

Ten percent of the funds have been allocated to indirect costs which are real but difficult to identify to this project because they are shared by all Center activities. Such costs are for general administrative services (payroll, purchasing, accounting), grant and contract administration, plant and operations maintenance (utilities, janitorial, building maintenance and repair), library expenses, departmental administration (administrative costs of the research and education departments) and depreciation or use allowance (building and equipment).

III. ANTICIPATED RESULTS AND DISCUSSION

Phase I will provide the Center with 2,500 sq. ft. of new space, which should provide the staff 1,500 sq. ft. of new office space. These plans include only the shell and a utility finish to the interior, but will provide immediate relief to the currently overcrowded conditions at the Center. Additional funds will be sought to finish the interior. This expansion is also timely because in 1996, the Science Center's staff is expected to expand to about 30 with Congressional funding of the Oil Spill Recovery Institute program.

Over the next five years, the implementation of new fisheries stock assessment projects on walleye pollock, Pacific herring and sockeye salmon, and expanding science education projects such as the

summer science camp and *Science of the Sound* outreach program could increase the staff above 40. The initial plans for development of a 50,000 sq. ft.. science-community center were presented to the EVOS Trustee Council in 1995. The Council requested more information on the projection of future needs for the facility, specifics of the construction, the availability of co-funding, projection of maintenance costs, and the financial plan for maintaining the larger facility. Phase II of this proposal will refine these plans into a formal proposal with a detailed funding strategy for construction and long term maintenance.

Both Phase I and II plans allow for consolidation to a central site of the Science Center's staff and programs, which are currently spread out in the community at six locations. In addition to the enhancement of education and research facilities, the plans will include a public display area for regional projects, new space to accommodate meetings and lectures, and provide the hub for a local area network and Internet access. Whereas, Phase I provides a short-term solution to facilities needs for next year, Phase II provides the facilities plan for the Science Center's needs over the next 25 years.

Prince William Sound Science Center

Estimated Facilities Expansion Budget

January 1, 1995 through June 30, 1998

	Phase 1	Phase 2	Total
Salaries			
Project Manager	10179.86	10179.86	
Project Planner	10816.00	5408.00	
Assistant	5667.20	5667.20	
subtotal salaries	26663.06	21255.06	47918.12
Supplies			
software	400.00	400.00	
publication supplies	250.00	250.00	
subtotal supplies	650.00	650.00	1300.00
Services			
A/E	15000.00	50000.00	
Piling subcontract	25000.00	0.00	
building contractor	120000.00	1500.00	
communications	850.00	850.00	
subtotal services	160850.00	52350.00	213200.00
Equipment			
personal computer	1250.00	1250.00	
printer	504.58	504.58	
subtotal equipment	1754.58	1754.58	3509.16
Travel			
Air	1250.00	1250.00	
Per Diem	1200.00	1200.00	
Car Rental	950.00	950.00	
subtotal travel	3400.00	3400.00	6800.00
Total Direct Costs	**193317.64**	**79409.64**	
Indirect Costs	19331.76	7940.96	**27272.73**
Total Costs	**212649.40**	**87350.60**	**300000.00**

EXHIBIT 2

Flow chart showing Internet network configuration

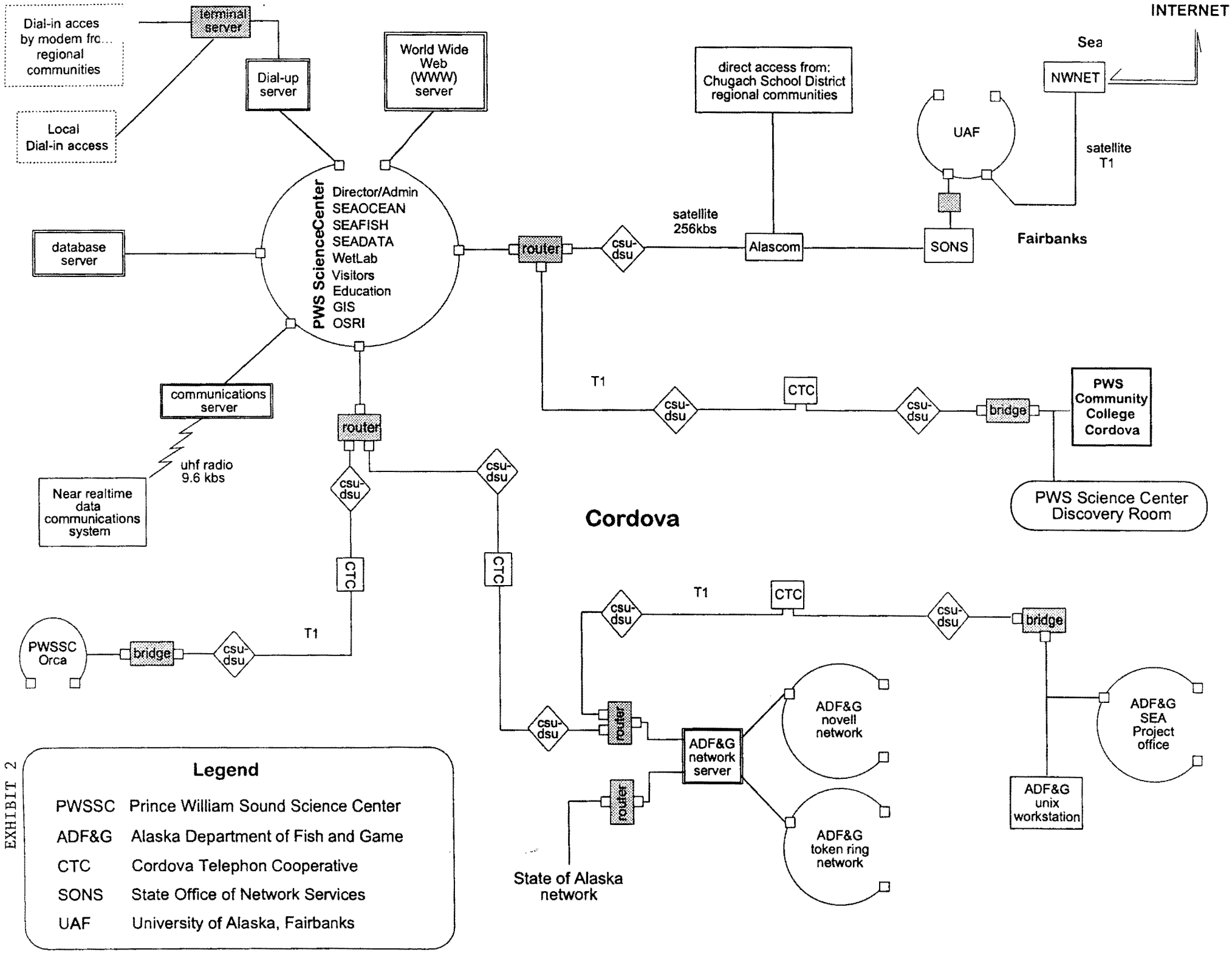

INTERNET
Dial-in acces by modem fro... regional communities
terminal server
Local Dial-in access
Dial-up server
World Wide Web (WWW) server
direct access from: Chugach School District regional communities
Sea
NWNET
UAF
satellite T1
Fairbanks
PWS ScienceCenter
Director/Admin
SEAOCEAN
SEAFISH
SEADATA
WetLab
Visitors
Education
GIS
OSRI
database server
router
csu-dsu
satellite 256kbs
Alascom
SONS
communications server
uhf radio 9.6 kbs
Near realtime data communications system
router
T1
CTC
bridge
PWS Community College Cordova
PWS Science Center Discovery Room
Cordova
PWSSC Orca
ADF&G network server
ADF&G novell network
ADF&G SEA Project office
ADF&G unix workstation
ADF&G token ring network
State of Alaska network
Legend
PWSSC Prince William Sound Science Center
ADF&G Alaska Department of Fish and Game
CTC Cordova Telephon Cooperative
SONS State Office of Network Services
UAF University of Alaska, Fairbanks

EXHIBIT 2

EXHIBIT 3

Artist's conceptual drawing of Phase II (long-term) expansion

Exhibit 3 - Potential plans for Phase II expansion

EXHIBIT 4

Engineer's inspection report on timber piling/foundation of PWS Science Center

EXHIBIT 4

Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants
1506 West 36th Avenue Anchorage, Alaska 99503 (907)561-1011 Fax (907)563-4220

March 25, 1996

DRAFT

Prince William Sound Science Center
P.O. Box 705
Cordova, Alaska 99574

Attn: Nancy Bird

Re: Timber Piling Inspection - PWS Science Center Building

Ms. Bird:

On March 6th and 7th, I made an inspection of the existing timber piling under the science center building and under a portion of the face dock which is being considered for an addition to the science center building. The inspection was made at low tide so that the piles were exposed down to the mud line. The inspection consisted of a visual assessment of each pile and the attached timber X-bracing, as well as drilled core samples from a selected piles.

We have attached to this report, a sketch of our condition survey so that you may easily see our assessment of each pile.

I have outlined below, our inspection observations as well as some general comments.

Brief History:
From discussions with several residents of Cordova, it is know that the building and the approach dock existed prior to the 1964 Alaskan Earthquake. This would make the timber piles in excess of 30 years old. The extent of pile maintenance or repairs during that period of time is not know. There are many remnants of timber piles under the building and dock which appear to have belonged to a different structure. In 1990, prior to an extensive remodel of the building, an inspection of the piling was performed by this firm. At that time, a recommendation was given to provide additional X-bracing between piles. This was accomplished by bolting treated 4x12's between the piles. The condition of these newer braces is good. By comparing the results of the 1990 inspection with the latest, we have noted that the condition of the piling has not changed significantly.

General Observations:
The building is constructed on treated timber pile-bents with a spacing of approximately 9-feet. Untreated 12x12 pile caps have been reinforced with 3x12 treated timbers bolted on each side of the cap. The floor joists of the building are untreated 4x12 at 16" o.c. Even though this material is untreated, the general condition of the pile caps and joists is good due to the covering that the building provides.

A 10-ft wide exterior deck which runs the entire width of the building at the south end has been exposed to water and weather. It is supported by an additional row of piles and an extension of the pile caps. It appears that the decking and joists have been replaced with treated wood as a result of the 1990 remodel. This deck slopes towards the building, which is causing water to come in contact with untreated joist and decking. Some of the original 2x12 decking for the building has rotted away at this juncture. A new addition over this area would solve this problem. A new level floor would have to be framed on top of the deck that would match the floor elevation of the building.

Adjacent to the exterior deck at the south side of the building, is a separate structure referred to in the last report as the face dock (see attached sketch). This dock consists of pile bents at about 17' o.c. with treated 14x14 pile caps and 4x14 stringers at 19" o.c. The pile caps and stringers are in satisfactory condition and should easily support the loads from a light framed two-story building addition. There are 4 piles along the west pile bent of the face dock that are in poor condition and should be replaced prior to any new construction. These piles are identified on the condition survey sketch.

The face dock is not attached to the building pile bents. New plans for a building addition covering portions of this face dock and the exterior deck would therefore straddle a joint in the substructure. Some work will need to be done at the pile cap level to connect the two substructures together. The diagonal bracing between piles of the face dock is light in the east-west direction. Additional diagonal bracing will have to be added as part of the addition construction.

Cost Estimate for Substructure Work:

In an earlier letter to you, Richard Ritter estimated $50,000 for repairs to the pile foundations before construction work could begin. This was a good conservative estimate on his part, without having my report in hand. We have refined this estimate below:

Item	Description	Cost
1.	Replace 5-exisitng timber piles.	$20,000
2.	Connect face dock to building substructure.	$7,000
3.	Additional X-bracing under face dock	$3,000
	Total	$30,000

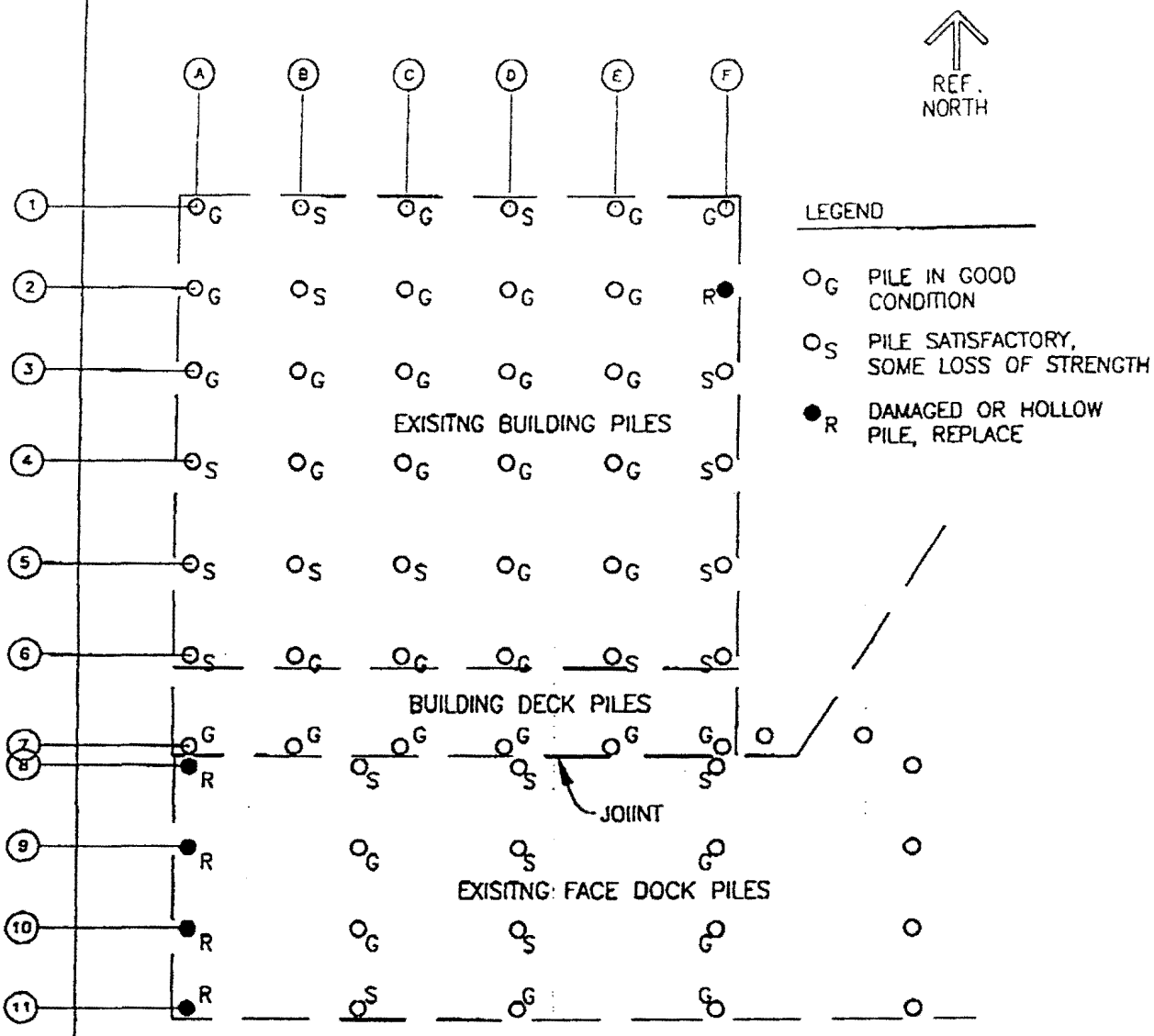
Summary:
The pile foundation under the building is in satisfactory condition. The structure beneath the face dock is adequate to support the loads of a new two-story addition with minor modifications. We recommend several damaged piles be replaced before construction of any new addition. These piles are identified on the attached sketch. We estimate the cost of this work to be $30,000.

The pile foundation is in excess of 30 years old. A good part of the useful life of the timber piling has been expended. We cannot make an accurate prediction of the remaining life of the foundation. We recommend that you base any additional investment in the building on an additional 10 to 15 years of remaining useful service. You may get more than that, with maintenance and careful inspection. You must also understand that a new foundation could be placed under the building in the future by driving steel piles around the perimeter of the building and supporting the structure with steel beams that would clear-span the entire width. This option would preserve your investment in the building even if the current foundation degenerates.

We hope this report meets your needs for planning and estimating. Please feel free to call us if you have any questions regarding this report.

Sincerely,

Charles Kenley, P.E.
Senior Engineer
Peratrovich, Nottingham & Drage, Inc.



PILING INSPECTION PLAN

Designed: _____
Drawn: _____
Checked: _____
Project No: _____

Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants
1506 West 36th Avenue,
Anchorage, Alaska 99503
(907) 561-1011

Date: _____
Scale: _____

PRINCE WILLIAM SOUND SCIENCE CENTER

sheet 1 of 1