19.04.03 (3 of 3)

93049

EXXON VALDEZ DRAFT DETAILED PROJECT DESCRIPTION

Project Title	Monitoring Recovery of Murres in the Barren Islands
Project Number	93049
Project Type	Restoration Monitoring
Lead Agency	U S Department of the Interior, Fish and Wildlife Service
Cooperating Agencies	None
Project Cost	FY93, $177 2, FY94, $22 3
Start Date 1 January 1993	**Finish Date** 31 December 1993
Project Location	Field work will be conducted on East Amatuli and Nord islands in the Barren Islands, northwestern Gulf of Alaska, and data will be analyzed at the U S Fish and Wildlife Service Alaska Maritime National Wildlife Refuge office in Homer, Alaska

Project Leader _____ Date 3/30/93

David G Roseneau, Wildlife Biologist

Project Manager G Vernon Byrd Date 3/30/93

G Vernon Byrd, Wildlife Biologist

B. Introduction

Murres *(Uria* spp *)* were heavily affected by the *T/V Exxon Valdez* oil spill About 250,000 common and thick-billed murres *(U aalge* and *U lomvia)* nested at 27 colonies in the area of the western Gulf of Alaska covered by the spill prior to the event, and about 80% of these seabirds were common murres (Sowls *et al* 1978, U S Fish and Wildlife Service 1990) When spilled oil carried by winds and currents swept through the region during April and early May, large numbers of these diving, fish-eating alcids were already aggregating in pre-breeding concentrations in waters near the nesting colonies (Piatt *et al* 1990) For example, flocks of murres were observed near the Chiswell Islands on 9 April and about 100,000 birds were found near the Barren Islands during an aerial survey on 6 April (Nysewander *et al* 1992) Most murres in these concentrations were almost certainly experienced breeders (i e , individuals older than 4-6 years, the age of first breeding—e g , Birkhead and Hudson 1977) and many died during the spill event About 75% of the 35,000 bird carcasses recovered during and shortly after the spill were murres, and initial estimates of murre losses were in the order of 100,000-300,000 individuals (Piatt *et al* 1990) A later computer modelling study using the same basic population and mortality data and more detailed information on search effort, persistence of carcasses at sea, and retention of carcasses on beaches suggested about 375,000-435,000 murres died when oil passed through the region containing the colonies (Ecological Consulting, Inc 1991) Regardless of the relative accuracy of these estimates, there is little doubt the spill caused large-scale mortality of murres, and losses of these birds, including many older age-class breeders, altered both the sizes and age structures of populations nesting within the spill zone

Fewer murres were found at the Barren Islands colonies after the oil spill (Fig 1) In 1975, about 20,000 birds were estimated nesting on Nord Island (E Bailey, pers comm), and similar broad-scale estimates made at East Amatuli Light Rock in 1977 and 1978 were about 10,000 and 20,000 birds, respectively (Manuwal and Boersma 1978, Manuwal 1980) Murres were recounted at both locations during the 1989-1992 nesting seasons (e g , Nysewander and Dippel 1990, 1991, Nysewander *et al* 1992, Dragoo *et al* 1993) During the 4 post-spill censuses, Nord Island counts were only 11,838, 12, 277, 13, 333, and 11,212 birds, respectively, and East Amatuli Light Rock counts only totaled 6912, 5865, 5529, and 5960 individuals, respectively Based on the 1 pre-spill Nord Island estimate of unknown accuracy and the mean of the 2 pre-spill East Amatuli Light Rock estimates also of unknown accuracy, these data suggest the Nord Island and East Amatuli Light Rock populations declined about 40% and 60%, respectively, between the late 1970's and the summer of 1989, and then remained relatively stable over the next 3 post-spill breeding seasons [the single historical pre-spill Nord Island estimate was significantly higher ($t_{0\ 10(1)\ 3} = 13\ 71$, $P < 0\ 0005$) than the mean of the 4 respective post-spill counts, and the mean of the 2 historical pre-spill East Amatuli Light Rock estimates was also significantly higher ($t_{0\ 10(1),4} = 3\ 80$, $P < 0\ 01$) than the mean of the 4 respective post-spill counts]

In addition to reductions in population levels, timing of breeding activities was delayed at Barren Islands murre colonies after the oil spill (Fig 2) Also, production of chicks was almost zero in both 1989 and 1990 (about 0 01 eggs or chicks per adult, Nysewander and Dippel 1990, 1991)

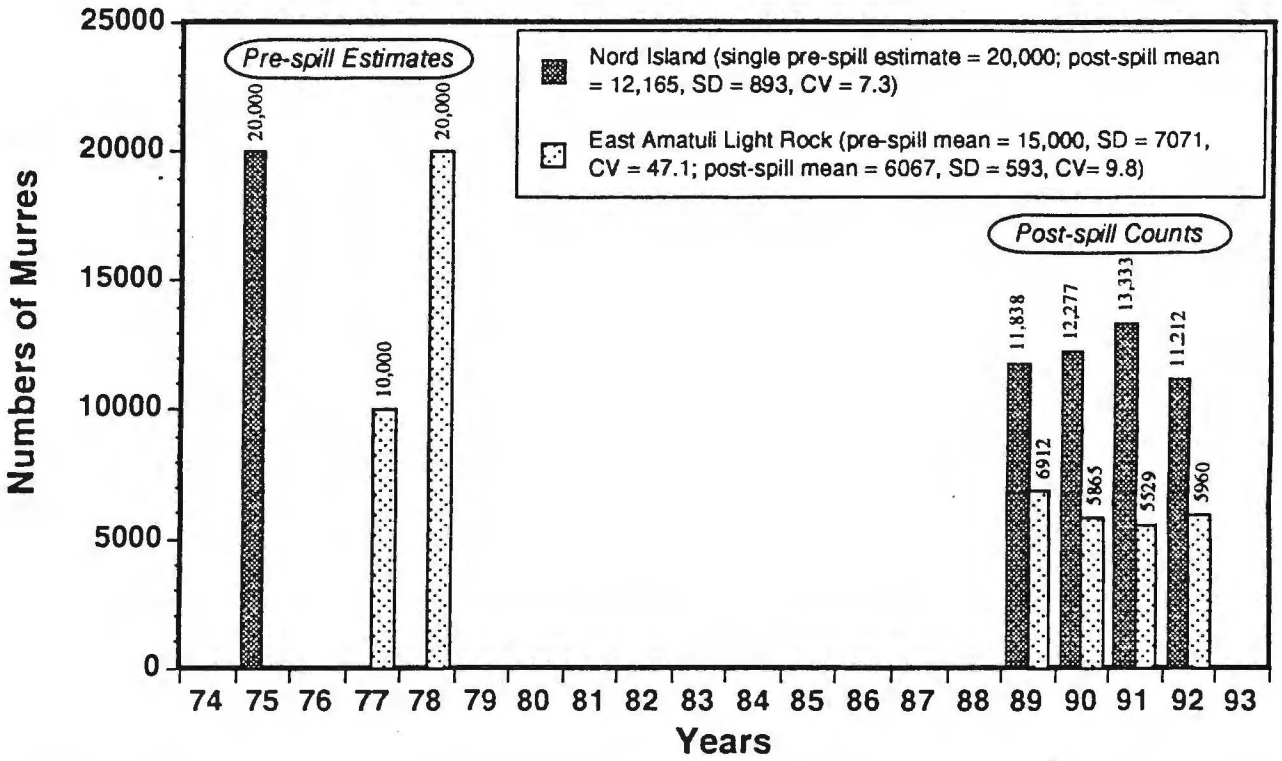

Figure 1. Pre-spill estimates and post-spill counts of murres *(Uria* spp.*)* at the Nord Island and East Amatuli Light Rock colonies in the Barren Islands, Alaska; the single Nord Island and 2 East Amatuli Light Rock pre-spill estimates were significantly higher ($P < 0.0005$ and $P < 0.01$, respectively) than the means of the 4 post-spill counts at these colonies (SD = standard deviation, CV = coefficient of variation; data from Dagroo *et al.* 1993).

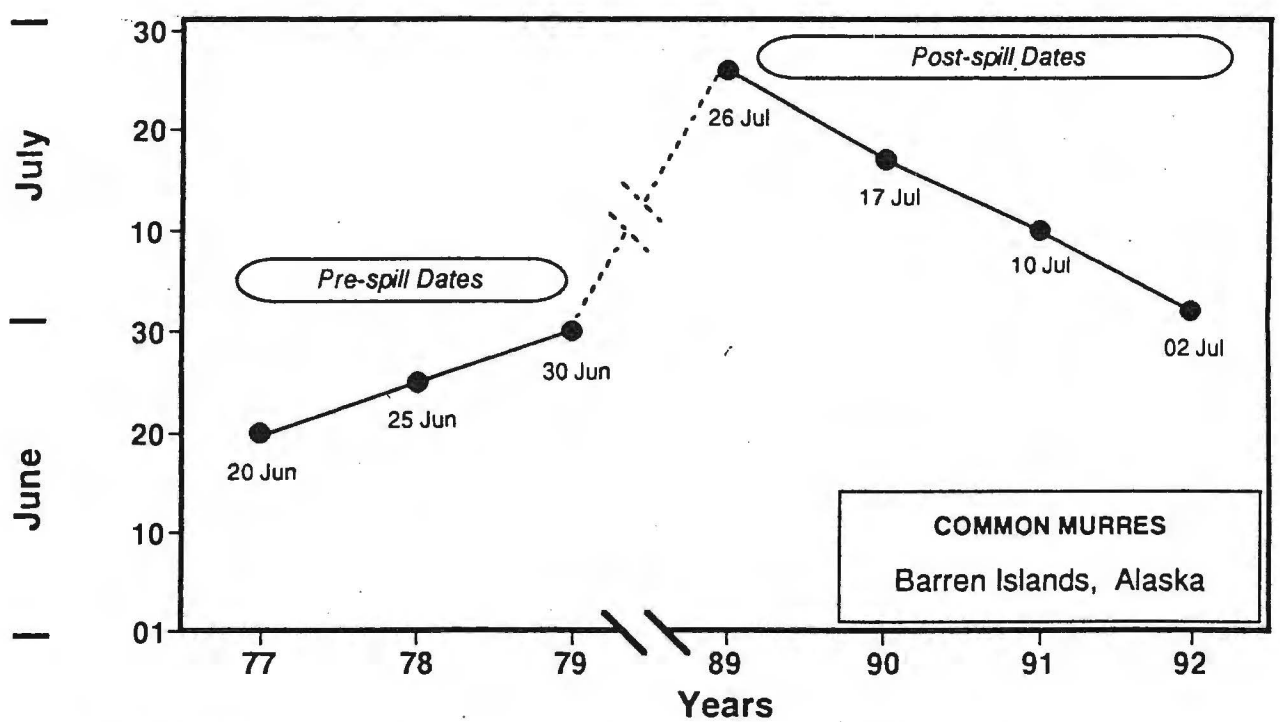

Figure 2. Dates of first egg-laying in common murres *(Uria aalge)* in the Barren Islands, Alaska before and after the *T/V Exxon Valdez* oil spill (1977 data from Manuwal and Boersma 1978; 1978 and 1979 data from Manuwal 1980; 1989, 1990, and 1991 data from Nysewander *et al.* 1992; 1992 data from Dragoo *et al.* 1993).

Data obtained on murre populations at the Barren Islands study sites during 1989-1992 indicate numbers have remained depressed since the oil spill During 1990-1992, a developing trend in first egg-laying dates suggested timing of nesting events was slowly returning to normal (Fig 2) Data obtained in 1991 and 1992 on numbers of eggs or chicks per adult also suggested productivity was beginning to recover at these colonies (0 01 in both 1989 and 1990, vs 0 13 in 1991 and 0 29-0 34 in 1992, Nysewander *et al* 1992, Dragoo *et al* 1993)

Restoration monitoring of murre colonies in the Barren Islands will furnish additional perspective on the degree of injury sustained by these important Gulf of Alaska populations It will also provide important information on rates of recovery of murre populations and supply a basis for testing hypotheses on why phenology of nesting events was delayed at these colonies after the spill (e g , abnormally late egg-laying dates) Also, data obtained during the work can be used to better predict extents of damages and injuries to nesting populations during future spills (e g , losses of birds, recovery rates)

C Project Description

This is the project description to the study plan for Project Number 93049 We plan to count murres at breeding colonies in the Barren Islands and determine the timing of nesting events and reproductive success to evaluate recovery following the *T/V Exxon Valdez* oil spill

1 Resources

The resources that will be studied during this project are common murres

2 Objectives

Monitor the recovery of murres in the Barren Islands

3 Methods

a Study Area

The study areas consist of Nord Island, East Amatuli Island, and East Amatuli Light Rock in the Barren Islands in the northwestern Gulf of Alaska (Fig 3) These locations contain all of the previously established murre population and productivity plots that have been monitored in past years

b Data Collection

All murres, with exception of chicks, will be counted on 13 population plots established in 1989 and 15 additional plots delineated since that time The counts will be made from boats and will follow standard seabird colony census protocols The counts will be conducted during the time between the completion of egg-laying and the first sea-going of chicks, the most suitable period for censusing murres at nesting colonies (e g , Birkhead and Nettleship 1980, Springer *et al* 1985, Murphy *et al* 1986) They will also be made during times of

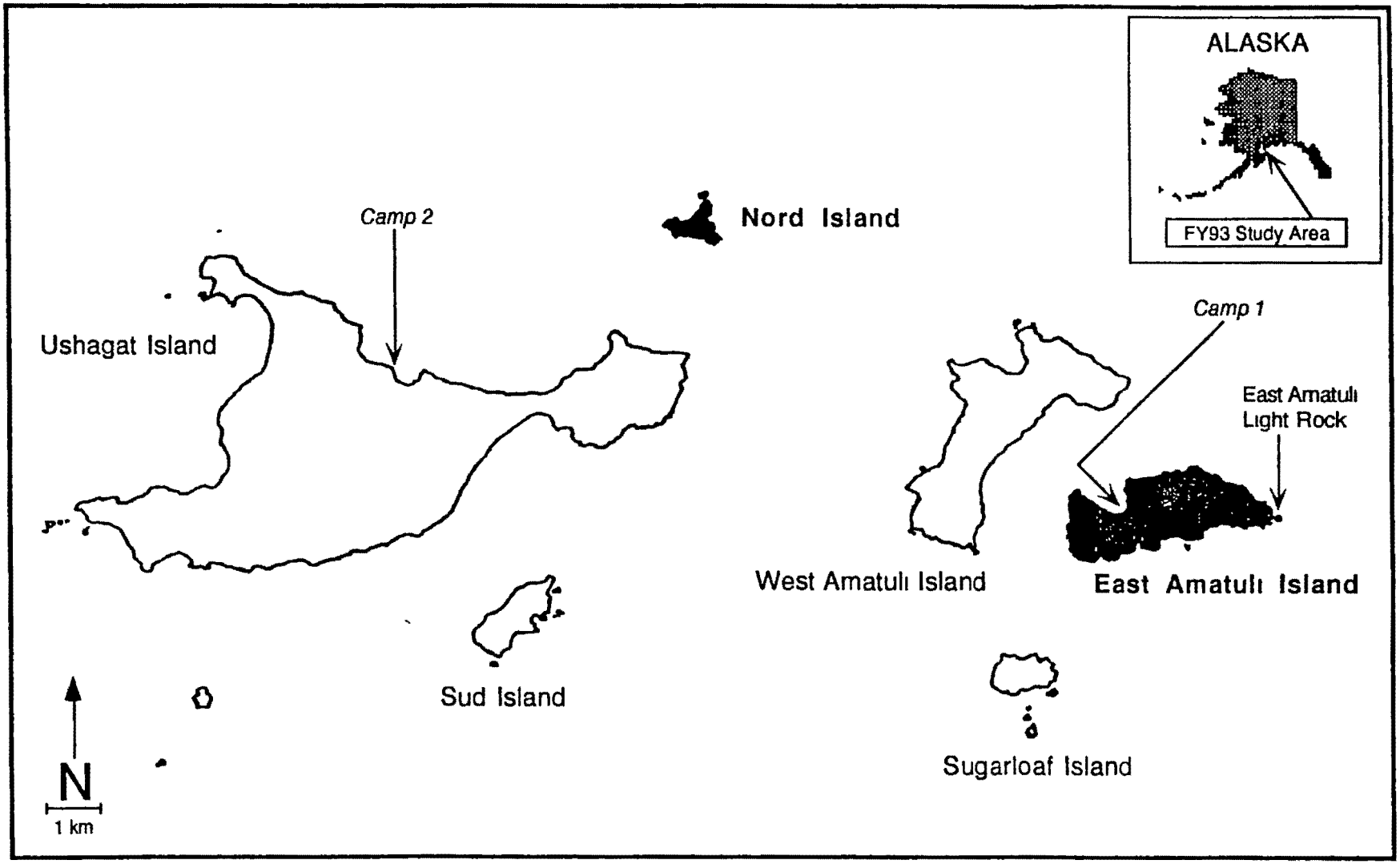

Figure 3 The Barren Islands, Alaska study area Field camps will be located on East Amatuli and Ushagat islands, and most of the field work will be conducted at previously established murre population/productivty plots on East Amatuli Light Rock and East Amatuli and Nord islands (shading indicates islands with historical murre population/productivity data)

day when attendance of murres at cliffs is the most stable (1000 hrs to 1600 hrs) The population plots will be counted simultaneously by 2 observers, and the observers' scores will be used to calculate mean values for each plot Also, all plots will be counted on at least 4 occasions during the census period to provide a set of replicate counts for statistical analysis (efforts will also be made to supplement these data with additional counts of selected plots, if time and weather permit) In addition, at least 2 counts will be made of all murres on Nord and East Amatuli islands and East Amatuli Light Rock for comparison with previous years

Information on the timing of nesting events and reproductive success of murres will be obtained at Nord and East Amatuli islands Data will be collected from 6 productivity plots previously established on Nord Island, and 5 comparable plots will be set up on East Amatuli Island and East Amatuli Light Rock, if suitable observations posts are available Regular observations of murres on plots will be used to estimate average laying, hatching, and fledging dates, as well as hatching and fledging success Observations will begin before first eggs are laid and will continue until chicks leave nest sites Nest sites will be observed every 3 days, weather permitting Also, 3 time-lapse cameras set to record the hourly status of up to 15 nest sites each will be installed at 3 of the historical productivity plots Information from the video tapes of these smaller subsamples of nest sites will be used to supplement observational data on nesting phenology and reproductive success Although detailed data on reproductive success will be obtained from the historical plots, it will also be necessary to establish and check at least 10 more small plots containing 10-15 nest sites each during the late chick-rearing period to obtain additional information on numbers of chicks fledged per adult These supplemental data will allow comparisons to be made with information collected at other Alaskan colonies in previous years

c Data Analysis

Murre count data will be used to test the null hypothesis that there is no evidence populations have increased in the Barren Islands since reductions occurred following the 1989 oil spill The sample unit will be the sum of counts of murres on all plots on a given day ANOVA will be used to determine if counts differ among years Multiple comparisons will also be made if the null hypothesis is rejected Regression analysis will be conducted to evaluate trends in numbers over the 5-year period since the spill

Measurements of reproductive success and timing of nesting events will be compared with previous information from the Barren Islands and other colonies These data will also be used to detect and monitor trends in productivity and phenological parameters The sample unit for timing of nesting events and reproductive success will be a cluster of nests (i e , the nests on a plot) Season-long observations of each sample unit are required to record events of interest (e g , first, last, and mean laying, hatching, and fledging dates, numbers of chicks hatched and fledged per adult) Summary statistics will be calculated and compared with a series of data obtained at other colonies in the Gulf of Alaska before the spill or outside the spill area to test the null hypotheses that the 1993 Barren Islands data are the same as data from populations not affected by the spill Historical data on timing of nesting events and reproductive success of

murres in the Barren Islands are too sparse to permit rigorous interannual comparisons However, regression analysis will be employed to test for trends between 1989 and 1993 in 2 parameters, first egg dates (see Fig 2) and numbers of chicks produced per adult

4 Alternatives

There are no other alternatives available to conduct the monitoring work and collect the types of information needed for comparisons with previous years Methodologies used for censusing populations and measuring productivity are designed to detect long-term trends and follow standard procedures and protocols developed by seabird biologists working at large colonies during the past 10 years

5 Location

Restoration monitoring will be carried out in the Barren Islands, located about 75 km south-southwest of Homer, Alaska between the Kenai Peninsula and the Kodiak Archipelago Specific study sites are located on Nord and East Amatuli islands and East Amatuli Light Rock (Fig 3)

6 Benefits

Monitoring is essential to assess the recovery of murre populations in the Barren Islands The underlying causes of the abnormal nesting behavior observed after the oil spill (e g , markedly late egg-laying dates) are not yet understood Monitoring data will provide a basis for testing various hypotheses about why phenological events were delayed after the spill Also, a better understanding of impacts of the oil spill on murres will help minimize damage to nesting colonies during future spills by providing information that can be used to direct clean up efforts more appropriately Moreover, documentation of responses of murres in the aftermath of the oil spill will provide information that can be used to better predict and measure effects of future events on nesting populations (e g , losses of birds, recovery rates)

7 Technical Support

No technical support will be required

8 Contracts

A ship will be chartered to provide a platform for the population counts in the Barren Islands It will be procured through standard competitive bid processes used by the Department of Interior

9 Mitigation Measures

No mitigation will be required because the project qualifies for a NEPA exemption

10 Literature Cited

Birkhead, T R and P J Hudson 1977 Population parameters for the common guillemot *Uria aalge* Ornis Scand 8 145-154

_____ and D N Nettleship 1980 Census methods for murres, *Uria* species a unified approach Can Wildl Serv Occas Pap No 43

Ecological Consulting, Inc 1991 Assessment of direct seabird mortality in Prince William Sound and the western Gulf of Alaska resulting from the *Exxon Valdez* oil spill Unpubl rept by Ecol Consulting, Inc , Portland, Oregon 154 pp

Manuwal, D A 1980 Breeding biology of seabirds on the Barren Islands, Alaska U S Fish and Wildl Serv , Off Biol Serv , Anchorage, Alas Unpubl Rep 195 pp

_____ and D Boersma 1978 Dynamics of marine bird populations on the Barren Islands, Alaska Pp 575-679 *in* Environ Assess Alaska Continental Shelf, Annu Rept Principal Invest , Vol 3 Natl Oceanographic Atmos Admin , Environ Res Lab, Boulder, Colorado

Murphy, E C , A M Springer, and D G Roseneau 1986 Population status of common guillemots at an Alaskan colony results and simulations Ibis 128 348-363

Nysewander, D , and C Dippel 1990 Population surveys of seabird nesting colonies in Prince William Sound, the outside coast of the Kenai Peninsula, Barren Islands, and other nearby colonies, with emphasis on changes of numbers and reproduction of murres Bird Study No 3 (progress report) U S Fish and Wildl Serv , Homer, Alaska Unpubl Rep 48 pp

_____ and _____ 1991 Population surveys of seabird nesting colonies in Prince William Sound, the outside coast of the Kenai Peninsula, Barren Islands, and other nearby colonies, with emphasis on changes in numbers and reproduction of murres Bird Study No 3 (progress report) U S Fish and Wildl Serv , Homer, Alaska Unpubl Rep 70 pp

_____, _____, G V Byrd, and E P Knutson 1992 Effects of the *T/V Exxon Valdez* oil spill on murres a perspective from observations at breeding colonies Draft Final Report, Bird Study No 3 U S Fish and Wildl Serv , Homer, Alaska

_____, _____, W Butler, M Kendziorek, and D R Nysewander 1990 Immediate impact of the "*Exxon Valdez*" oil spill on marine birds Auk 107 387-397

Springer, A M , E C Murphy, D G Roseneau, and M I Springer 1985 Population status, reproductive ecology and trophic relationships of seabirds in northwestern Alaska U S Dept Comm , NOAA OCSEAP, Final Rept , Vol 30, pp 127-242

Sowls, A L , S A Hatch, and C J Lensink 1978 Catalog of Alaskan seabird colonies U S Fish and Wildl Serv , Biol Services Prog FWS/OBS 78/78, Anchorage, Alaska 153 pp

U S Fish and Wildlife Service 1990 Catalog of Alaskan seabird colonies -- computer archives U S Fish and Wildl Serv , Migratory Bird Management, Anchorage, Alaska

D. Schedule and Planning

1 1993 Milestones

Mar	Complete study plan, advertise for vessel charter, recruit for seasonal employees
Apr	Refine study plan, purchase field equipment, interview and select seasonal employees
May-Jun	Organize and pack field supplies and equipment, train seasonal employees
Jun-Sep	Occupy field camps at Ushagat and East Amatuli islands to obtain data on timing of nesting events and reproductive success (and if time and weather permit count selected population plots at East Amatuli Light Rock and Nord Island)
Jul-Aug	Conduct primary population census work by counting all previously established boat-based population plots at East Amatuli Light Rock and Nord Island at least 4 times on separate occasions, and counting all nesting areas on East Amatuli Island at least 2 times on 2 of these occasions (this work will be conducted via inflatable boats based on the contract vessel)
Oct	Inventory and store equipment, summarize data, archive data and plot photographs
Nov-Dec	Analyze data and write report Draft report submitted to OOS November 15, 1993, draft report submitted for peer review December 15, 1993, final report completed December 31, 1993

2 Project Personnel

G Vernon Byrd	Project Manager supervising planning and training, will also assist during population counts, data analyses, and report writing
David G Roseneau	Project Leader in charge of all aspects of field work, including logistics, planning, training of field crews, and data collections, also primary analyzer of data and principal report writer

Ushagat Island

Camp Leader 1	Responsible for data collection on timing of nesting events and productivity of murres on Nord Island
Field Tech 1	Assists with data collection on Nord Island

East Amatuli Island

Camp Leader 2	Responsible for data collection on timing of nesting events and productivity of murres on East Amatuli Island and East Amatuli Light Rock
Field Tech 2	Assists with data collection on East Amatuli Island and East Amatuli Light Rock
Field Tech 3	Assists with data collection on East Amatuli Island and East Amatuli Light Rock

3 Logistics

a Field camps

Field camps are required at Ushagat and East Amatuli islands to support crews collecting data on timing of nesting events and reproductive success

b Vessel Support

A charter vessel is needed to support the field camps and serve as living quarters and a staging/viewing platform during the population census work (2 outboard motor-equipped inflatable rafts will be deployed from the vessel on an as-needed basis to count birds on historical sea-based population plots abutting shallow waters)

c Helicopter Support

Up to 10 helicopter trips may be required for transporting personnel and some supplies between Homer and the Barren Islands (the helicopters will be chartered on an as-needed basis)

E Environmental Compliance / Permit / Coordination Status

This study relies on observation from boats or from observation points removed from nesting ledges and is a non-intrusive study Based on a review of CEQ regulation 40 CFR 1500-1508, this study has been determined to be categorically exempt from the requirements of NEPA, in accordance with 40 CFR 1508 4

F Performance Monitoring

1 Backup strategy

In the event either the program manager (G V Byrd) or the project leader (D G Roseneau) leaves before the project is completed, the remaining member of the study team will assume the other person's duties until a replacement can be hired (hiring would be done on an ASAP basis)

2 Quality assurance and control plan

Product quality will be ensured by

a Using experienced personnel to collect and analyze data (both camp leaders tentatively selected for the project have conducted the same type of work on seabirds in the Barren Islands in previous years, and the project leader is familiar with the study sites and has extensive experience conducting similar studies and analyzing similar types of data)

b Training other field team members in proper procedures, including practicing census techniques at a murre colony in Kachemak Bay before going to the study sites

c Following accepted, standard procedures and protocols when making counts of birds (e g , conducting censuses at correct times during the breeding season, recounting plots if observer scores vary by more than 10%, making replicate counts to allow statistical comparisons to be made)

d Checking to see if data are being recorded and entered correctly on a regular basis both in the field and in office

3 List of Products

A final report on the 1993 monitoring study that will compare these data with historical data from the Barren Islands and with information from other Alaskan murre colonies

G Personnel Qualifications

Both the project leader, David G Roseneau, and the project manager, G Vernon Byrd, are well qualified to undertake the proposed study Brief resumes describing the qualifications of these key personnel are provided below

1 Project Leader - 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 (thesis research was on gyrfalcons, *Falco rusticolus*), and he joined the U S Fish and Wildlife Service in January 1993 He has been a consulting biologist for the past 20 years, and has conducted and managed research on marine birds, raptors, and large mammals in Alaska and Canada for both government agencies and private-sector clients Mr Roseneau began working on seabirds in the mid-1970's, and he has been involved in several large-scale murre *(Uria* spp *)* population monitoring projects since that time During 1976-1983, as co-principal investigator of NOAA/OCSEAP Research Unit 460, he conducted baseline and 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 research at Bluff in Norton Sound In 1984-1986, he was involved in several follow-up studies of murres and kittiwakes in the northeastern Chukchi Sea, and during 1987-1988 and 1991-1992, he helped conduct additional monitoring work on murres and kittiwakes at the capes Lisburne and Thompson and Chamisso-Puffin island colonies 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 spent over 2800 hrs operating inflatable rafts and other outboard-powered boats in the Bering, Chukchi, and Beaufort seas and on various Alaskan rivers He has also spent several hundred hours operating rafts, skiffs, and larger, more powerful vessels (e g 25 ft, 400 hp HydroSport) in Kachemak Bay, Prince William Sound, Kenai Peninsula coastal waters, and waters surrounding the Barren Islands [Mr Roseneau spent 6 weeks on East Amatuli Island in 1965 and discovered the fork-tailed storm-petrel *(Oceanodroma furcata)* colony there—see Isleib, P and B Kessel 1973 Birds of the north gulf coast - Prince William Sound region, Alaska Biol Paper No 14 Univ of Alaska Press] During his career, Mr Roseneau has authored and co-authored over 65 reports and publications, including 22 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

Murphy, E C , D G Roseneau, and P J Bente 1984 An inland nest record for the Kittlitz's murrelet Condor 86 218

Springer, A M , D G Roseneau, E C Murphy, and M I Springer 1984 Environmental controls of marine food webs food habits of seabirds in the eastern Chukchi Sea Can J Fish Aquat Sci 41 1202-1215

2 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 (with an emphasis in applied statistics) from the University of Idaho in 1989 Thesis research was on kittiwakes *(Rissa* spp *)* and murres *(Uria spp)* in the Pribilof Islands 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 have centered around monitoring long-term trends in seabird populations, including numbers of birds and reproductive performance at colonies He has worked on murres at colonies in the Aleutian Islands, the Bering Sea, the Chukchi

Sea, and western Gulf of Alaska Mr Byrd was a coauthor on the Final Report covering the assessment of damage to murres from the *T/V Exxon Valdez* oil spill He has written over 40 scientific papers and 50 U S Fish and Wildlife Service reports on field studies, and he has presented over 15 papers on seabirds at scientific meetings Mr Byrd currently serves as supervisory wildlife biologist at the Alaska Maritime National Wildlife Refuge, the premier area for seabirds in the national public land system

Selected 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

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

Day, R H and G V Byrd 1989 Food habits of the whiskered auklet at Buldir Island, Alaska Condor 91 65-72

Byrd, G V , J L Sincock, T C Telfer, D I Moriarty, and B G Brady 1984 A cross fostering experiment with Newell's race of Manx shearwater J Wildl Manage 48 163-168

Byrd, G V , D I Moriarty, and B G Brady 1983 Breeding biology of wedge-tailed shearwaters at Kilauea Point Hawaii Condor 85 292-296

H Budget

Cost breakdowns for the project are attached (see Forms 2A and 2B) The total cost of the FY93 project ($177 2) has not changed since the initial proposal However, the initial FY93 proposal (see 1993 Draft Work Plan) was divided into 2 subprojects that included both a monitoring study (as described here) and experimental murre decoy study that was not funded Because the monitoring work was partially dependent on some items in the murre decoy study, some funds were reallocated within and between budget categories (e g , contractual vs personnel) Also, initial budget categories were carefully reviewed by the new project leader, and when detailed cost breakdowns were made, it was determined that certain reallocations would improve the overall cost-effectiveness and safety of the proposed monitoring work For example, boating in waters surrounding the study sites requires a minimum of 2 people per boat and climbing to many of the productivity plots also requires that a "buddy system" be used, and in many of these cases, experienced personnel are needed to ensure basic safety requirements (i e , as opposed to volunteer staff that are typically less experienced) Also in some cases, some types of transportation to and from the study area were found to be more cost-effective than others (e g , helicopters vs contract vessels)

The cost shown for FY94 ($22 3) is the amount needed to close out all work started in FY93 The close out work consists of most data analyses and report writing tasks

EXXON VALDEZ TRUSTEE COUNCIL

Project Description This project is designed to monitor the recovery of murres *(Una* spp *)* at colonies in the Gulf of Alaska affected by the *T/V Exxon Valdez* oil spill In 1993, research will focus on populations nesting in the Barren Islands These populations will also be studied during 1994-1996 However, in 1996, the last year of work, numbers and productivity data will also be collected at the Ugaiushak Island and Puale Bay colonies on the Alaska Peninsula, and at colonies on the Triplet Islands between Kodiak and Afognak islands, the Chiswell Islands near Aialik Bay, and the Semidi Islands between Kodiak and the Shumagin Islands

Budget Category	Approved 1-Oct-92 28-Feb-93	Proposed* 1-Mar-93 30-Sep-93	Total FY 93	** FY 94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond
Personnel	$0 0	$80 0	$80 0	$19 4				
Travel	$0 0	$13 6	$13 6					
Contractual	$0 0	$55 5	$55 5					
Commodities	$0 0	$8 2	$8 2					
Equipment	$0 0	$4 0	$4 0					
Capital Outlay	$0 0	$0 0	$0 0					
Subtotal	$0 0	$161 3	$161 3	$19 4	$0 0	$0 0	$0 0	$0 0
General Administration	$0 0	$15 9	$15 9	$2 9				
Project Total	$0 0	$177 2	$177 2	$22 3	$0 0	$0 0	$0 0	$0 0
Full-time Equivalents (FTE)	0 0	2 4	2 4	0 7				
					Amounts are shown in thousands of dollars			

Budget Year Proposed Personnel

Position	Months Budgeted	Cost	Comments
Project Leader GS11	9 0	$34 3	Project Leader for all of Project 93049 studies
Biological Science Technician GS6 (2)	10 0	$20 8	***GS6 Bio-techs will function as field camp leaders
Biological Science Technician GS5 (2)	8 0	$14 9	***GS5 Bio-techs will assist GS6 Bio-techs during field studies
Wildlife Biologist GS12	1 0	$4 0	
Program Manager, Anchorage	1 2	$6 0	

*FY 93 is a transition year from the previously used oil fiscal year to the federal fiscal year This project also includes proposed funding for January and February, 1993

**The total shown in FY94 is the amount needed to close out work started in FY93 (close out work consists of archiving and analyzing data and report writing)

***Bio-tech time was increased because initial estimates were integrated with a jointly proposed murre decoy study (however, this change and other adjustments to initially proposed budgetary categories did not alter the FY93 project total)

EXXON VALDEZ TRUSTEE COUNCIL

		Proposed
Travel	Ten (10) helicopter trips @ $0 87K/trip to transport personnel to and from field camps in the Barren Islands (using helicopters on an as-needed charter basis in more cost effective than using a vessel)	$8 7
	Other travel, including trips to Anchorage that may be necessary to attend meetings	$2 0
	Per diem for field crews @ 3 dollars/day/person, & for trips to Anchorage to attend meetings	$2 9
Contractual	SCA Volunteer (1) @ $3 5K for 3 months (includes $0 5K to cover potential increases in air fares)	$3 5
	Vessel charter to support population census work and resupply field camps, 26 days @ $2 0K/day	$52 0
Commodities	Food, fuel, and camping supplies for 2 remote field camps	$8 2
Equipment	Check & upgrade safety & survival equipment (e g , test 10 survival suits, buy batteries for EPIRBS & suit strobe lights), check, repair, & tune radio equipment (4 hand-helds & 2 base stations) , check, repair & upgrade 8 outboard engines (buy carburetors to convert two 9 9 hp to15 hp), 2 inflatable rafts, & time-lapse video cameras (4 units), purchase 2 fuel pumps,1 antenna for radio,1 Honda generator, 2 kerosene heaters, 2 battery chargers, & additional safety and survival gear (2 flare kits, 3 survival suit strobes, 2 sea anchors)	$4 0

93051 Part A

DETAILED RESTORATION PROJECT DESCRIPTION

Project Title	Information Needs for Habitat Protection
Sub-Project Title	Stream Habitat Assessment
Project ID No	Restoration Project No 93051 Part A
Project Type	Habitat Protection and Acquisition - Survey
Project Personnel	Mark N Kuwada, Project Manager
	Kathrin Sundet, Project Leader
Lead Agency	Alaska Department of Fish and Game, Habitat and Restoration Division
Cost of Project	$335 7
Project Start-up and Completion Dates	3/93 - 10/94
Geographic Area of Project	Prince William Sound/Lower Kenai Peninsula

Project Manager _____

Project Leader _____

Regional Supervisor _____

Administrative Assistant _____

Restoration Program Manager _____

B Introduction

Coastal streams and associated riparian areas are critical habitat for a number of species that were injured by the Exxon Valdez oil spill The ADF&G Stream Habitat Assessment (SHA) project is designed to document habitats that are of potential importance to salmon and Harlequin ducks These species were injured as a result of the Exxon Valdez oil spill, and both are associated to some extent with stream environments Salmon are anadromous species of fish that utilize freshwater environments for important life functions such as spawning, rearing and overwintering Harlequin ducks use freshwater streams for nesting and feeding activities

In 1989, pink salmon egg mortality in oiled streams averaged about 15 percent, compared to about 9 percent in unoiled streams In 1991, there was a 40 to 50 percent egg mortality in oiled streams, and about an 18 percent mortality in unoiled streams Since 1989, Harlequin ducks have exhibited an almost complete reproductive failure in the Prince William Sound oil spill area, and birds appear to be in poor physical condition It is possible that disturbance from the cleanup and ingestion of petroleum contaminated food items could have resulted in additional impacts on Harlequin ducks

Certain development activities, particularly clearcut logging of mature forests, represent a threat to the recovery of injured fish and wildlife resources This threat is expressed as an incremental loss of habitat that impedes or suppresses the recovery of injured species populations Surveys are intended to focus on private lands that are scheduled for logging or other types of major habitat alterations so that habitat protection measures, such as land acquisition, can be evaluated Unless these types of restoration actions are taken in 1993, opportunities may be lost to identify and protect key habitats

C Project Description

Resources and/or Services

The injured resources that are targeted by this study include anadromous fish and Harlequin ducks

Objectives

The Stream Habitat Assessment (SHA) project is intended to provide basic habitat information for evaluating candidate lands under the Habitat Protection process of the oil spill restoration program Candidate lands are nominated by landowners, agencies, and the general public for additional habitat protection or acquisition using Exxon Valdez settlement funds At a minimum, candidate lands must demonstrate that (1) there is a willing seller of the parcel or property right, (2) the parcel contains key habitats that are linked to, replace, provide the equivalent of, or substitute for injured resources or services, (3) the parcel or property rights are available at or below fair market value, and (4) an injured or equivalent resource or service will benefit from protection in addition to that provided by the owner and applicable laws and regulations

The SHA project documents (1) the number and type of anadromous fish streams that occur on potential candidate lands, (2) the location of these streams, (3) the species of anadromous fish that occur in each stream and the upper limits of their distribution, (4) the physical and vegetative characteristics that constitute existing fish habitat, and (5) barriers that impede upstream fish migration This will provide an inventory of anadromous fish stream resources that can be used to compare and rank candidate lands Information obtained by this project may additionally assist in defining habitat protection measures on candidate lands, and facilitating negotiations between the government and private landowners Enhancement opportunities that could potentially increase available fish habitat are also identified The only alternative to this study is to proceed with habitat protection efforts using existing sources of information to evaluate various candidate lands This may result in an evaluation process that favors certain lands over others on the basis of available information rather than a consistent survey of injured species habitats A lack of detailed resource information may also restrict options for selecting the appropriate protection tool(s) for achieving restoration objectives

Methods

In order to be responsive to the needs of the restoration program, study site selection will be influenced by several factors (1) a prioritized list of private lands in the oil spill area that are scheduled for development within the next five years, (2) policy decisions by the Trustees that focus on certain lands for potential acquisition or some other protective strategy, (3) the approval of land owners to access lands for purposes of conducting surveys, (4) existing Anadromous Waters Catalog information that depicts a potential for expanding anadromous fish resources in candidate areas, and (5) integration with other upland habitat assessment studies

Once potential sites are selected, one or two reconnaissance visits will be conducted in each area to assess general hydrologic, topographic and vegetative features This information will be used to determine the overall approach to conducting a formal survey in the area Considerations to be addressed during initial site reconnaissance are access, vegetative cover, helicopter logistics, obvious barriers to upstream fish migration, and estimated time to complete the survey

Surveys will employ standard, established techniques for recording habitat information and establishing the presence of anadromous fish Streams will be surveyed after spawning has begun during the months of August and September A field crew will walk stream channels and record site locations and habitat characteristics using a Global Positioning System (GPS) Streams will be segmented into homogeneous reaches in order to accurately describe physical features Habitat characteristics that will be recorded include substrate, gradient, stream width, bank incision, riparian vegetation, and instream debris In addition, a backpack electrofisher will be used to sample for fish presence All wildlife observations will be recorded

The information generated during a stream survey will be downloaded to a laptop computer from handheld GPS receivers and post-processed to provide accurate locational and attribute data The products of this effort are intended to be integrated as one data

layer in a comprehensive Geographic Information System (GIS) The Habitat Protection GIS will incorporate many other types of information including hydrography, land ownership, wildlife habitat and vegetation, and will be used to assist in the analysis and identification of key habitats throughout the spill-affected area

Alternatives

There are no alternatives that will provide a more conclusive inventory of anadromous fish streams and anadromous fish distribution Channel typing procedures have the potential to locate anadromous fish streams based upon the physical and vegetative characteristics of a study area, but cannot substitute for actual observations of fish

Location

The SHA has already surveyed most available private lands on Afognak Island during 1992 SHA surveys are planned to occur in Prince William Sound, and possibly along the outer Kenai Peninsula, during 1993

Benefits

The benefit of surveying anadromous streams and expanding known fish distribution has already been described in terms of facilitating informed habitat protection and land acquisition decisions However, another benefit of the study is that anadromous fish streams are automatically protected from logging under provisions of the state Forest Practices Act A 66-foot wide stream buffer is applied to anadromous fish streams that are five feet or more in width, while a 25-foot buffer is applied to streams that are less than five feet in width This means that a minimum level of protection is conferred just by identifying new fisheries habitat Therefore, all fish and wildlife species that use stream and riparian habitats will benefit Previously unidentified streams will also be added to the ADF&G Catalog and Atlas of Anadromous Waters and be protected under the provisions of Alaska Statute Title 16

Technical Support

The technical support needed to accomplish the project is considered minimal Project personnel have been trained in the use of survey equipment and have additional expertise in the implementation of GPS and GIS technologies

Contracts

Service contracts will be needed for helicopter support and lodging Contracts will be awarded on the basis of price and availability, consistent with State of Alaska contracting procedures In addition, a contract for GPS base station data will be needed Sole source contracts are likely to be required for lodging at a remote logging camp within the study area or village site, and for acquiring GPS base station data from the Surveyor's Exchange in Anchorage

Mitigation

All helicopter fuel will be cached in accordance with State of Alaska Department of Environmental Conservation regulations All surveys will be conducted to avoid any impact on the surrounding landscape

Literature Cited

None

D Schedules and Planning

Activities scheduled and budgeted for in this budget period

March 1, 1993	Begin candidate land selection process Obtain aerial photographs and select potential survey areas Request access approvals from private landowners
April 30, 1993	Candidate land selection process completed Access approvals obtained Arrange logistics, including helicopter charter and field lodging Coordinate with other upland restoration projects
June 1, 1994	Training for field personnel Equipment purchases and repair Specific survey planning
July 30, 1993	Stream surveys begin At biweekly intervals, data will be submitted to the Anchorage regional office and processed Surveys will occur continuously for the first 30 days, after which a 7 day break will occur Surveys will then resume and continue until the end of the survey period
September 30, 1993	End of data collection

Activities scheduled and budgeted for outside of this budget period

November 15, 1993	Data QA/QC has been completed for all streams surveyed during the season Generation of final maps and data tables begins
December 15, 1993	Maps and tables undergo final review Report production begins
January 30, 1994	Report and data submission deadline

Field staff will be deactivated on November 15, 1993 The Project Manager and Project Leader will continue through March 31, 1994 Ongoing responsibilities include

1) coordination with the Habitat Protection Working Group (HPWG) on land acquisition and protection strategies, 2) coordination with private land owners on land development planning, 3) coordination with other restoration projects on survey results, and 4) administrative duties as required

E Environmental Compliance/Permit/Coordination Status

The study will comply with all applicable environmental regulations, including regulations relating to fuel storage, transportation of hazardous materials, and the collection of anadromous fish for purposes of research In addition, the approval of landowners will be obtained before accessing any private lands

F Performance Monitoring

Coordination and overall project supervision will occur in Anchorage The Project Manager will attend all necessary meetings, participate in the candidate land selection and survey approval process, conduct site reconnaissance surveys and participate in stream habitat surveys In addition, the Project Manager will be responsible for all administrative duties including budgeting, logistics, and training The Project Leader will oversee all data-related functions, including GPS post-processing, database development, GIS mapping and report generation The Project Leader will also serve as the primary field supervisor The remainder of the field crew, including two biologists and a technician, will be responsible for acquiring stream habitat data and performing various post-survey quality assurance duties

Data output will consist of color coded maps and overlays depicting stream sections and their associated habitat parameters, annotated incidental species catches, and documented upper limits of anadromous species Tables of this information with additional references to wildlife observations, sampling conditions and location information will be generated, accompanied by a summary report Digital data and Autocad transfer files will be available upon request An accompanying report will describe survey methodology and results in narrative form

G Personnel Qualifications

Project Manager Mark N Kuwada Habitat Biologist with the Alaska Department of Fish and Game for 12 years Extensive experience in mitigating major project impacts and restoring damaged habitats Susitna Hydroelectric Project, Bradley Lake Hydroelectric Project, Diamond Chuitna Coal Project ADF&G Response Coordinator, Exxon Valdez oil spill

Project Leader	Kathrin Sundet Habitat Biologist and Fisheries Biologist with the Alaska Department of Fish and Game for 7 years Data management for Kinnetic Labs, America North Inc , and environmental consulting companies in California for 4 years Experience in management of biological databases, GIS, fish habitat evaluations and various fisheries related field projects Susitna Hydroelectric Project and Exxon Valdez oil spill

H Budget

Personnel	$182 8
Travel	15 0
Contractual	101 0
Commodities	1 0
Equipment	1 5
Capital Outlay	0 0
Subtotal	$301 3
General Administration	34 4
Project Total	$335 7

Project Description Stream habitat assessment study surveying anadromous fish distribution and documenting the total number and extent of anadromous fish streams on candidate lands The number for this project in 1992 was R 47

Budget Category	Approved 1-Oct-92 28-Feb-93	Proposed* 1-Mar-93 30-Sep-93	Total FY 93	FY94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond
Personnel	$88 8	$182 8	$271 6	$79 8				
Travel	$3 2	$15 0	$18 2	$0 0				
Contractual	$40 2	$101 0	$141 2	$3 5				
Commodities	$0 0	$1 0	$1 0	$0 0				
Equipment	$0 0	$1 5	$1 5	$0 0				
Capital Outlay	$0 0	$0 0	$0 0	$0 0				
Sub-total	$132 2	$301 3	$433 5	$83 3	$0 0	$0 0	$0 0	$0 0
General Administration	$16 1	$34 4	$47 9	$12 0				
Project Total	$148 3	$335 7	$481 4	$95 3				
Full-time Equivalents (FTE)	2 1	3 6	5 7					

Amounts are shown in thousands of dollars

Budget Year Proposed Personnel

Position	Months Budgeted	Cost	Comment
Principal Investigator	7 0	$41 0	
Fisheries Biologist I	5 0	$24 6	* FY 93 is a transition year from the previously used oil fiscal year to the federal fiscal year
Fisheries Technician III	5 0	$16 8	
Habitat Biologist	5 0	$20 0	
Project Leader	7 0	$31 7	
Clerk Typist III	7 0	$20 6	
Database Manager	7 0	$13 1	
OSIAR Management	2 0	$15 0	

Project Number 93051 Part A
Project Title Information Needs for Habitat Protection
Sub-Project Stream Habitat Assessment
Agency AK Dept of Fish & Game

FORM 3A SUB-PROJECT DETAIL

		Proposed
Travel	Airfare and per diem	$15 0
Contractual	Helicopter for 45 days, phone, fax, video processing, and xeroxing	$101 0
Commodities	Office and field supplies, survey supplies, GPS parts, computer disks and paper	$1 0
Equipment	GIS software and computer equipment	$1 5

93051 Part B

DRAFT Detailed Project Description - DeVelice and Hubbard

Title **CHARACTERIZATION OF UPLAND NESTING HABITAT OF THE MARBLED MURRELET IN THE EXXON VALDEZ OIL SPILL AREA**

Project ID Number	93051 Part B
Project Type	Survey
Project Leaders	Robert L DeVelice, Ph D Connie Hubbard, M S
Lead Agency	USDA Forest Service
Cooperating Agency	USDI Fish & Wildlife Service
Cost of Project	$247,600 (FY93) $275,200 (FY94)
Dates of Study	1 March 1993 - 30 September 1993
Study Area	Prince William Sound, south Kenai Peninsula

Robert L DeVelice — 4-1-93

Robert L DeVelice (Project Co-Leader) — Date

USDA Forest Service, Chugach NF
201 E 9th Ave , Suite 206
Anchorage, AK 99501
(907)-271-2500

Connie Hubbard — 4-1-93

Connie Hubbard (Project Co-Leader) — Date

USDA Forest Service, Chugach NF
P O Box 129
Girdwood, AK 99587
(907)-783-3242

Kenneth E. Holbrook — 4/2/93

Kenneth Holbrook (Project Manager) — Date

USDA Forest Service, Chugach NF
201 E 9th Ave , Suite 206
Anchorage, AK 99501
(907)-271-2500

B Introduction

Marbled murrelets (*Brachyramphus marmoratus*) were killed by oil contamination from the Exxon Valdez oil spill of March, 1989 Between 9,500 and 14,000 marbled murrelets died from the direct effects of oiling (Ford et al 1991) This estimated mortality represents approximately 10% of the present total population size within the spill area (Laing and Klosiewski, in prep) Presently, there is no known evidence of population recovery within the spill area (Kuletz, in prep , Laing and Klosiewski, in prep)

Habitat modifications (especially logging) both within and outside the spill area may pose additional threats to the area's marbled murrelet populations Protection of nesting habitat areas through acquisition and stewardship may significantly enhance the prospects for population recovery

Although it has been reported that marbled murrelets primarily nest in trees within ancient forests (Marshall 1988, Nelson et al 1992, Quinlan and Hughes 1990), their nesting requirements within the spill area remains poorly known This study will attempt to characterize the nesting habitat of marbled murrelets throughout the spill area so that habitat protection or acquisition options can be most effectively evaluated

This study represents a continuation and expansion of the 1992 work conducted cooperatively by the USDI Fish & Wildlife Service and USDA Forest Service (Kuletz 1992) The 1992 work provided initial characterizations of nesting habitat within Prince William Sound In 1993, habitat surveys will be conducted in Prince William Sound and the southern portion of the Kenai Peninsula

C Project Description

1 Resources and/or Services

Marbled murrelets were injured by the Exxon Valdez oil spill and identifying their habitat requirements is the focus of this study

2 Objectives

The primary objective of this study will be to characterize and contrast sites occupied by marbled murrelets versus unoccupied sites This characterization will focus on documenting vegetation composition and structure

3 Methods

Field sampling will focus on sites identified as having significant marbled murrelet activity, known nesting areas, and areas where the birds have been found to exhibit occupied nesting behavior These sites will be identified in a separate cooperative study

conducted by the USDI Fish & Wildlife Service All of these sites will be located within the oil spill zone in Prince William Sound and along the southern portion of the Kenai Peninsula

A circular 500 m^2 sample plot will be established at a representative location within each identified marbled murrelet site Complete lists of vascular plant species will be recorded within each plot and canopy cover classes, mean heights, and size classes of each species will be estimated Physical site characteristics will also be recorded at each plot, including elevation, slope, aspect, landform, and soil type Vegetation, landforms, and soil types will be mapped within a 500 m radius of the plot center Comparative data for assessing marbled murrelet habitat characteristics will be provided by establishing additional study plots on sites lacking marbled murrelet activity (based on the surveys by the USDI Fish & Wildlife Service)

Data analysis will focus on using a combination of classification to determine vegetation and habitat types, and gradient analyses to describe general patterns of vegetation characteristics, marbled murrelet activity, and environmental factors Classification will be achieved using a combination of two-way indicator species analysis (Hill 1979a), a variety of cluster analyses (Lance and Williams 1967, Ludwig and Reynolds 1988), ecological judgement, and consideration of the gradient analysis results

The gradient analyses will utilize a combination of multivariate procedures, including detrended correspondence analysis (Hill 1979b) and nonmetric multidimensional scaling (Ludwig and Reynolds 1988), and graphic descriptions of vegetation/ environmental patterns (Whittaker 1967) Canonical correspondence analysis (Ter Braak 1986), multiple discriminant analysis (Ludwig and Reynolds 1988), and generalized linear modeling (Nelder and Wedderburn 1972) will be used to statistically test the degree the vegetation characteristics and environmental factors relate to one another and to marbled murrelet activity level (e g , high vs low)

The vegetation/landform/soils mapped data will be imported to a GIS These data will be used to evaluate the relationship between marbled murrelet activity and the pattern and composition of habitat patches

The analyses will be directed toward providing models characterizing habitat for marbled murrelets These models could then be applied in an operational sense towards identifying potential habitat areas for protection The following hypotheses will be examined

- Marbled murrelet habitat preference varies by vegetation type
- Marbled murrelet habitat preference varies by vegetation structure (*sensu* the habitat layer index of Short 1988)
- Marbled murrelet habitat preference varies by total tree volume

- Marbled murrelet habitat preference varies by biophysical site type
- Marbled murrelet habitat preference varies by landscape pattern and composition of habitat patches
- Marbled murrelet habitat preference varies by a multivariate combination of two or more of the above factors

4 Alternatives

This project is highly dependent on coordination with the USDI Fish & Wildlife Service to locate marbled murrelet nest sites, areas where marbled murrelets are exhibiting nesting behavior, and sites with or without marbled murrelet activity Alternative methods that did not provide for this coordination were not considered further

Potentially, the type and diversity of information collected at each plot could be changed However, the set of information proposed for collection will allow for the documentation of the widest possible range of habitat characteristics in the shortest possible time The vascular plant species lists and cover/size class estimates will provide for quantifying such diverse characteristics as species richness and diversity, vegetation type, and habitat structure Similarly, the physical site characterizations, in combination with the vegetation data, will provide for multivariate correlations among habitat characteristics and marbled murrelet activity that would not be possible otherwise When linked to biophysical GIS databases, the models produced in such correlation exercises may be particularly invaluable in identifying habitat areas for protection

5 Location

The precise location of the study sites will be determined by the USDI Fish & Wildlife Service The survey area within which study sites will be located includes the entire oil spill zone in Prince William Sound and along the southern portion of the Kenai Peninsula

6 Benefits

This project will provide detailed information and models characterizing marbled murrelet habitat within the oil spill area This information will be invaluable towards evaluating habitat protection/acquisition options within the oil spill area and biophysically similar areas in the region

7 Technical Support

In addition to the technical support provided by the USDI Fish & Wildlife Service, this project will require 24 3 person months of effort R L DeVelice and C Hubbard will

each dedicate three months to the project and will act as co-project leaders and joint authors of the final project report Field work will largely be accomplished by two crews of biotechnicians each composed of one ecologist and one soil scientist The two ecologists will work for a total of nine months and the two soil scientists will work for a total of eight months

8 Contracts

To accomplish the necessary travel to remote study sites, this project will require chartering two boats One of these boats will be contracted by the USDA Forest Service and the other will be contracted by the USDI Fish & Wildlife Service Both of the contracts will be for 60 days duration (total of 120 days)

9 Mitigation Measures

No mitigation measures will be required

10 Literature Cited

Ford, R G , M L Bonnell, D H Varoujean, G W Page, B E Sharp, D Heinemann, and J L Casey 1991 Assessment of direct seabird mortality in Prince William Sound and the Western Gulf of Alaska resulting from the Exxon Valdez oil spill Ecological Consulting, Inc , Portland, Oregon

Hill, M O 1979a TWINSPAN A FORTRAN program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes Ecology and Systematics, Cornell University, Ithaca, New York

Hill, M O 1979b DECORANA A FORTRAN program for detrended correspondence analysis and reciprocal averaging Ecology and Systematics, Cornell University, Ithaca, New York

Kuletz, K J In prep Assessment of injury to Marbled Murrelets from the Exxon Valdez Oil Spill NRDA Bird Study No 6 U S Fish and Wildlife Service, Anchorage, Alaska

Kuletz, K J 1992 Identification of upland nesting habitat of the marbled murrelet in the EVOS zone (unpublished study proposal submitted to the Exxon Valdez Oil Spill Trustee Council)

Laing, K K and S P Klosiewski In prep Marine bird populations of Prince William Sound, Alaska, before and after the Exxon Valdez Oil Spill NRDA Bird Survey No 2 U S Fish and Wildlife Service, Anchorage, Alaska

Lance, G N and W T Williams 1967 A general theory for classificatory sorting strategies 1 Hierarchical system Computer Journal 10 271-276

Ludwig, J A and J F Reynolds 1988 Statistical ecology a primer on methods and computing John Wiley & Sons, New York

Marshall, D B 1988 Status of the Marbled Murrelet in North America with special emphasis on populations in Washington, Oregon and California USFWS Biological Report 88(30)

Nelder, J A and R W M Wedderburn 1972 Generalized linear models Journal of the Royal Statistical Society A 135 370-384

Nelson, S K , T E Hamer, and K Holtrop 1992 Nest-site characteristics of Marbled Murrelets in the Pacific Northwest Abstract Pacific Seabird Group Annual Meeting January 15-19, 1992

Quinlan, S E and J H Hughes 1990 Location and description of a Marbled Murrelet tree nest in Alaska Condor 92 1068-1073

Short, H L 1988 Habitat structure model for natural resource management Journal of Environmental Management 27 289-305

Ter Braak, C J F 1986 Canonical correspondence analysis a new eigenvector technique for multivariate direct gradient analysis Ecology 67 1167-1179

Whittaker, R H 1967 Gradient analysis of vegetation Biological Review 42 207-264

D Schedules and Planning

1 Data Collection and Reporting Schedule

1993	March	secure charter vessels advertize for personnel
	April - 14 May	hire personnel (two ecologists, two soil scientists) prepare for field work (e g , organize training for field crews, acquire maps and aerial photographs, order necessary equipment, generate sufficient copies of field forms)
	14 May - 11 June	safety training vegetation/soils characterization training premapping
	13 - 22 June	Prince William Sound survey (first trip)
	29 June - 8 July	Prince William Sound survey (second trip)

15 - 22 July	southern Kenai Peninsula survey (first trip)
27 July - 5 Aug	southern Kenai Peninsula survey (second trip)
10 - 19 Aug	Prince William Sound survey (third trip)
24 Aug - 2 Sept	Prince William Sound survey (fourth trip)
7 - 30 Sept	data entry and initial analysis
Oct - Dec	final analysis and report writing
1994 Jan	preliminary report
28 Feb	final report

2 Personnel

Robert L DeVelice, Ph D - will co-supervise project (with C Hubbard) and conduct analyses and reporting

Connie Hubbard, M S - will co-supervise project (with R DeVelice) and conduct analyses and reporting

Biological Technicians - Ecologist (2) - will lead field survey crews and record the vegetation component of field surveys One of these technicians will remain in the office after the field season to assist in data entry and preliminary analysis

Biological Technicians - Soils Scientist (2) - will record the soils and landform data component of the field surveys

E Environmental Compliance/Permit/Coordination Status

This project qualifies for a categorical exclusion under terms of the National Environmental Policy Act

F Performance Monitoring

Robert L DeVelice will coordinate project design/implementation and data exchange with the USDI Fish & Wildlife Service DeVelice will be responsible for final study design and final completion of reports Connie Hubbard will provide overall coordination for field operations (DeVelice will assist) Hubbard and DeVelice will jointly work on data analysis and reporting

In the event that one of the project leaders leaves before the project's completion, the remaining project leader will take on all coordination, analysis, and reporting responsibilities

Quality control will be accomplished by subjecting each field crew member to a two-week training program prior to initiating field work This training will include lectures on the basic procedures to be used followed by actual applications of the methods in the field Finally, the trainees will be tested in the field for consistency and accuracy in characterizing vegetation, landforms, and soils At least three times during the field season either DeVelice or Hubbard will join the field crews to provide technical assistance and ensure high standards in data collection

A preliminary report documenting the findings from this study will be submitted in January 1994 Following incorporation of review comments, the final version of this report will be submitted by the end of February 1994

G Personnel Qualifications

Project Co-Leader Robert L DeVelice received his Ph D in plant ecology from New Mexico State University, Las Cruces, in 1983 His dissertation involved the development of a vegetation type classification in the southern Rocky Mountains Dr DeVelice was a post-doctoral fellow in New Zealand from 1984 - 1987 where he conducted preserves selection and design research From 1987 - 1989 Dr DeVelice worked as a contract scientist working on global climatic change research for the US Environmental Protection Agency Prior to joining the staff of the Chugach National Forest in 1992, Dr DeVelice worked as the Montana state ecologist for The Nature Conservancy The focus of much of Dr DeVelice's work and experience is field vegetation ecology and quantitative plant community analysis

Project Co-Leader Connie Hubbard received her M S in forest science from Oregon State University Her thesis involved developing a plant association classification for the College of Forestry's research forest lands Connie has worked for the USDA Forest Service as Forester, Silviculturalist, and Ecologist She has also worked for both state and private resource management agencies in Idaho and Montana Connie is currently the District Ecologist for the Glacier Ranger District of the Chugach National Forest The emphasis of this position is the development and application of community classifications for the Forest, including plant association classification in Prince William Sound

H Budget

(see attached budget sheets)

Project Description Characterize the nesting habitat of marbled murrelets in the spill affected area Determine and map cover attributes, specifically forest structure, volume stand class and plant association for dawn watch sites

Budget Category	Approved 1-Oct-92 28-Feb-93	Proposed* 1-Mar-93 30-Sep-93	Total FY 93	** FY 94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond
Personnel	$12 0	$80 4	$92 4	$91 2				
Travel	$1 2	$7 9	$9 1	$11 2				
Contractual	$0 0	$120 0	$120 0	$145 0				
Commodities	$0 0	$1 0	$1 0	$1 0				
Equipment	$0 0	$2 5	$2 5	$3 0				
Capital Outlay	$0 0	$0 0	$0 0	$0 0				
Sub-total	$13 1	$211 8	$225 0	$251 4	$0 0	$0 0	$0 0	$0 0
General Administration	$2 1	$20 5	$22 6	$23 8				
Project Total	$15 2	$232 3	$247 6	$275 2	$0 0	$0 0	$0 0	$0 0
Full-time Equivalents (FTE)	0 3	2 0	2 3	2 4				

Amounts are shown in thousands of dollars

Budget Year Proposed Personnel

Position	Months Budgeted	Cost
Ecologist GS 12	3 0	$16 4
Ecologist GS 9	3 0	$12 0
Biotechnician GS7 (2) Ecologist	9 0	$26 6
Biotechnician GS6 (2) Soil Scientist	8 0	$21 3
Biotechnician GS5	0 8	$1 6
Program Manager	0 5	$2 5

Comment

* FY 93 is a transition year from the previously used oil fiscal year to the federal fiscal year

** Close out costs for final data analysis and report writing of FY 93 work would be $60,000

1 Apr 93

1993

Project Number 93051 Part B
Project Title Information Needs for Habitat Protection
Sub-Project Marbled Murrelet Habitat Identification
Agency Dept of Agriculture, Forest Service

FORM 3A SUB-PROJECT DETAIL

		Proposed
Travel	To and from Whittier (road, train) and to and from PWS, Homer and other sites	$4 3
	Per diem - 4 people x $15/day x 60 days	$3 6
Contractual	Boat Charter, 120 days at $1000/day	$120 0
Commodities	Office supplies, field books	$1 0
Equipment	Aerial photos, waterproof camera, backpacks and replacement of expended field equipment	$2 5
	Total	$131 4

1 Apr 93

1993

Project Number 93051 Part B
Project Title Habitat Protection
Sub-Project Marbled Murrelet Habitat Identification
Agency Dept of Agriculture, Forest Service

FORM 3B
SUB-
PROJECT
DETAIL

93051 Part B

EXXON VALDEZ DRAFT DETAILED PROJECT DESCRIPTION

Project Title	Information Needs for Habitat Protection
Sub-Project	Marbled Murrelet Habitat Identification
Project ID#	93051 Part B
Project Type	Habitat Protection and Acquisition
Project Leader	Katherine J Kuletz
Lead Agency	U S Department of the Interior, Fish and Wildlife Service
Cooperating Agencies	U S Department of Agriculture, Forest Service
Project Cost	$ 271 0 (FY 93), $ 71 5 (FY 94)
Start Date	1 February 1993 **Finish Date** 31 March 1994
Project Location	Prince William Sound, south Kenai Peninsula

Project Leader _____ **Date** 4-1-93
Kathy Kuletz, Migratory Bird Management

Project Manager _____ **Date** 4-15-93
Kent Wohl, Migratory Bird Management

B. Introduction

The protection of habitats has been identified as a viable means of restoring resources injured by the *Exxon Valdez* oil spill The marbled murrelet (*Brachyramphus marmoratus*) is a small seabird which was injured by the oil spill (Piatt et al 1990, Kuletz in prep) and could benefit from habitat protection The murrelet primarily nests in old-growth forests (Binford et al 1975, Manley and Kelson 1991, Quinlan and Hughes 1990, Singer et al 1991, Nelson and Hamer 1992, Naslund et al in press, Piatt and Ford in press), which are threatened by logging in the spill zone The majority of murrelet carcasses were retrieved in Prince William Sound and along the south Kenai Peninsula (Ecological Consulting, Inc 1991, Kuletz in prep) Prince William Sound is one of three major population centers of the marbled murrelet in Alaska (Mendenhall 1992) The Prince William Sound population has declined significantly, from approximately 300,000 to 100,000 in 1989 (Klosiewski and Laing ms) Even though it is unlikely that all of the decline was due to the spill (Klosiewski and Laing ms), the oil spill undoubtedly hindered any recovery to historic levels Murrelets also showed effects of human disturbance at Naked Island in 1989 and possible disruption of reproduction (Kuletz in prep)

Loss of nesting habitat to logging could impede the natural recovery of murrelets in the spill zone The marbled murrelet is listed as threatened under the Endangered Species Act in California, Oregon and Washington, due in large part to loss of its forest nesting habitat (Stein and Miller 1992), and forested areas in the spill zone are under increasing pressure to be logged In addition, the murrelets in the spill zone are vulnerable to human disturbance, whether they nest in trees or on the ground This study, in cooperation with the U S Forest Service, will identify forested and unforested habitat features associated with nesting murrelets These results can be used to identify areas needing protection to ensure the recovery of marbled murrelet populations in the spill area

Prior to 1990, no systematic survey of murrelet nesting activity had been attempted in southcentral Alaska, including the spill zone Since then, my colleagues and I developed the first survey protocol for Alaska and we located probable nesting areas on Naked Island, in Prince William Sound (Kuletz 1991) In 1991 and 1992, we located 10 marbled murrelet nests (Naslund et al in press, Kuletz et al in prep) The nest trees were in high volume (1883-5649 net m^3 per hectare) and size class (≥23 cm dbh [diameter at breast height]) stands of old-growth hemlock (*Tsuga mertensiana* and *T heterohylla*) and spruce (*Picea sitchensis*) All nests were on tree branches in shallow depressions on large moss covered platforms, which is typical throughout the murrelet's range (Binford et al 1975, Quinlan and Hughes 1990, Singer et al 1991, Nelson and Hamer 1992) Nest trees were larger and had more epiphyte cover and platforms (i e , horizontal surfaces large enough to support a nest and pair of murrelets) than surrounding trees We also found higher levels of murrelet activity (i e , flying or calling) near the heads of bays on moderate to steep slopes, and higher activity and behavior indicative of nesting, in forests with trees ≥23 cm dbh and with mossy platforms However, not all forests of high stand size class and volume class had murrelet activity

The southern Kenai Peninsula, which is in the spill zone, is one of the few places where murrelets have been found nesting in unforested areas on the ground (Simons 1980, Hirsch et al 1981, B Rice, pers comm, Kenai Fjords National Park) However, the pressence of Kittlitz's murrelets (*B brevirostris)* on the Kenai complicates casual observations, since the Kittlitz's murrelets nest only on the ground The area also appears to support tree nesting murrelets, based on observations of murrelets flying into trees (M Tetreau, unpubl data, Kenai Fjords National Park) Preliminary surveys along the coast of the Kenai Fjords National Park by Park Service biologists in 1991 and 1992 found no significant difference in murrelet activity between forested and unforested areas (Rice 1991) Because murrelets may use different nesting habitat on the Kenai Peninsula, murrelet activity in this region also needs to be examined further

The effort required to document nests, survey murrelet activity and quantify nesting habitat in the spill zone is labor intensive, because upland areas beyond a few kilometers from the coast are often steep and difficult to access In the past, we have concentrated on surveying murrelet activity and habitat use within about 1 5 km from the coast Using radio-telemetry for finding nests and quantifying nesting habitat could be more efficient compared to present techniques, especially on a large scale and at distances more than a few kilometers inland Capture methods, radio attachment and the ability to track murrelets in steep terrain are experimental (Varoujean et al 1989, Quinlan and Hughes 1992, Prestash et al 1992, Burns et al 1993 a, b), and have not been attempted in southcentral Alaska

To better quantify marbled murrelet nesting habitat, particularly habitat in the spill zone, we propose to do three things (1) we plan to expand our study area to include the southern Kenai Peninsula, to determine the relative use of forested and unforested areas, (2) we plan to quantify the features that determine murrelet use of forested and unforested areas, and, (3) we plan to do a pilot radio-telemetry study, to evaluate the feasibility of using this method to collect data on murrelet nesting habitat

C Project description

1 Resources

The resource to be studied by this project is the marbled murrelet

2 Objectives

a Determine habitat features that are reliable indicators of high density murrelet nesting areas in the spill-affected area

b Determine the feasibility of using radio telemetry to determine nesting habitat of murrelets in the spill-affected area

3 Methods

To meet the first objective, we will do three things (1) we will identify habitat indicative of murrelet nesting along the southern Kenai Peninsula, (2) we will quantify features that determine murrelet habitat use, by combining all the murrelet survey data and habitat data (GIS timber types and detailed vegetation plots), and (3) we will test the application of marine radar to murrelet surveys To meet the second objective, we will (4) do a pilot study on the capture and radio tagging of murrelets

1 Identification Of Murrelet Nesting Habitat On The Kenai Peninsula

i Study Area

Efforts will focus on Aialik Bay, Harris Bay and the East Arm of Nuka Bay (Fig 1), on the Gulf of Alaska coast of the Kenai Peninsula All of these sites are located within the Kenai Fjords National Park In each bay, both forested and unforested areas will be sampled

ii Data Collection

The basic sampling method will be the 'intensive inventory' survey (Ralph et al 1993) (hereafter referred to as a 'dawn watch'), with modifications for southcentral Alaska (Kuletz et al in prep) Dawn watches focus on the murrelet's pre-dawn activity period, when birds fly from foraging areas to inland nesting areas The 'detection' is the basic unit of observation and is defined as "the sighting or hearing of a single bird or a flock of birds acting in a similar manner" (Paton et al 1990 2) Data collection for each detection will include time, number of birds, flight direction (to the nearest 10°), distance from observer (to the nearest 25 m), occurrence of behaviors, numbers and types of vocalizations and wing sounds, bird height (i e , below canopy, ≤15 m above canopy, 16-40 m above canopy, and >40 m above canopy), and whether or not birds were seen Behavior categories will include those identified as 'occupied' behaviors, which indicate nearby nesting (Ralph et al 1993) For unforested areas, we will note the bird's height above ground and consider flights leading into rocky outcrops or low vegetation (such as alder clumps) as occupied behavior We make note of any unrecognizable murrelet calls or visual observations which might be Kittlitz's murrelets rather than marbled murrelets The observer will record observations into a hand-held tape recorder and later transcribe the tape onto a data sheet

A 50 m radius vegetation plot will be surveyed at each dawn watch site At forested sites, the data collected will include (1) dominant tree

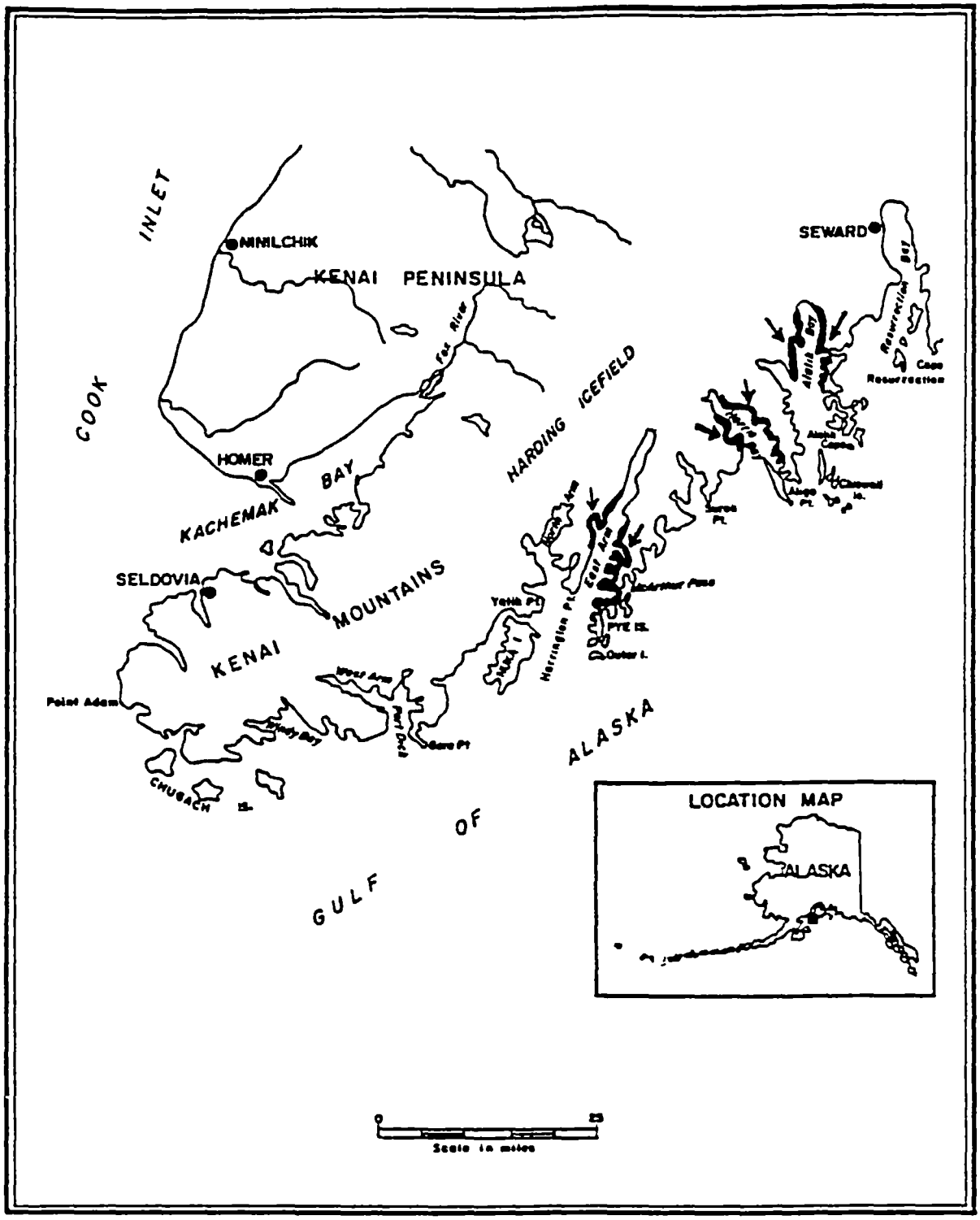

Figure 1 Map of the 1993 study sites on the Kenai Peninsula for the Marbled Murrelet Restoration Study Murrelet surveys will be conducted at sites in Alalik Bay, Harris Bay and the East Arm of Nuka Bay The areas to be surveyed are shown in black.

species, percent canopy cover, tree basal area, and percent cover and height of dominant understory species, (2) species, dbh, vigor, top condition, ephiphyte cover, and number of platforms for the ten closest upper canopy trees, (3) elevation, slope degree (using an inclinometer) and aspect (using a compass), presence of streams and ponds, and (4) distance to salt water Vigor will be classified as live, declining, or dead Platforms are defined as any flat horizontal surface with a diameter ≥15 cm in diameter (including moss) Epiphyte cover will be categorized as none, trace (<1% cover), low (1-33%), moderate (34-66%), or high (>66%) Distance from salt water will be determined from aerial photos

In unforested areas, we will record the following within the 50m radius plot (1) percentage vegetation, epiphyte and rock cover, (2) dominant plant species, (3) rock size, (4) number of rock crevices or outcroppings, and, (5) topographic features (elevation, slope, aspect, presence of freshwater and distance to salt water) We will also collect samples of dominant epiphyte species for later identification by experts Forest Service biologists will conduct detailed vegetation plots at all survey sites

III Study Design

We will survey for habitat and murrelet activity (i e , numbers and types of detections) along the southern Kenai Peninsula, in areas where the National Park Service has conducted preliminary murrelet surveys Twenty sites in forested and 20 sites in unforested habitat will be surveyed The 1993 surveys will occur over 20 days in July A vessel will be chartered to transport and serve as a base of operations for 4 biologists The Forest Service teams will operate from their own vessel, or two Forest Service biologists will join the FWS vessel At every anchor site, two FWS teams will hike inland the evening prior to the dawn watch to establish survey camps Survey camps will be at least 1 km apart The distance inland will depend on the local topography, but will generally be between 0 5-2 km from the shore One person in each of the two-person teams camped inland will conduct the dawn watch

Infra-red photographs will be used to determine forested and unforested areas for site selection To insure that murrelet activity is associated with the habitat at each dawn watch site, only sites with ≥12 ha (i e , the area of a ca 200 m radius circle) of contiguous habitat will be chosen The effects of seasonal changes in murrelet activity levels will be minimized by sampling forested and unforested sites on alternate days, such that the surveys are distributed equally throughout July

IV Data Analysis

We will do a paired t-test between murrelet activity levels at forested and unforested sites surveyed in the same two-day period In addition, the mean and variance of murrelet detection levels, and the number of sites with occupied behaviors, will be tested for significant differences between forested and unforested sites among all south Kenai survey sites Correlation and chi square analysis will be done to examine the relationship between habitat or vegetation characteristics and murrelet activity levels or occurrence of occupied behaviors, respectively

2 Quantification of Habitat Features Indicative Of Murrelet Habitat Use

The goal of our 1993 work is to develop the means to quantitatively rank the value (for murrelets) of lands considered for protection To accomplish this goal, we propose to combine the data from four years (1990 - 1993) of murrelet and habitat surveys We have identified several habitat features associated with high murrelet activity and with actual nest sites However, many of the habitat features were correlated (Kuletz et al in prep), and it will be necessary to determine the interactive effects of all habitat variables, and if these effects vary throughout the spill zone In addition, our results to date have identified vegetation and habitat features which need to be examined in more detail The additional habitat measurements do not need to be done concurrent with murrelet dawn watches, and vegetation data collected by the Forest Service in 1993 will be integrated with results from murrelet surveys

i Study Area

This portion of the study will include data from Prince William Sound, the Kenai Peninsula and Afognak Island The U S Fish and Wildlife Service will not have a field component for this portion of the study The U S Forest Service will collect data at sites surveyed for murrelets in Prince William Sound in 1992 (Fig 2) and at additional sites throughout the Sound

ii Data Collection

Detailed habitat and vegetation data will be collected by Forest Service biologists, using methods described in the U S Forest Service Proposal (ID 93051 Part B) The existing murrelet and habitat data collected by the U S Fish and Wildlife Service will be compiled under the direction of the FWS principal investigator

iii Study Design and Data Analysis

We will compile data from murrelet surveys done throughout the spill zone The Afognak Island data was collected by the Division of Realty,

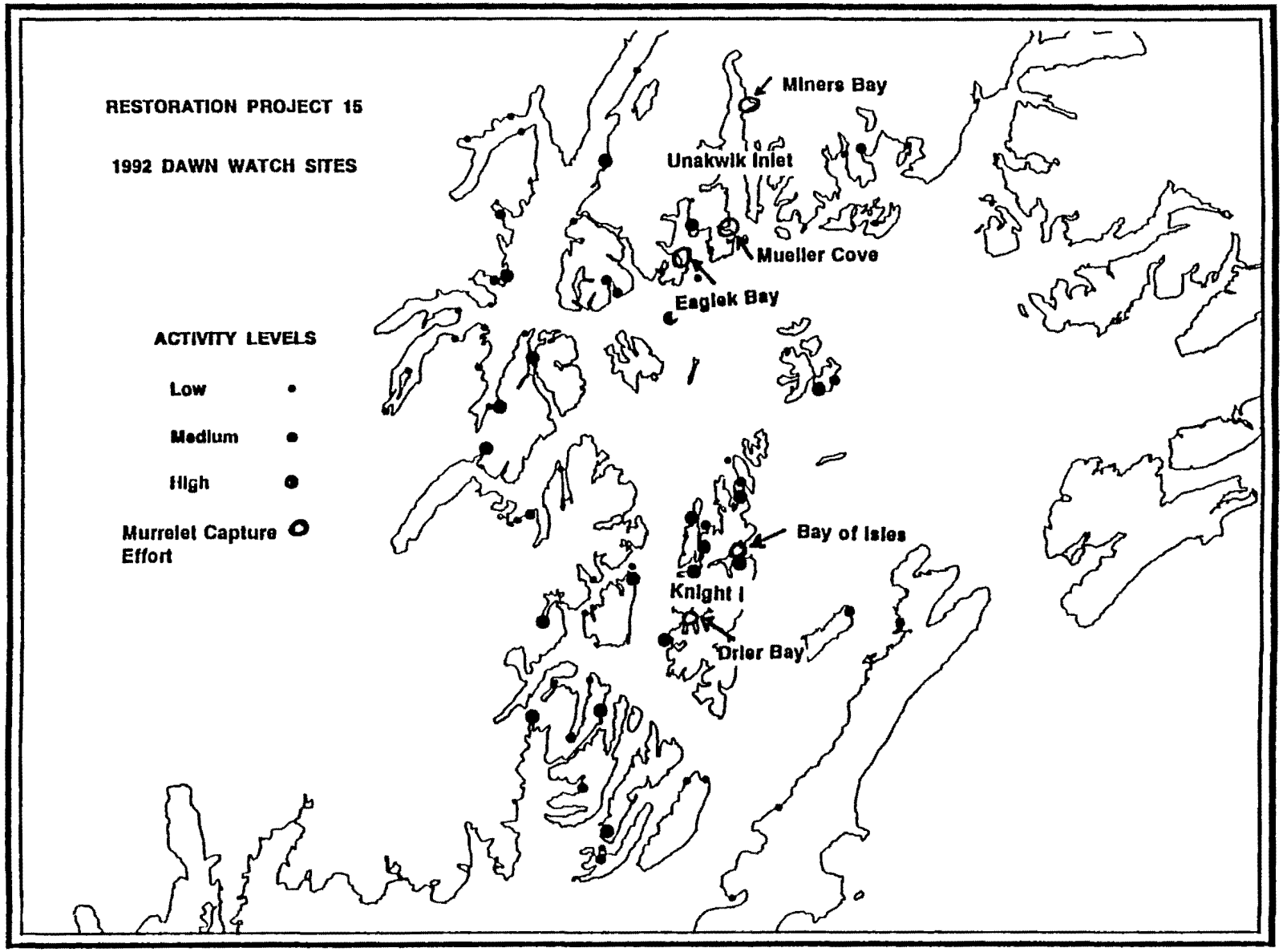

Figure 2 The 1992 Prince William Sound survey sites, with their relative murrelet activity levels, and the proposed murrelet capture / radio-tagging sites for 1993 In 1993, the high and low activity sites will be revisited by the U S Forest Service vegetation team

USFWS, in 1992 The Kenai Peninsula data will be collected by USFWS and USFS in 1993 The Prince William Sound data was collected between 1990 - 1992, and there will be additional detailed habitat data collected by the USFS in 1993 A multivariate approach will be used to make full use of the available data on murrelets

In Prince William Sound, we will integrate murrelet activity data with the recently available GIS elevational and timber type database and the detailed vegetation data collected by the Forest Service in Prince William Sound In 1993, detailed vegetation plots will be done at forty study sites previously surveyed for murrelet activity levels, 20 sites of high murrelet activity and 20 sites with low murrelet activity The remaining study sites will be identified by the Forest Service, based on FWS questions about microhabitat effects on such variables as tree species, tree size and epiphyte cover

First, we will quantify habitat features that are indicative of high murrelet activity by comparing high and low murrelet activity sites, and the detailed vegetation and habitat data collected in 1993 The sample units will be sites surveyed for murrelets in Prince William Sound in 1992, 20 sites with high murrelet activity and 20 sites with low murrelet activity Second, we will combine all existing data on sites surveyed for murrelets Prince William Sound (n = 195), the Kenai Peninsula (n = 40) and Afognak Island (n = 75), for a total of 310 sites

We will use a multivariate approach, (eg , principal components analysis or multiple regression), to incorporate habitat variables into a predictive model of murrelet activity and occupation We will also explore the use of logistic regression, i e , sample-based resource selection functions (Manly 1991) to derive a probability for identifying murrelet nesting areas with a given set of habitat variables

3 Pilot Study on the Use of Marine Radar to Quantify Inland Murrelet Activity

Murrelet detections obtained during a dawn watch can only be used to measure relative activity levels, and cannot provide an estimate of murrelet abundance We have two purposes in testing the application of marine radar (1) to determine if marine radar can provide us with a correction factor by which to convert our detection numbers into estimates of murrelet abundance and (2) to determine if marine radar would be a cost-effective method of quantifying murrelet activity in the spill zone Marine radar has been used for monitoring bird migrations (Cooper et al 1991) and recently was attempted with murrelets in California (Hamer and Cooper 1993) However, it has not been attempted in a marine fjord-type environment This pilot effort is minimal, and will not require additional FWS field work or interfere with our on-going data collection

i Study Area

This pilot study will occur in conjunction with the Kenai Peninsula surveys The exact location will depend on the schedules of FWS and USFS personnel, and on weather

ii Data Collection

A contractor will join the murrelet surveys based on a vessel used for transport and living quarters during the Kenai Peninsula surveys The methods used by the marine radar operator will follow those described in Cooper et al (1993), with appropriate modifications for operating from a marine vessel in a fjord environment A key modification for monitoring murrelets during the peak activity period will be to video-tape the radar screen for later analysis, which improves accuracy of the radar observer (B Cooper, ABR, pers comm)

For seven mornings, the contractor will monitor and record murrelet activity from the anchored vessel, using marine radar This survey will be conducted simultaneously with one of the on-going murrelet dawn watches, which will be stationed on land within 500 m of the anchored vessel (Murrelets can be detected by radar at distances up to 1 3 km, Hamer and Cooper 1993) The radar operator will count and map all murrelet flights The radar operator can separate murrelet flights which occur over the on-land survey station, for comparison with the detections recorded by the on-land observer

iii Evaluation of Marine Radar

We will evaluate the feasibility of using marine radar by two criteria First, whether or not the system operated successfully i e , within the constraints of weather and terrain Second, was the correlation between radar counts and observer detections consistent ? If the variance associated with the two techniques is consistent, we can use the model to apply a correction factor to our detection numbers to derive an estimate of murrelet abundance

4 Pilot Study on the Capture and Radio-tagging of Murrelets

i Study Area

The capture and tagging of murrelets will be done at sites in Prince William Sound where murrelet densities are known to be high and where high numbers of murrelets have been previously observed flying inland (Kuletz et al unpubl data) These areas include (1) Mueler Cove and

Miner's Bay in Unakwik Inlet, (2) Southwest side of Eaglek Bay and (3) Bay of Isles and Drier Bay on Knight Island (Fig 2)

II Data Collection

Contracted professionals will spend about four days, interspersed throughout the study period, confirming the presence of murrelet flyways Methods will follow Prestash et al (1992) for stationary counts Systematic shoreline surveys at dawn and dusk will be conducted to locate specific concentrations of murrelets on the water A net system for capturing murrelets will be set up once the location of a flyway or murrelet concentration has been established This method of capturing murrelets has been highly effective in British Columbia (Prestash et al 1992, Burns et al 1993a, b) The contracted team will capture murrelets with the net system during twilight hours before dawn for about 10 days If the net system is unsuccessful at catching murrelets, then alternate methods may be employed including (1) using a net gun and, (2) using bright lights and a dip net at night All murrelets that are caught will be fitted with radio transmitters, banded with a U S Fish and Wildlife Service band, and released Personnel handling murrelets will wear surgical gloves, to avoid soiling or destroying the integrity of murrelet feathers, and murrelets will be handled quickly to reduce stress Radio transmitters specially designed and custom made for marbled murrelets by Holofil, in Woodland, Ontario, (weighing about 1 5 g) will be attached using a specially designed epoxy and reinforced with one suture

Each morning, following dawn capture efforts, murrelets will be tracked using a small plane combing inland areas and the waters adjacent to the capture site Murrelets will be tracked for about 2 hours per morning This should be sufficient time to locate murrelets at inland sites based, on ≤1 hour required for a less expansive area in British Columbia (R Burns, pers comm) If murrelets are located at inland sites, potential nest locations will be approximated using triangulation techniques A murrelet will be considered to be attending a nest if it is found at the inland site on alternate days at least twice (indicating incubation) or if it is found flying inland during broad daylight (i e , after the dawn activity period) on at least two occasions (indicating chick feeding) Efforts may be made to locate the exact nest site from the ground, depending on topography and availability of personnel However, locating the actual nest tree will not be a goal of this study

The following data will be collected for each murrelet that is captured (1) weight, wing chord, tarsus and culmen measurements, (2) presence of brood patch, (3) presence of subcutaneous fat, (3) molt, and, (4) condition and behavior of bird on release

Date, time and location will be recorded each time that the signal of a radio-tagged murrelet is detected Because the steep terrain may cause problems in identifying the true source of the radio signal from the air, we will also use the support vessel to narrow the location Locations will be mapped on topographic maps and latitude and longitude recorded using GPS or Loran

iii Data Analysis

The feasibility of capturing, tagging and using radio-telemetry to document murrelet nesting habitat in the spill zone will be evaluated based on the following (1) success of the capture method (number of birds caught), (2) success of tagging (number of birds successfully released with tags), (3) ability to locate radio signals of tagged birds (number and reliability of fixes we are able to make per tagged individual) Secondarily, (as time allows) we will examine (4) survival of radio-tagged murrelets, (5) the effect of transmitters on murrelet behavior, (6) longevity of radio transmitters within the time frame of this portion of the study, (7) the ability to identify habitat use in steep terrain or >2 km from the coast, and, (5) the relative effort (i e , person hours) and cost per murrelet tracked to an inland site compared with dawn watch techniques

4 Alternatives

The current protocol for the survey of murrelet nesting habitat throughout its range is the dawn watch This is the only method which has produced consistent data on murrelet activity at inland sites, as well as documentation of occupied behaviors indicative of a nearby murrelet nest The use of remote tape recorders to record murrelet vocalizations was considered However, tape recorders cannot document visual detections or occupied behaviors, nor can they determine distance and direction of murrelet activity They are also subject to inclement weather and could be easily lost in the terrain we will be surveying In areas with roads or established trails, tape recorders could be used to provide a record of murrelet presence in the area

This study will examine the feasibility of two alternative methods to the dawn watch (1) radio-tagging murrelets and tracking them to their nesting sites and (2) using marine radar to monitor murrelet activity levels Radio-tagging is still experimental, and currently requires high funding for a relatively small data return By testing the feasibility of using capture and radio tagging techniques developed for areas outside Alaska, we hope to make this method a viable alternative in the future The use of marine radar to monitor murrelet activity at dawn has been attempted in California with some success, but has not been attempted from a boat or in steep terrain

5 Location

The murrelet surveys will take place at pre-selected sites at Ailiak, Harris and Nuka bays on the southern Kenai Peninsula (Fig 1) The radio-tagging effort will be conducted in Prince William Sound (Fig 2) The expected sites of capture operations are Unakwik Inlet, Eaglek Bay and Knight Island The radio-tracking of the murrelets may extend throughout Prince William Sound, depending on the movements of tagged murrelets

6 Benefits

The expected benefits of this project to the resource are to assist with protection of nesting habitat of the marbled murrelet We will do this by defining forested habitats which have a high probability of use by marbled murrelets, and by evaluating the importance of forested and unforested habitat in an area where both may be used by murrelets As a result of our surveys, we will also have located and documented specific murrelet nesting areas

7 Technical Support

The technical support of the GIS working group of the Office of Oil Spill, USFWS, will be critical to the completion of this project We will require GIS services for site selection, analysis of habitats within specified buffer zones at selected sites, and mapping of all products We will also require the support of the GIS and habitat/wildlife biologists of the U S Forest Service, to assist in habitat quantification

8 Contracts

a Vessel contracts - Two vessels will be contracted, one for surveys along the southern Kenai Peninsula and one in Prince William Sound for the radio-telemetry study The vessel for the south Kenai will be required for 20 days and is needed to provide transportation, accommodations, and support for field personnel conducting murrelet surveys The second boat contract will be needed to provide transportation, a mobile work platform, and support during capture and radio tagging of murrelets Both contracts will be awarded to the lowest bidder

b Radio telemetry - The radio telemetry part of this study will be contracted to Rick Burns and Lynn Prestash, a professional team with prior experience in capture and radio telemetry techniques for marbled murrelets in a fjord type environment We will require a sole source contract because (1) murrelets are difficult to capture and radio tag, (2) very few people have the necessary experience to capture, handle, and track murrelets to nest sites in a fjord type environment, and, (3) the success of the study depends on efficient and safe capture, radio

tagging, and tracking of murrelets The use of a portable mist net system over water has been the only method proven to be effective and safe for capturing marbled murrelets for radio-telemetry studies This method was developed by Rick Burns and Lynn Prestash and successfully used in British Columbia Their work (including the initial pilot study) has resulted in the capture of over thirty murrelets and 3 murrelets tracked to nest areas Mr Burns and Ms Prestash are the only people who currently have the experience and knowledge required to build and implement the mist net system and to successfully radio-tag and track murrelets in a fjord type environment

c Radar - The proposed radar work will require a sole source contract with Alaska Biological Research (ABR) ABR has used marine radar to study bird migration in Alaska (Cooper et al 1991) and is the only group to have devised a technique for using radar to monitor marbled murrelet dawn activity levels (Hamer and Cooper 1993) Their familiarity with interpretation of marine radar data, and with murrelets in particular, will be critical to assure the success of this test

9 Mitigation Measures

No mitigation measures will be required because the project qualifies for a NEPA exemption

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D Schedule and Planning

1 Milestones

1993	March-April	Complete study plan, advertise for charter vessels, contract radio-telemetry study, hire personnel
	May-June	Safety training for field personnel, training for murrelet and vegetation surveys, purchase equipment, finalize selection of Kenai Peninsula sites and coordinate with Forest Service on PWS sites Prepare murrelet data for integration with 1993 data and GIS coverage of PWS
	July	Survey selected sites on Kenai Peninsula for murrelet activity, have radio-telemetry contractors on-site and operating in PWS, have marine radar contractor based on Kenai Peninsula boat for 7 days Continue data analysis and preparation for integration of all murrelet and habitat data
	Aug-Sept	Inventory and store equipment, data entry and compilation, data analysis
	Oct-Dec	Reports due from radio-tagging and marine radar study contractors, data analysis and report writing
1994	Jan 15	Draft report submitted to OOS
	Feb 15	Draft report submitted for peer review
	March 30	Final Report to Chief Scientist

2 Project Personnel

Kent Wohl	Project Manager, responsible for overall management of project, supervises logistics and reviews reports
Kathy Kuletz	Project Leader, will coordinate activities and data exchange with the U S Forest Service Project Leader will also be responsible for study design, contract management, data analysis and completion of final products Will remain in office except for brief visits to Kenai and radio tagging operations Through June, will complete obligations for R15 and then prepare data for integration with 1993 data Will also act as office liaison for field supervisor

Nancy Naslund — Assistant Project Leader, will assist with field coordination, write contracts, conduct training She will remain in the office to assist the Project Leader with the completion of tasks, analysis and writing

Dennis Marks — Assistant Project Leader and field supervisor of south Kenai Peninsula portion of study During the field season will be responsible for planning, data collection and logistics in the field Post season duties include data compilation, analysis and report writing

Bio Tech 1 — Will assist with data entry in the office, logistic support and assistance with the radio tagging effort

Bio Tech 2 — Assist in field preparation and conduct dawn surveys and vegetation plots along the south Kenai Peninsula Will remain in the office after the field season to assist with data entry and equipment maintenance

Bio Tech 3 — Assist in field preparation and conduct dawn surveys and vegetation plots along the south Kenai Peninsula Will remain in the office after the field season to assist with data entry and equipment maintenance

Bio Tech 4 — Assist in field preparation and conduct dawn surveys and vegetation plots along the south Kenai Peninsula Will remain in the office after the field season to assist with data entry and equipment maintenance

3 Logistics

a Field camps

Temporary field camps (i e , 1-2 days) will be required for collecting data during each dawn survey of murrelets

b Vessel Support

A charter vessel is needed to support the field camps, and to provide living quarters and transportation Two outboard motor-equipped inflatable rafts will be used from the vessel for transportation of field personnel and gear to shore

A second charter vessel is needed to support the radio-telemetry study, to provide living quarters and transportation, and to serve as a viewing

platform during stationary counts for documenting murrelet flyways One outboard motor-equipped inflatable raft will be used from the vessel to implement capture efforts of murrelets for radio-tagging

c Small Plane

A small plane will be required for tracking radio-tagged murrelets to inland sites

E Environmental Compliance \ Permit \ Coordination Status

The murrelet dawn survey portion of this study relies on observations only and is a non-intrusive study Based on a review of CEQ regulation 40 CFR 1500-1508, this study has been determined to be categorically exempt from the requirements of NEPA, in accordance with 40 CFR 1508 4 The radio-tagging portion of this study is designed to minimize the potential for accidental death of the birds during handling, and the birds will be released unharmed As a scientific study, it is also exempt from the requirements of NEPA, in accordance with 40 CFR 1508 4

F Performance Monitoring

1 Backup Strategy

In the event that the Project Leader, Kathy Kuletz, leaves before the project's completion, Nancy Naslund will take on same office, analysis and writing responsibilities Dennis Marks will remain in the field to supervise survey efforts for the remainder of the season In the event that Nancy Naslund or Dennis Marks leave before the project's completion, replacements will be hired on an ASAP basis

2 Quality Assurance and Control Plan

Quality control will be provided for the dawn watch, the basic sampling method, by training all field personnel in Anchorage and in Seward The training program will consist of three phases Trainees will first attend an introductory lecture explaining survey procedures and initial instruction on murrelet identification using videos of flying murrelets and audio recordings of murrelet calls and calls of other species that may be encountered The next phase will include three days during which trainees are instructed in the field (Seward) on the identification of flying murrelets and their calls, behavior classifications, and proper completion of data forms Finally, trainees will be tested in the field Successful completion of the course will occur when a trainee adequately records 80% of the murrelet detections recorded by the instructor during a dawn watch survey We will establish a training area with several flagged landmarks of known distances where field personnel can practice and be tested on accuracy of distance estimations Visual sightings of calling murrelets will then

be used for interpreting distances and heights of murrelets that are heard but not seen Field personnel will also be trained in the use of compass and inclinometer and in recording data for the vegetation plots

Field personnel will use aerial photographs, maps and a hand-held Global Positioning System to record the location of the exact survey site Data taken on hand-held tape recorders during the dawn watch will be transcribed by the observer as soon as possible, using the data sheet developed for this study The data sheet will be field-checked by the field supervisor, entered at the USFWS Anchorage office, checked against the raw data and corrected

All reports will be submitted to Office of Oil Spill, USFWS for internal review, followed by the Trustee Council peer review process The reports submitted by contractors for the radio-tagging and marine radar pilot studies will also be subject to the Trustee Council review process

3 List of Products

There will be three products

1) A final report on the 1993 results that will compare murrelet and vegetational data on the south Kenai Peninsula, and which will integrate all available murrelet and vegetational data (1990-1993) from Prince William Sound, the Kenai Peninsula and Afognak Island

2) A report on the use of marine radar to monitor murrelets, to be submitted by the contractors and subject to internal FWS review as well as the Trustee Council peer review process

3) A report on the capture and radio-tagging efforts, submitted by the contractors and subject to internal FWS review as well as the Trustee Council peer review process

G Personnel Qualifications

1 Project Manager Kenton D Wohl

Kent has worked on the monitoring and management of marine and coastal birds for over 20 years He has collaborated with Russian scientists on the conservation and management of Beringian seabirds As Nongame Coordinator for Region 7, Kent oversees a staff of 5 full-time biologists and during the summer field season, he supervises an additional temporary staff of 20 people Kent's career has been based in Alaska, and he is familiar with the logistical requirements of field projects in remote areas

Kathy Kuletz received her B S degree in biology from The California Polytechnic State University, San Luis Obispo, and her M S degree in Ecology and Evolutionary Biology from the University of California, Irvine, in 1974 and 1983, respectively Her thesis, based on research done at Naked Island, PWS, was on foraging and reproductive success of pigeon guillemots (*Cepphus columba*) Ms Kuletz has worked in Alaska since 1976 for Dames and Moore Consulting, LGL Alaska Research and the U S Fish and Wildlife Service She has studied inland lakes and streams, shorebird breeding on the North Slope, conducted waterfowl seabird surveys in relation to environmental disturbances from petroleum and mining developments In 1988 she conducted an independent study on at-sea censusing of murrelets for the Alaska Maritime National Wildlife Refuge Since 1989, Ms Kuletz has been P I for the marbled murrelet damage assessment study and the restoration feasibility study for marbled murrelets She has also been co-Project leader and co-author of the Pigeon Guillemot damage assessment study While engaged in seabird studies over the past 15 years she has managed study design, data collection, analysis and reporting of seabird populations, foraging and productivity In the past three years she has been actively involved in developing and updating the Pacific Seabird Group's (PSG) protocols for murrelet surveys, nest site documentation and management guidelines

Selected Seabird Publications

Kuletz, K J 1983 Mechanisms and consequences of foraging behavior in a population of breeding pigeon guillemots M S thesis, University of California, Irvine 79pp

_____ 1991 Restoration feasibility study number 4 - identification of upland habitats used by wildlife affected by the EVOS marbled murrelets Final rep , U S Fish and Wildl Serv , Anchorage, Alaska

Kuletz, K J , D K Marks, N L Naslund, and M B Cody In press Marbled murrelet activity in four forest types at Naked Island, Prince William Sound, Alaska Proceedings of the Pacific Seabird Group's Marbled Murrelet Symposium, 1993

Naslund, N L , K J Kuletz, M B Cody, and D K Marks In press Tree and habitat characteristics at fourteen marbled murrelet tree nests in Alaska Proceedings of the Pacific Seabird Group's Marbled Murrelet Symposium, 1993

2 Assistant Project Leader Nancy Naslund

Nancy Naslund received her B A degree in biology in and will receive her M S degree in marine biology from the University of California, Santa Cruz, in 1985 and 1993, respectively Ms Naslund's B A thesis encompassed the distribution and abundance of seabirds and shorebirds along the Big Sur coast of Central California Her M S thesis research was on the breeding biology of marbled murrelets and their seasonal use of inland nesting areas in central coastal California This work led to the discovery of two murrelet tree nests and represents the first in depth study on murrelet breeding behavior Part of this study also resulted in the development of a ground search technique for locating murrelet tree nests In addition, Ms Naslund has conducted field work since 1980 on a variety of terrestrial and marine bird species including the California least tern (*Sterna antillarum*), peregrine falcon (*Falco peregrinus*) and California condor (*Gymnogyps californianus*) Ms Naslund was part of the 1991 team and supervised the 1992 team for the marbled murrelet restoration feasibility study, and performed analysis and report writing duties Ms Naslund heads subcommittees on developing two new PSG protocols and has also been involved in updating other PSG protocols

Selected Seabird Publications

Kuletz, K J , D K Marks, N L Naslund, and M B Cody In press Marbled murrelet activity in four forest types at Naked Island, Prince William Sound, Alaska Proceedings of the Pacific Seabird Group's Marbled Murrelet Symposium, 1993

Marks, D K , and N L Naslund In press Predation on a breeding adult marbled murrelet at a nest site Proceedings of the Pacific Seabird Group's Marbled Murrelet Symposium, 1993

Naslund, N L In press Ecological and conservation implications of attendance by marbled murrelets at old-growth forest nesting areas during the non-breeding season Auk

Naslund, N L , K J Kuletz, M B Cody, and D K Marks In press Tree and habitat characteristics at fourteen marbled murrelet tree nests in Alaska Proceedings of the Pacific Seabird Group's Marbled Murrelet Symposium, 1993

Singer, Singer, S W , N L Naslund, S A Singer, and C J Ralph 1991 Discovery and observations of two tree nests of the marbled murrelet Condor 93 330-339

3 Assistant Project Leader Dennis Marks

Dennis Marks completed his B S degree in biology at the University of California, Irvine, and his M S degree in biology at the University of Oregon Institute of Marine Biology in 1979 and 1986, respectively His M S research was on the feeding ecology of several species of bottom fish In 1990 he participated in the marbled murrelet and pigeon guillemot damage assessment studies In 1991 he coordinated various field logistics of the marbled murrelet restoration study In 1992 he supervised the PWS boat survey studies and performed analysis and report writing duties Previous to these studies, Mr Marks spent several years coordinating field projects on the west coast and abroad

Selected Seabird Publications

Kuletz, K J , D K Marks, N L Naslund, and M B Cody in press Marbled murrelet activity in four forest types at Naked Island, Prince William Sound, Alaska Proceedings of the Pacific Seabird Group's Marbled Murrelet Symposium, 1993

Marks, D K , and N L Naslund in press Predation on a breeding adult marbled murrelet at a nest site Proceedings of the Pacific Seabird Group's Marbled Murrelet Symposium, 1993

Naslund, N L , K J Kuletz, M B Cody, and D K Marks in press Tree and habitat characteristics at fourteen marbled murrelet tree nests in Alaska Proceedings of the Pacific Seabird Group's Marbled Murrelet Symposium, 1993

H Budget ($000)

(See attached budget sheets, Forms 2A and 2B)

There have been several modifications to the budget as presented with the preliminary draft study plan The proposed budget for FY93 (March - Sept, 1993) has decreased by $29 7 K, from $301 4K to $271 7K The proposed budget for FY94 (Oct 1993 - March 1994) has increased by $41 5K, from $30 0K to $71 5K These changes are described in detail below

1 The principal investigator will use R15 funds through June, 1993, to complete analysis and finalize reports from the 1992 season Therefore, only 3 months ($12K) have been budgeted for the PI to work on 93051 B in FY93

2 The wildlife biologist (GS9) position, originally budgeted for 9 months ($29 7K), is budgeted for 7 months ($23K)

3 A bio-statistician will be hired for 4 months ($16K) in FY93 to assist in analysis of 1993 data and the integrated, multivariate analysis of all existing murrelet and habitat data

4 The murrelet surveys in Prince William Sound, requiring a $60K boat contract, one field supervisor and four biotechnicians, have been dropped from this study proposal The $60K for the boat was included in the Forest Service budget for 93051 B, so this savings will be reflected in their budget We changed this aspect of the proposal because we determined that the project would benefit more by integration of all existing murrelet data, and by including key vegetation and habitat features which recently became available on GIS or are obtainable independently by the Forest Service

5 The original proposal was for $20K to contract the entire pilot radio-tagging study We have determined that that amount was insufficient to adequately test the feasibility of capturing and radio-tagging murrelets in Southcentral Alaska Therefore, we have budgeted $40K for the pilot radio-tagging effort This amount includes the boat contract ($17K) and the services of the capture and tagging professionals, equipment, travel and per diem ($23)

6 We have added $4K to contract experts in the use of marine radar to monitor murrelet dawn activity This minor effort could ultimately provide information which will assist in the interpretation of dawn watch data (ie , converting murrelet activity levels to abundance estimates) If successful, the use of radar could be a cost-efficient means of surveying for murrelets in the spill zone

7 The FY94 budget is higher due to retaining personnel for data analysis and report writing, and includes anticipated increases in salaries The original budget was $30K for personnel and is now $71 5K This increase covers the principal investigator (6 months, $24K) and two wildlife biologists (6 months, $19 5K each) from October, 1993 through March 1994 The amount and complexity of data requires this level of personnel funding for completion of 93051 B The new FY94 budget also includes $2K for updating of software programs and miscellaneous office needs

Project Description Characterize the nesting habitat of murrelets in the spill affected area Project has 2 elements 1) conduct dawn watches and habitat surveys along the south Kenai Peninsula and combine all data from previous surveys in Prince William Sound with new habitat data to determine what habitats are used most 2) radio telemetry feasibility study

Budget Category	Approved 1-Oct-92 28-Feb 93	Proposed* 1-Mar-93 30-Sep-93	Total FY 93	FY 94**	FY95	FY 96	FY 97	Sum FY 98 & Beyond
Personnel	$57 5	$106 0	$163 5	$63 0				
Travel	$0 0	$20 0	$20 0	$0 0				
Contractual	$0 0	$102 0	$102 0	$0 0				
Commoditities	$0 0	$5 0	$5 0	$0 0				
Equipment	$0 0	$14 0	$14 0	$2 0				
Capital Outlay	$0 0	$0 0	$0 0	$0 0				
Sub-total	$57 5	$247 0	$304 5	$65 0	0 0	0 0	0 0	0 0
General Administration	$8 6	$24 7	$30 5	$6 5				
Project Total	66 1	$271 7	$335 0	$71 5	0 0	0 0	0 0	0 0
Full-time Equivalents (FTE)	0 9	2 3	3 2	1 5				

Amounts shown in thousands of dollars

Budget Year Proposed Personnel

Position	Months Budgeted	Cost	Comments
Principal Investigator	3 0	$12 0	
Program Manager	2 0	$10 0	
Supervisory Biologist	0 5	$ 3 0	
Wildlife Biologist	7 0	$23 0*	
Wildlife Biologist/ Statistician	4 0	$16 0	
Biotechnician (4)	14 0	$42 0*	

Project Number 93051 Part B
Project Title Information Needs for Habitat Protection
Sub-Project Marbled Murrelet Habitat Identification
Agency Dept of Interior Fish & Wildlife Service

FORM 3A SUB-PROJEC DETAIL

1993

		Proposed
Travel	To and from Whittier (road, train) and to and from Prince William Sound, Seward and Homer (floatplane, boat), and perdiem (subsistence)	$ 20 0
Contractual	GIS support (20K), boat charter in south Kenai Peninsula (25K), contract for murrelet radio telemetry study (includes services, travel, equipment, radio tags, air time for radio tracking) (23K), boat charter for capture/tagging effort in Prince William Sound (17K), contract for pilot study on use of marine radar to survey murrelets (4K), safety training (5K), warehouse (3K), inflatable boat & outboard motor maintenance (5K)	$102 0
Commodities	Backpack/camp food, fuel	$ 5 0
Equipment	Computer software (SAS update and Atlas GIS) (4K), GPS (2K), Aerial photograghy (2K), Replacement of field gear and technical forestry supplies (6K)	$ 14 0

Project Number 93051 Part B

Project Title Information Needs for Habitat Protection / Marbled Murrelet Habitat Identification

Agency Dept of Interior, Fish & Wildlife Service

FORM 2B

PROJECT

DETAIL

1993

93051 Part C

DRAFT - DETAILED RESTORATION PROJECT DESCRIPTION

Project Title	Habitat Protection Information for Anadromous Streams
Project ID#	93051 Part C
Project Type	Survey
Project Leader(s)	Steven V Zemke
Lead Agency	USDA Forest Service
Cooperating Agencies	Alaska Department of Fish and Game
Project Cost	$363,000 (FY 93) $114,000 (FY 94)
Start Date 1 March 1993	**Finish Date** 30 September 1993
Geographic Area of Project	Prince William Sound, Kenai Peninsula, Alaska Peninsula, Afognak Island, Kodiak Island
Project Leader Signature	Steven V Zemke
Project Manager	
Name	Kenneth Holbrook
Signature	Kenneth E. Holbrook

A. Introduction

Anadromous fish were injured by oil contamination from the Exxon Valdez oil spill of March 1989 The oil spill affected anadromous fish in several ways, pink salmon had high egg and fry mortalities, reduced growth rates, and possible morphological abnormalities; sockeye salmon suffered poor smolt survival due to over escapement Besides the oil spill impacts, freshwater rearing habitat for anadromous fish within the area may be influenced by habitat modification, especially logging (Murphy, el al, 1986) Frissel, et al, 1986, advocated that classification of streams and the habitat contained would be useful in determining the impacts of land use practices, assessing basin wide cumulative effects of the management practices on the stream habitats, and would provide useful generalized information on stream habitats from site specific data. The USDA Forest Service, Region 10, Chugach National Forest channel type system (USDA-FS, 1990) provides a powerful tool in viewing streams in this watershed framework As such, the stream channel classification project will provide detailed information on the locations and characteristics of fish habitat and services of injured resources so that habitat/protection options may be evaluated

Channel typing is basically a dichotomous keying system Physical characteristics of streams such as width, gradient, basin area, substrate, side slopes, and a host of other variables are used to characterize stream segments into a given "channel type " Channel type designations allow quick identifications of what physical and/or hydrological processes are occurring or may occur within a given segment of a stream They also broadly identify relative fish habitat spawning and rearing capability for a given stream segment Channel types, in their simplest form, provide managers with an inventory of general habitat characteristics, their location, and in what quantities. Specific fish habitat data is also collected for a given channel type so that habitat conditions may be characterized These habitat conditions will be applied to other stream segments having similar channel types, eliminating the necessity to collect redundant data for thousands of channel type segments within the project area

The stream classification study will also provide a Geographical Information System (GIS) based tool allowing comparative evaluations of streams throughout the area affected by the oil spill The R10 Channel Type system is a unique system developed for the classification of streams within the Tongass National Forest. It has been modified to fit the streams within the Chugach National Forest The streams within the oil spill affected areas, western Prince William Sound, Afognak Island, Kodiak Island, lower Kenai Peninsula, and the Alaska Peninsula, have not been field verified Protocols for modifying the initial classification of the stream channel types have not been established and will be an integral part of the field verification Project work sites will be stratified using geographic and ecological provinces within the inventoried area

The project will gather detailed information on the stream channel types, which will provide a comprehensive evaluation of the watersheds fish habitat value and the comparative sensitivity of the stream system to management related changes Individual channel type units are defined by their physical attributes, such as channel gradient, channel pattern, stream bank incision and containment, available fish habitat rearing and

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spawning areas, and riparian plant community composition The channel type inventory will provide key information on fish habitat utilization, fish habitat capability, and fisheries enhancement options in survey area watersheds This information will be extrapolated to all watersheds affected by the oil spill

B Project Description

1 Resources and/or Services

The project gathers detailed information on the characteristics of anadromous fish habitats so that habitat protection and/or acquisition options can be objectively evaluated

2 Objectives

The primary objective of this study is to develop channel typing procedures that will allow comparative evaluations of the fish habitat on private and public lands within all areas affected by the oil spill This classification will focus on providing a GIS based tool allowing comparative evaluations of streams throughout the oil spill affected area Specific objectives are

a develop consistent and reproducible descriptions and interpretations for a wide range of stream channels and associated watershed areas,

b identifying stream habitat capabilities and limitations,

c extrapolating stream morphology, fish habitat, and riparian resource data to non sampled areas,

d providing a mechanism for stratifying sampling sites for a representative data sampling design, and

e providing a framework for an aquatic resource accounting using a Geographic Information System

3 Methods

Channel Types are stratifications of stream drainage networks into segments that are distinct functional units with homogeneous characteristics Channel form at any location in a basin depends on the, 1 stream flow quantity and velocity, 2 quantity and character of the sediment moving through the section, and 3 the character or composition of the materials making up the bed and banks of the channel There are eight observable stream channel features that can be used to characterize these factors discharge, channel width and depth, mean velocity,

sediment load and size, water surface slope, and roughness of the channel materials (Leopold et al 1964) These parameters are the basis for the differentia delineating channel types

Using these basic criteria, channel types will be initially interpreted and mapped on aerial photography The representative stream segments will be identified on aerial photos for field evaluation (premapping) Then, during field verification, individual stream sites are fully evaluated for their channel type characteristics After sampling, the original mapping is then reevaluated for accuracy Where necessary, channel type segments are remapped to correspond to the field findings The field data is then analyzed for a more refined characterization of individual channel type characteristics The data is correlated and the channel types digitized on a GIS Finally, a written report will detail methods and results

a Premapping

Premapping will involve the mapping of all affected areas and drawing these identified stream segments on orthoquad photos Affected watersheds are identified by the Forest Service Aerial photos are collected for all affected areas Interpretation of the channel types on the large scale aerial photos (1 15,840 or 4 inches = 1 mile) will be completed for the Prince William Sound area, and Afognak Island PWS and Afognak Island will have all first order (Strahler, 1957) and larger channels mapped For Kodiak island, southern Kenai Peninsula, and the Alaska Peninsula, only 1 inch to the mile (1 63,360) resource photography is available Within these areas, stream segments identified within the Alaska Department of Fish and Game Anadromous Stream Catalog (1988) will be classified Other stream segments will be mapped but not be classified Persons performing premapping will use the differentia described in Appendix 2 to identify the individual channel type segments These photo interpretations are then delineated on orthoquad photos These pre-field verified photos are used as the basis for the next stage of field verifying the aerial photo interpretation calls

b Field Verification

Field verification requires the sampling of representative areas of a given channel type segment The primary reason for field verification is to determine if the channel type mapping, based on aerial photographic interpretation, is accurate The secondary reason for field verification is to characterize key physical features associated with the various channel types measured in the field, to better define the channel type classification units

1 Site Selection All verification sampling will use a representative site to characterize the physical properties of an entire channel type segment The term "site" refers to a short representative channel area that is a subset of the entire segment, and can be used as the sampling unit Sample sites will represent a channel area having physical features that occur most frequently for the segment

being sampled These features, which are present or absent within the segment as a whole, will generally have the same occurrence frequency in the site The predominant ranges in physical dimensions that occur for key features throughout the segment also occur similarly within the site The site will also demonstrate the spatial patterns of features occuring over the entire segment The site will not necessarily be uniform in its physical characteristics Rather, the variation in these characteristics will occur in an amount and pattern similar to that of the entire segment

Sampling begins only after the site has been confirmed to be representative Representative sites are selected from "potential" sampling sites in the office before field verification In the field, a ground survey of several hundred yards is used to determine if the potential site represents the segment Sites disturbed by road construction, mining, recreation, or other developments will not be sampled Sites downstream of such developments will be noted as such on the data card

The length of each sample site will be, (1) two pool/riffle sequences, (2) ten times the channel bank full or, (3) 330 feet, whichever is least, but sample length will always be greater than 100 feet Sampling will occur at low flow stage, which is one-third or less of the bank full stage

2 Data Collection The Region 10 Channel Type Classification System (USDA-FS, 1990) data entry and data collection methods will to be used at each sample site Data records collected are listed on the Channel Type Verification Data Card (Appendix 1)

c Final Mapping/Manuscripting

This phase will take the field verification efforts and correlate them to the premapping products First the indiviual channel type segments will be reviewed If needed, the segments are changed on the basis of the correlation of field data with the premapped diffrentia The mapping differentia will be compared to the field information, and the differentia will be modified to fit the ground truths Here, experienced premappers that have been out with the crews during the field verification will develop final aerial photo delineations The premapped orthoquads or aerial photos will be re-examined and changed to fit the new differentia Here, persons experienced in preparing manuscripts will perform the task

d GIS Mapping/Correlation

Data analysis will focus on using the channel type segments to figure out habitat value and quality Classification is achieved using multi-parameter analysis and ecological judgment The GIS mapping effort will encompass three steps First is the digitizing from the manuscripts and/or aerial photos The second part is to check the GIS generated plots to validate their accuracy The final work will be

to attribute the channel types onto the GIS plots Also included in this step is to attribute other information, if available, into the database The process will be to use computer programs designed to fit existing flat file information, such as ADF&G escapement data files, into the GIS network (USDA-FS, 1993) A one-way analysis of variance (ANOVA), using general linear model procedures in SAS (1988), will be used to compare habitat units among channel types

e Report Writing

The final product generated will include a final report presenting methods, results, discussion of results, and conclusions regarding this proposal The report will include a correlation of the channel type analysis, and detailed descriptions of channel type attributes that will provide a companion volume to the GIS mapping

4 Alternatives

As stated, the R10 channel type system is a hierarchical classification system specific to stream habitats of the coastal areas of Southcentral and Southeastern Alaska No other comparative system exists that provides measures of stream habitat capability and sensitivity that can be extrapolated to watersheds over a large geographical area Perhaps the key to successful channel typing is the interpretation and delineation of the channel types on low level aerial photos Two experiences favor the use of "in-house" work The Chugach attempted to contract the premapping of the Glacier Ranger District streams The contract went to a person (the only bidder on the contract) with a strong hydrology education and extensive aerial photo interpretation skills The results were channel type maps that had to be redone by a person experienced in channel typing involving four weeks work

Successful channel type classification was obtained through a 1987 to 1989 contract with the State of Alaska Thes work was accomplished by previously experienced channel type mappers Unfortunately, the people involved in the work have since left the agency Conversely, environmental contracting firms throughout the area are not known to have specialized experience with the Region 10 channel typing system, and contracting with such firms could lead to problems previously identified on the Chugach

The cost of contracting will exceed the cost of doing the work in-house The channel type contract work on the Tongass was performed at 10 cents an acre Contract price for completion of the approximately six million acres is estimated to be $675,000, based on the 10 cents per acre (1989 ADF&G Contract) The estimated cost, with overhead, profit and risk factors estimated, is $866,000 This is compared to the $360,000 estimated for in-house completion Finally, there is an estimated four month time-frame for contract preparation, advertisement, and award This puts award well into the field season

5 Location

The project area within which the study sites are located includes the entire oil spill zone in PWS, Afognak Island, Kodiak Island, Kenai Peninsula, and the Alaska Peninsula PWS and Afognak Island will have all first order and larger stream channels mapped and digitized Stream segments identified by the ADF&G anadromous stream catalog within coastal areas affected by the oil spill (Kodiak Island, southern Kenai Peninsula, and the Alaska Peninsula) will be channel typed The precise location of the study sites will be determined based on their representativeness within the stratified random sample for the study area

6 Benefits

This project will provide detailed information and characterizations of anadromous fish habitat within the oil spill area This information will provide the cornerstone for evaluating habitat protection/acquisition options within the oil spill area and biophysically similar watersheds within the areas affected by the oil spill

The channel type system is designed to describe the structure and relationships of similar streams and simplify these relationships to general statements can be made about them By developing consistent and reproducible descriptions for stream channels, channel types become a means of distinguishing the various parts of a stream system These characteristics will allow definition of the characteristics of the channel and predict, with a high degree of accuracy, probable responses to natural and human influences

Channel types will provide the identification of stream capabilities and limitations The stream inventory data will include relevant data relating to fish habitat capability, including available spawning area, available rearing area, and large woody debris volume Tabular summaries of qualitative ratings for spawning and rearing habitat capability will be developed These ratings will be based on a combination of habitat inventory, fish population sampling, and professional judgment of fisheries biologists and hydrologists involved with the projects These ratings will give a general picture of the potential quality of fish habitat associated with a given stream channel The table will also describe various habitat characteristics, including spawning habitat distribution, the type and distribution of large woody debris habitat, pool characteristics, over wintering habitat, stream bank cover, and other important features associated for the channel types These habitats or stream classification units provide the basis for extrapolating stream morphology, fish habitat, and riparian resource data, to non-sampled areas This in turn will provide for comparative evaluations of watersheds within PWS, Afognak Island, and oil spill affected watersheds within Kodiak Island, southern Kenai Peninsula, and the Alaska Peninsula

Final products to be generated will include a final report presenting methods, results, discussion of results and conclusions regarding this study The report will

include a set of GIS based maps of all streams within the survey areas The report and GIS maps will provide the basis for rule based models developed to assess the comparability of streams within oil spill areas

7 Technical Support

No support from technical working groups is needed This project will require 41 person months of effort in FY 93 Steven Zemke will dedicate six months to the project and will act as project leader and primary author of the project report Field work will be accomplished by four crews of biotechnicians each composed of a fish habitat ecologist and/or hydrologist The crews will work for three months

8 Contracts

To accomplish the necessary travel to remote study sites, this project will require the chartering of two live aboard vessels, carrying two crews for ten day work periods The boats will be contracted by the USDA Forest Service The contract time for these boats will be 40 and 24 days respectively

9 Mitigation Measures

No mitigation measures will be required

10 Literature Cited

Fissell, C A , W J Liss, C G Warren, and M D Hurley 1986 A hierarchical Framework for stream habitat classification viewing streams in a watershed context Envir Mgt 10(2) 199-214

Martischang, M F 1993 A technique for moving existing habitat data sets into the spacial environment of a geographical information system FHR Currents 11 1-17

Murphy, M L , J Heifetz, S W Johnson, K V Koski, and J F Thedinga 1986 Effects of clear-cut logging with and without buffer strips and juvenile salmonids in Alaskan streams Can J Fish Aquat Sci 43 1521-1533

SAS Institute, Inc 1988 SAS/STAT Users Guide, Release 6 03 Cary, N C , SAS Institute, Inc 1028p

Strahler, A N 1957 Quantitative analysis of watershed geomorphology, Trans Am Geophys Union 38 913-920

USDA-FS 1990 DRAFT - Alaska Region Channel Typing System Forest Service

C Schedules and Planning

The schedule work is divided into five distinct segments These are (1) Premapping, (2) Field verification, (3) Final mapping, (4) GIS mapping and data loading, and (5) report compilation The sum of these efforts produce a final map and correlated field data for areas affected by the oil spill The following is the schedule for completion of each of the five phases of the project

1 Premapping Time Requirements

Area	Duration	Total Time	Timeframes
Data Acquis	2 weeks	10 days	June
Chugach NF	2 weeks	10 days	June
State & Priv	3 weeks	10 days	July
Afognak	2 weeks	10 days	June
Kodiak	1 week	5 days	July
Kenai	1 week	5 days	August
Alaskan Pen	1 week	5 days	August

2 Field Verification

Sub-task	Duration	Crew Time	Timeframes
Training	3 weeks	120 days	June-July 2
Field verification	9 weeks	405 days	July-August
Database management	4 weeks	40 days	September

3 Final Mapping/Manuscripting

Sub-task	Duration	Crew Time	Timeframes
Photo remapping	14 weeks	140 days	August-September
Orthoquad mapping	10 weeks	100 days	Sept-October

4 GIS Development

Sub-task	Duration	Crew Time	Timeframes
Digitizing	15 weeks	150 days	October-November
Check plotting	2 weeks	10 days	Nov-December
Attributing	15 weeks	150 days	December-January

5 Final Report

Sub-task	Duration	Crew Time	Timeframes
Correlation/Report	12 weeks	120 days	January-April

6 Overall Project Schedule

Phases	Timeframe	People	Person days
Premapping	April-August	3	55 days
Field Verification	May-September	8	565 days
Final Mapping	October-Dec	4	240 days
GIS Work	Jan-April	4	310 days
Correlation/ Report	Jan-April	2	120 days
Total	93Feb-94May	n/a	1290 days

D Environmental Compliance/Permit/Coordination Status

This project qualifies for a categorical exclusion under terms of the National Environmental Policy Act

E Performance Monitoring

Steve Zemke will coordinate project design and implementation Mr Zemke is responsible for completion of reports and GIS based mapping Robert Olson will provide general coordination of field operations, with assistance from Zemke Zemke and Olson, with assistance from Jay Perlberg will jointly work on data analysis and reporting

Quality control is accomplished through several methods Training for field crews on the R10 channel type system is planned for two weeks, prior to initiation of field work The training includes indoctrinations on the basic field procedures used, followed by actual applications of the methods in the field The field crews will be assessed for accuracy and consistency in characterizing channel types During all field inventory tours, Olson and/or Zemke will join field crews to provide technical assistance and ensure high standards in data collection

F Personnel Qualifications

Project Leader Steve Zemke received his B S in fisheries science from the University of Idaho in 1973 Steve has worked for the USDA Forest Service as a fisheries biologist on national forests within Idaho, Oregon, and Alaska He has extensive experience in planning, inventory, and enhancement of anadromous fish resources From 1985-1990 he was fisheries program leader on the Ketchikan Area of the Tongass National Forest A primary accomplishment of his tenure was the completion of the R10 channel type system on the Ketchikan Area Steve has six years experience in aerial photo interpretation and channel type correlation Steve is currently the Chugach National Forest Fish Habitat Relationships Coordinator The emphasis of this position is the development and application of fish habitat ecological classifications for the Forest, including the stream channel type classification for Prince William Sound

Robert Olson Robert Olson received his M S in aquatic ecology from the State University of New York in 1983 Robert has worked for the USFWS on Kodiak Island performing research on red salmon population dynamics He has extensive Alaskan field experience, and has a detailed background in statistical analysis He has also worked as the Chugach National Forest Fish Habitat Relationships Coordinator, and was the previous Chugach National Forest Channel Type Program Manager He is extremely familiar with PWS and the R10 channel type system

Jay Perlberg Jay has conducted channel type inventories within the Tongass National Forest, Ketchikan Area and the Chugach National Forest, Seward Ranger District He has extensive experience in aerial photo interpretation, channel type mapping, and R10 channel type field inventory He has been extensively involved in the development of the GIS stream channel type mapping

G Budget

(see attached budget sheets)

Project Description Develop channel typing procedures that will allow comparative evaluation of stream habitat on public and private lands

Budget Category	Approved 1-Oct-92 28-Feb-93	Proposed* 1-Mar-93 30-Sep-93	Total FY 93	** FY94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond
Personnel	$0 0	$133 9	$133 9	$99 0				
Travel	$0 0	$10 0	$10 0	$0 0				
Contractual	$0 0	$128 4	$128 4	$0 0				
Commodities	$0 0	$20 0	$20 0	$0 0				
Equipment	$0 0	$36 7	$36 7	$0 0				
Capital Outlay	$0 0	$0 0	$0 0	$0 0				
Sub-total	$0 0	$329 0	$329 0	$99 0	$0 0	$0 0	$0 0	$0 0
General Administration	$0 0	$34 0	$34 0	$15 0				
Project Total	$0 0	$363 0	$363 0	$114 0				
Full-time Equivalents (FTE)		5 1	5 1	2 5				

Amounts are shown in thousands of dollars

Budget Year Proposed Personnel

Position	Months Budgeted	Cost
Principal Investigator (1)	6 0	$28 6
Fisheries Biologist (1)	4 0	$14 3
Fisheries Technician (8)	32 0	$56 8
Program Manager (1)	1 0	$4 0
GIS Technician (2)	8 0	$35 0
Clerk/Typist (1)	6 0	$15 0

Comment

* FY 93 is a transition year from the previously used oil fiscal year to the federal fiscal year This new project also includes proposed funding for January and February, 1993

** Funds for Fy 94 are for project termination which would include final report and GIS data entry

Project Number 93051 Part C
Project Title Information Needs for Habitat Protection
Sub-Project Channel Typing
Agency Dept of Agriculture, Forest Service

FORM 3A SUB-PROJECT DETAIL

		Proposed
Travel	Air fare to Cordova, Kodiak, Alaska Peninsula, Homer and Seward (eight trips, Three people per trip, each eight trips @ $250 RT)	$6 0
	Per diem (Three people for 60 days @ $90/day)	$16 2
Contractual	Helicopter Charter (30 days @ $2200/day)	$66 0
	Boat Charter (64 days @ $950/day)	$62 4
Commodities	Maps, photographs, stream survey forms, GIS supplies	$20 0
Equipment	Stream survey equipment and supplies	$36 7

APPENDIX 1 -

USDA Forest Service - Chugach National Forest
CHANNEL TYPE VERIFICATION CARD

DATE _____ SITE ID _____ RANGER DISTRICT _____

MERIDIAN _____ TOWN-SHIP ____ RNG ____ SECT _____ 1/4 SECT ____

QUAD _____ ADF&G #· _____

STREAM _____ CREW _____

AEROPHOTO YR _____ FLT _____ ROLL _____ PHOTO _____

CAMERA PHOTOS
UPSTREAM ROLL _____ PHOTO _____
DOWNSTREAM ROLL _____ PHOTO _____

PRELIM CT _____
FINAL CT _____

****

WATER _____ °C AIR _____ °C WEATHER. _____

ADJACENT LANDFORM & VEGETATION SITE DISTURBED Yes / No

LEFT BANK LANDFORM - _____ LB CANOPY TYPE - _____

RIGHT BANK LANDFORM - _____ RB CANOPY TYPE - _____

COMMENTS _____

SG/DT ____%/____ METHOD Clino Clino w/Poles HD

SG - stream gradient DT - distance of gradient shot ft/m

OUTBURST FLOOD POTENTIAL (H - High, L - Low, N - Negligible)

GLACIAL ____ LANDSLIDE OR AVALANCHE ____

INCISION DEPTH (measured in meters)

RIGHT	<1	1 - 2	2 - 4	4 - 6	6 - 10	10 - 20	>20
LEFT	<1	1 - 2	2 - 4	4 - 6	6 - 10	10 - 20	>20

****

BASIN AREA _____ sq mi PRECIPITATION _____ in

% LAKE _____ SITE ELEV _____ ft MAX ELEV _____ ft

Revised 05/16/90 jdb

SUBSTRATE			STREAM PATTERN
Tally			SINGLE
_____	BEDROCK	_____ % (>3 FT)	MULTIPLE
_____	SM BOULDER	_____ % (10 IN TO 3 FT)	BRAIDED
_____	LG RUBBLE	_____ % (5 TO 10 IN)	
_____	SM RUBBLE	_____ % (2 5 TO 5 IN)	BANK CONTROL
_____	CRS GRAVEL	_____ % (1 TO 2.5 IN)	BEDROCK
_____	FINE GRAVEL	_____ % (4 MM TO 1 IN)	MIXED
_____	VFG/SAND	_____ % (<4 MM)	COARSE SEDIMENTS
_____	ORG MCK/SILT	_____ %	FINE SEDIMENTS
			FIBROUS ORGANICS

STREAM GEOMETRY UNITS - feet meters

	BF								BF
DISTANCE (n n)									
BF DEPTH (n nn)									
ACTIVE DPTH (n nn)	LEFT BANK								RIGHT BANK

	BF	AW
START		
END		
WIDTH		
- 5 -		(rnd down)

	ASA %	ARA %	POOL %	MN P DEPTH
				ft

SPAWNING GRAVEL QUALITY _____

	OBSVD	LIFESTAGE	IDENTITY
FISH			

TRANSECT LENGTH - _____ ft

COMMENTS

APPENDIX 2 LASSIFICATION CRITERIA

REVISED 11/01/89 INCORPORATES REVISIONS AGREED TO AT CT CORRELATION MEETING 10/23-27 1989, JUNEAU AND ALSO 12/89 REVISIONS

SUMMARY OF THE DIFFERENTIA USED TO MAP TONGASS NATIONAL FOREST CHANNEL TYPES

Channel Type Description	Gradient Width Pattern Vegetation	Control Process Substrate	Basin Area Landfrom Side Slope Incision	Comments and Special Mapping Conventions
A1 - Forested steep mnt slope channel (also unforested 3/90)	>15% Gradient <15 M Width Single channel C9 C7 C4 C5 C1 B1 A1	Bedrock Transport Br Bldr Rubb	Small 30's 40's 10 s 51 >10 M >100% <50 M Incision	Linear channel pattern, Very high gradient V-notch
A2 - Forested high grad upper valley channel	6 - 15% Gradient </ 20 M WIDTH Single channel C5 C3 C1 C4 B1	BR - Mixed Transport BR Bldr Rubb	Small - Moderate 30's 40's >20 M, <100% <50 M Incision	A2 CT s associated w/ upper valley development
A3 - Forested, high gradient alluvial cone channel (also unforested 3/90)	>6% @ Midpoint VARIABLE Single - Multiple ALL B'S AND C'S	Alluvial to mixed Transport/Storage C Grv - BLDR	Small - Moderate 52 51 <2 M </ 4 M Incision	Minimum legnth is 200 M Poor flow containment no side slope developmt Exclusively assoc with the alluvial cone landform
A4 - Very high gradient mountain slope cascade channel	>/ 15 % gradient Variable width Single Channel All C's A's B1	BR but may vary Transport BR, Bldr Rubb	Small 10 40 s, 51 52 <10 M <10 M Incision	Waterfalls & steep cascades very common
A5 - Lowland high grad incised muskeg channel	6 - 20% Gradient 6 - 15 M Width Single Channel C9 C5 C4	Bedrock Transport BR Bldr Rubb	Small - Moderate 60's 40's 36 6 - 20 M >100% 6 - 20 M Incision	May appear in high elev headwaters abrupt incision containment excellent
A6 - High grad shallow - moderate incision lowland, muskeg channel	6 - 15% Gradient </ 10 M Width Single Channel C4	BR - Mixed Transport BR - Rubble	Small - Moderate 60's 40's, 36 <6 M Side Slope <6 M Incision	Well contained w/ mod - shallow incision

REVISED 11/01/89 INCORPORATES REVISIONS AGREED TO AT CT CORRELATION MEETING 10/23-27 1989 JUNEAU AND ALSO 12/89 REVISIONS

SUMMARY OF THE DIFFERENTIA USED TO MAP TONGASS NATIONAL FOREST CHANNEL TYPES

Channel Type Description	Gradient Width Pattern Vegetation	Control Process Substrate	Basin Area Landfrom Side Slope Incision	Comments and Special Mapping Conventions
A1 - Forested steep mnt slope channel (also unforested 3/90)	>15% Gradient <15 M Width Single channel C9 C7 C4 C5 C1 B1 A1	Bedrock Transport Br Bldr Rubb	Small 30 s 40's 10 s 51 >10 M, >100% <50 M Incision	Linear channel pattern, Very high gradient V-notch
A2 - Forested high grad upper valley channel	6 - 15% Gradient </= 20 M WIDTH Single channel C5 C3 C1 C4 B1	BR - Mixed Transport BR Bldr Rubb	Small - Moderate 30 s 40 s >20 M, <100% <50 M Incision	A2 CT s associated w/ upper valley development
A3 - Forested high gradient alluvial cone channel (also unforested 3/90)	>6% 8 Midpoint VARIABLE Single - Multiple ALL B S AND C S	Alluvial to mixed Transport/Storage C Grv - BLDR	Small - Moderate 52 51 <2 M </= 4 M Incision	Minimum legnth is 200 M Poor flow containment no side slope developmt Exclusively assoc with the alluvial cone landform
A4 - Very high gradient mountain slope cascade channel	>/ 15 % gradient Variable width Single Channel All C s A's B1	BR but may vary Transport BR Bldr Rubb	Small 10 40 s 51,52 <10 M <10 M Incision	Waterfalls & steep cascades very common
A5 - Lowland high grad incised muskeg channel	6 - 20% Gradient 6 - 15 M Width Single Channel C9 C5 C4	Bedrock Transport BR Bldr Rubb	Small - Moderate 60 s 40's 36 6 - 20 M >100% 6 - 20 M Incision	May appear in high elev headwaters abrupt incision, containment excellent
A6 - High grad shallow - moderate incision lowland muskeg channel	6 - 15% Gradient </= 10 M Width Single Channel C4	BR - Mixed Transport BR - Rubble	Small - Moderate 60 s 40 s 36 <6 M Side Slope <6 M Incision	Well contained w/ mod - shallow incision

Channel Type Description	Gradient Width Pattern Vegetation	Control Process Substrate	Basin Area Landfrom Side Slope Incision	Comments and Special Mapping Conventions
A7 - High grad shallow footslope channel	6 - 15% Gradient <15 M Width Single Channel C4 or better All B s	BR may vary Transport Br Bldr Rubb	Small - Moderate 51 52 40 s <10 M Side Slope 1- 10 M Incision	High grad forested footslope channel Most often assoc with footslope 52
B1 - Small lowland low gradient alluvial forest channel	< 2% Gradient <10 M Width Single - Multiple Most C s	Alluvial Depositional Sand - Sm Rubb	Small - Moderate 53 52 42 61 62 Short shallow </ 2 M Incision	Beaver activity common on the B1 channel
B1 4 - Lowland non-forested low gradient channel	<2% Gradient <10 M Width Single Channel M1 M3	Alluvial Depositional Sand - C Grv	Small - Moderate 53 61 62 Negligible <2 M Incision	B1 4 is a non-forested phase located in open meadows Similar to L1 w/ sand/gravel bar develp
B1 5 - Forested Yakutat Foreland channel	<2% Gradient <15 M Width Single Channel C1 C3	Alluvial Depositional Sand - F Grv	Small - Moderate Yakutat Foreland Negligible <2 M Incision	Vegetation is Sitka spruce//Devils club & Sitka spruce/Devils club/ Vaccinium
B1 6 - Non-forested Yakutat Foreland	<2% Gradient <15 M Width Single Channel All B s	Alluvial Depositional Sand - C Grv	Small - Moderate Yakutat Foreland	Found on lowland (60's) Alder/willow & Willow/ salmonberry plant assoc
B2 - Forested moderate gradient narrow valley channel	2 - 6% Gradient </ 10 M Width Single Channel C4 or better	Alluvial - Mixed Transport - Deposit F Grv - Sm Bldr	Small - Moderate 40 50 60 Short shallow <4 M Incision	Floodplain terrace is at least 1X bankfull Channel is a B2
B3 - Forested, moderate gradient, upper valley	2 - 6% Gradient >10 M Width Single Channel C4 or better	Alluvial - Mixed Transport Variable	Moderate - Large 40 50 & 60's Variable <4 M Incision	Variable landform, active floodplain terraces present

Channel Type Description	Gradient Width Pattern Vegetation	Control Process Substrate	Basin Area Landfrom Side Slope Incision	Comments and Special Mapping Conventions
B3 4 - High energy upper valley forest channel	2 - 6% Gradient ›10 M Width Single Channel B1, A2	Alluvial - Mixed Transport C Grv - Rubb S Bldr	Moderate - Large 30 40 50 60 Variable ‹3 M Incision	High energy upper valley brush channel
B4 - Scrubby moderate gradient channel	‹6% Gradient ‹10 M Width Single Channel C5 or poorer	BR - Mixed Transport C Grv - BR	Small - Mod 61 62 40 s Short Shallow ‹/ 4 M Incision	
B5 - Forested moderate gradient alluvial fan channel	1 - ‹/ 6% Gradient ‹20 M Width Single - Multiple C1 C3 C5 C6	Alluvial Depositional F Grv - Lg Rubb	Small 52 53 Short Shallow ‹2 M Incision	B5 is a transitional alluvial fan channel between high gradient A CT to Valley CT s
B6 - Moderate gradient lowland muskeg chan	2 - 6% Gradient ‹20 M Width Single Channel C4 C5 C8	BR - Mixed Transport C Grv - BR	Small - Mod 60 40 51 4 - 20 M Side Slope 4 - 20 M Incision	The abruptly incised B6 chan often follows BR fracture zones and may display linear or rectangular pattern
B7 - Deep gorge channel brushy moderate-high gradient	› 4% Gradient ‹15 M Width Single Channel C9 C7 C6 A1	BR Transport Rubb - BR	Mod - Large 54 ›20 M ›70% ›10 M Incision	Contains major falls B7 is an abrupt deeply incised channel w/ very steep side slopes

Channel Type Description	Gradient Width Pattern Vegetation	Control Process Substrate	Basin Area Landfrom Side Slope Incision	Comments and Special Mapping Conventions
C1 - Forested lower valley low grad channel	</ 2% Gradient 10 - 20 M Width Single - Multiple C1 C3 C5 C6 C9 and D s	Alluvial Depositional Sand - Rubble	Large 53 all 60's Short - shallow </ 2 M Incision	Floodplain channel Multiple channels & bar development common
C1 1 - Forested low gradient high energy channel	<2% Gradient 10 -20 M Width Single - Multiple C3 C6 B1 B3 D1 M3	Alluvial Deposition - Transport F Grv - Lg Rubble	Large 53 Shallow - Deep	Includes forested & non-forest phases

C1 4 - Non-forested Phase of C1 channel, Vegetation is M2 M3 or marginal stringers of C4 C8 Substrate are sandy

C1 5 - Yakutat Forelands Glacial Outwash Forested Phase (old F1 channel) Vegetation consists of Sitka Spruce/Cottonwood/ Willow or Sitka Spruce/Devils Club/Vaccinium plant associations Substrate is predominately sand and gravel

C1 6 - Yakutat Forelands Glacial Outwash Non-forested Phase (old F2 channel) Vegetation consists of Willow/Sedge, Alder/Willow and Cottonwood/Alder plant associations Stream gradient is low (<0 5%) Substrates are predominately sand and gravel Bankfull width averages 13 m

C1 8 - Underfit Glacial Phase assoc with flat lowlands and outburst flooplains C1 and B canopy types compose riparian veg

C2 - Lower valley or muskeg type landforms, low gradient incised channel	</ 2% Gradient >10 M Width Single channel C5 C4 C8	Bedrock - mixed Transport C Grv - BR	Large - Very Large 40's 60's Steep <20 M < 10 M Incision	Meanders cannot exceed 1/2 bankful width Discontinuous 53 landforms can occur
C2 7 - Lower valley low gradient, incised channel	<2% Gradient >7 M Width Single channel C5 C4 C8 C6 C1	Bedrock Deposition Rubb Bldr BR	Large - Very Large 40's 60's Steep <20 M Variable	Glide phase of C2

C2 8 - Glacial MOraine Phase associated with flat lowlands and outburst floodplains large erratic boulders may be present in substrate, bankfull width averages 26 m

Channel Type Description	Gradient Width Pattern Vegetation	Control Process Substrate	Basin Area Landfrom Side Slope Incision	Comments and Special Mapping Conventions
C3 - Forested broad low gradient lower valley channel	<2% Gradient >20 M Width Single - Multiple C3 C5 C6 All D's	Alluvial Depositional Sand - Sm Rubb	Very Large 53 Flat Variable </ 2M Incision	
C3 1 - Broad high energy phase lower valley channel Old C4 - incl forest & non-forested phase	<2% Gradient >20 M Width Single - Braided B1 C3 C6	Alluvial Depositional C Grv - S Bldr	Very large 53 Flat Variable <2 M Incision	Often times occurs where A1 CT's feed directly into low gradient valley bottom channels
C3 3 - Broad, low grad lower valley bedrock influenced channel	<2% Gradient >20 M Width Single - Multiple C6 C3	BR influenced Transport F Grv - BR	Very Large 53 Flat Variable	BR influenced phase C2/C3 mix found as channel approaches salt water
C3 4 - Broad placid low gradient channel	<2% Gradient >20 M Gradient Single Channel C6 C3	Alluvial Depositional F Grv - Rubb	Very Large 53 Flat Variable	Non-forested placid water phase of C3
C3 5 - Yakutat Foreland Glacial Outwash Forested Channel (Old F3)				
C3 6 - Yakutat Foreland Glacial Outwash Forested Channel (Old F4)				
C4 - Beach and sand dune channel	<0 5% Gradient >12 M Width Single - Multiple C6 B3	Alluvial Depositional Sand F Grv Silt	Large - Very Large 72 Shallow <2 M Incision	Competing channels: B1 5 & L1
C4 4 - Non-forested Phase (Old G6)				
C5 - Confined narrow valley forested channel	</ 5% Gradient 10 - 30 M Width Single channel C5 C4 C3	Bedrock-mixed Transport - Deposition C Grv - BR	Large - Very Large 30 s 51 54 61 40'S >20 M <70% Variable Incision	Channel occurs within narrow confining valley Varied incision

Channel Type Description	Gradient Width Pattern Vegetation	Control Process Substrate	Basin Area Landfrom Side Slope Incision	Comments and Special Mapping Conventions
L1 - Low gradient, lowland muskeg channel with ponds or placid flow	<2% Gradient <10 M Width Single channel M1,M2 M3 B3	Alluvial Depositional Muck Sand	Small 60's 40's 53 Flat negligible </ 2 M Incision	Assoc w/53 's in broad river valley affected by wide range in river stage
L1 4 - Scrub forest phase lowland low gradient, muskeg channel	<2% Gradient <10 M Width Single M1 M3 C4	Alluvial Depositional Muck Sand	Small 60's 40's Flat negligible <2 M Incision	Canopy is scrubby and in narrow bands
L2 - Wide low gradient deep water muskeg channel	0 - 1% gradient >10 M Width Single channel All B's and M's	Alluvial Depositional Muck, Sand	Large - Very Large 60's 53 Nonglacial Flat, negligible </ 2 M Incision	Commonly associated with lake outlet or meadow area
L3 - Stable beaver dam pond chain complex	<1% Gradient Variable Single channel B1 B2, C8 C4 C6 M3	Alluvial Depositional Muck - F Grv	Small 60's 40's 53 Flat variable </ 2 M Incision	Series of Beaver ponds often recognized on the aerial photo by a stand of dead trees
L4 - Shallow Groundwater-fed Slough (12/89 Revision)	<1% Gradient Variable Multiple -raidedED Variable Veg Type	Alluvial Depositional Silt - Rubble	Variable 53 64 62 Flat Negligible </ 4M Incision	Occupy relic glacial outwash channels can be connected to main river is normally < 3 ft deep (bankfull)
N B THIS IS A NEW DESCRIPTION FOR THE L4 GROUNDWATER RECHARGE IS DOMINANT				
L5 - Deep Upland Slough (12/89 Revision)	</ 0 5% Variable Single Variable (B1 B2 C6) (D1 D2 M1 M2)	Alluvial Depositional Silt/Clay - Fine Grvl	Large to very large 53 62 64 </ 4 M	Often associated with up-lifted mudflats and glacial river terraces Clear water flow deep rectangular x-section profile

N B -THE L5 IS A VERY LOW GRADIENT CHANNEL WITH SLUGGISH LAMINAR FLOW GLACIAL WATER FROM ADJACENT GLACIAL CHANNELS MAY INUNDATE THE LOWER PORTION OF THE L5 (where it meets the main river) THESE CHANNELS ARE DEEP SLOUGHS, GREATER THAN 3 FT AT BANKFULL AND DIRECTLY AFFECTED BY MAIN RIVER STAGE BANKS OFTEN COMPOSED OF SILT AND CLAY MAP REVISION NOTE: Convert Chatham Area B8 to L5

Channel Type Description	Gradient Width Pattern Vegetation	Control Process Substrate	Basin Area Landfrom Side Slope Incision	Comments and Special Mapping Conventions
E1 - Small substrate, large estuarine channel	</ 2% Gradient >10 M Width Single - Multiple E2 E3	Alluvial Depositional Sand - Rubb	Large - Very Large 71 Flat variable Shallow 0 - 5M Incision	Width > 10 M at upstream boundary
E1 3 - Large substrate large esturine channel	0 to 2% Gradient >10 M Width Single - Multiple E2 E3	Alluvial mixed Depositional C Grv - Sm Bldr	Large - Very Large 71 Flat variable Shallow 0 - 5M Incision	Large substrate phase typically no sedge/ grass area associated
E1 6 - Beach and dune estuarine channel (old E4 channel)	<1% Gradient >10 M Width Single - Multiple E2 E3	Alluvial Depositional Sand	Large - Very Large 72 74 Flat variable	Outer coastal area w/ sand and dune (22) and and uplifted beach (74) landforms
E2 - Small rocky estuarine channel	0 to 3% Gradient <10 M Width Single Channel E2 E3	Alluvial mixed Depositional C Grv - Bldr	Moderate - Large 71 Variable Shallow <3 M	Width <10 M measured at upstream boundary may be > 10 M w/ channel spreading thru lower estuary
E3 - Narrow small substrate estuarine channel	</ 1% Gradient <10 M Width Single channel E2 E3	Alluvial Depositional Sand - Sm Rubb	Moderate - Large 71 Flat negligible Shallow, <3M Icision	Better quality habitat than the E2 channel Width <10 M at upstream end may be >10 M due to spreading as noted with E2
E4 - SILTY ESTUARY CHANNEL OR SLOUGH	> 1% GRADIENT < 20 M SINGLE E2 E3	ALLUVIAL DEPOSITIONAL SILT/CLAY - VFG/SAND	VARIABLE 71 72 SHORT STEEP </ 4 M INCISION	May lie in proximity to large glacial E5 ct or M zones High degree of sinuosity is normal
E5 - Broad braided glacial estuarine channel	<2% Gradient >20 M Width Multiple channel E1 E2 E3	Alluvial Depositional Sand	Moderate - Large 71 Shallow-Flat variable Shallow <3 M Incision	15% or greater of basin area covered by alpine glaciers or permanent snow fields

Channel Type Description	Gradient Width Pattern Vegetation	Control Process Substrate	Basin Area Landfrom Side Slope Incision	Comments and Special Mapping Conventions
D7 - Confined high gradient (cascade) glacial channel	5 - 10% Gradient 20 - 30 M width Single channel B2, C1,C7	Bedrock Transport Rubble to bedrock	Large 30 s 40's 52 54 Steep Side Slope ›/ 16M Incision	Mid to lower valley position, cascades and short falls readily visible
D8 - GLACIAL SIDECHANNEL (1/90)	‹/ 1 0% VARIABLE SINGLE TO MULTIPLE VARIABLE (M1 B1 B2 D1) (D2, C3 C4)	ALLUVIAL DEPOSITIONAL SILT - RUBBLE	LARGE TO VERY LARGE 53 62 64 SHALLOW TO FLAT ‹/ 4 M	Usually associated with D5 riverines, upper width limit is ‹ 200M 0 5 in on photos, 0 25 in on base maps Formerly called L4

POLYGONS

R - See D5	Perimeter of active D5 channel, channel must be wider than 200 feet to use polygon
L - Lake	Lake must be 5 acres or larger to be mapped
M - Marine deposition zone	Marine zone must be 10 acres or larger to be mapped

93053

DETAILED RESTORATION PROJECT DESCRIPTION

Project Title: Hydrocarbon Data Analysis, Interpretation, and Database Maintenance for Restoration and NRDA Environmental Samples Associated with the *Exxon Valdez* Oil Spill

Project ID# 93053

Project Type Technical Support

Project Leader(s): Sid Korn, Jeff Short, and Stanley Rice

Lead Agency: NOAA, Auke Bay Fisheries Laboratory

Cooperating Agencies None

Project Cost: 105 5 K

Start Date: 03/01/93 **Finish Date:** 09/30/97

Geographic Area of Project: Entire Oil Spill Area

Project Leader Signature: Stan Rice

Project Manager: Bruce Wright Bruce Wright

Signature:

A Introduction

The Auke Bay Laboratory (ABL) has provided data archival and interpretive services for environmental samples that have been collected and analyzed for hydrocarbons in support of the Exxon Valdez NRDA effort The samples derive from all projects, investigators, and agencies (including both State of Alaska and Federal agencies) that have collected samples for hydrocarbon analysis The general purpose of this project is to make a large and complex hydrocarbon database available to principal investigators PIs), resource managers, and the public by providing user friendly services The hydrocarbon database contains sample collection and chemical analyses information from thousands of samples from 1989 to the present Briefly the database contains

1) Sample collection information for >38000 samples including major sample types of sediment, tissue, water, and oil
2) Hydrocarbon analysis information for >9000 samples, each sample analyzed has results for 73 analytes plus quality assurance data
3) Bile and HPLC analysis for >2000 samples
4) Data in support of NRDA and restoration projects over the period 1989-1992

This project will provide the following

a) Continued use and access of NRDA hydrocarbon data
b) Expansion of the hydrocarbon database with restoration data resulting in a consistent database allowing comparison of NRDA and restoration results
c) Interpretation of hydrocarbon results for PI's managers, and the public
d) Continued quality control of sample storage, and hydrocarbon analyses

Interpretive services include hydrocarbon data interpretation to identify probable sources of hydrocarbons found, evaluation of new hydrocarbon data for evidence of systematic bias, hydrocarbon data editing according to consistent criteria and hydrocarbon data mapping to facilitate identification of temporal and geographic trends of these data The results of these efforts provide numerical correlates that are directly related to oil, and that may be used by PI's of other Restoration projects, by other governmental agencies, and by the general public, to assess associations of observed biological effects with concentrations of Exxon Valdez oil These archival and interpretive services have been provided by staff at ABL for hydrocarbon samples generated for the Exxon Valdez NRDA effort, who have developed automated computer methods to insure that the various criteria are consistently applied to these data, and which result in computer-generated maps of the final results The purpose of the presently proposed project is to integrate these additional data with the Exxon Valdez NRDA hydrocarbon database, and to continue to provide interpretive services, thereby insuring that hydrocarbon data resulting from Restoration efforts are directly and unequivocally comparable with the existing data

B. Project Description

Resources and/or Services Data associated with hydrocarbon samples will be added to the existing Exxon Valdez NRDA database Principle investigators from all projects collecting hydrocarbon samples will be assisted by this project through archival, interpretation, and

mapping of their data Data archival will include maintenance of a Rbase database with sample collection information and hydrocarbon results This database allows inventory of hydrocarbon sample collection, and retrieval of collection and hydrocarbon results for PI and management use Data interpretation will include examination of the data for evidence of systematic bias, which will provide the basis for an evaluation of data quality, and a probability based determination of sources of hydrocarbons found in samples Finally, maps of specific hydrocarbon samples will be provided on request by PIs, government agencies, or the general public

Objectives The objective of this project is to apply and extend hydrocarbon interpretation methods and data archival developed in NRDA assessments to samples analyzed for the Restoration effort, and to insure the comparability of analytical and interpretive results with those of the NRDA effort

Methods Procedures developed during the NRDA effort will be followed in this project Incoming samples are inventoried and collection information is entered into a database located at Auke Bay, AK and described by Manen et al, (1993) Hydrocarbon results returned from analytical laboratories are also added to the database Hydrocarbon data will be evaluated using methods described in the final reports of Exxon Valdez NRDA project Subtidal #8 (in prep) These methods were developed specifically for Exxon Valdez NRDA hydrocarbon data

Alternatives There are alternative database designs which were rejected because they are not completely compatible with NRDA data Location of NRDA and restoration data in the same database was judged important for compatibility and comparison reasons Two alternatives for evaluating hydrocarbon data quality and for interpreting and mapping hydrocarbon data were considered (1) leaving these tasks to the PI's who collected samples for analysis, and (2) contracting these tasks to a private-sector consultant Alternative (1) was rejected because many PI's do not have direct access to the expertise required (ABL staff include most of the agency chemists that participated in collection, analysis, and interpretation on Exxon Valdez NRDA hydrocarbon samples), because different PI's would almost certainly adopt different methods for data analysis and interpretation which would invalidate data comparison among projects, and because of anticipated inefficiencies that would result due to many PI's duplicating and re-inventing methods that are already standard procedures available at ABL Alternative (2) was rejected because of anticipated inefficiencies that would result due to contractors' efforts to re-invent or acquire methods that are already developed and available at ABL, and because of the difficulty of stipulating contractual requirements that would guarantee strict comparability with existing Exxon Valdez NRDA data

Location The project will be undertaken at the Auke Bay Laboratory in Juneau, Alaska

Benefits Hydrocarbon sample data archival in the Exxon Valdez NRDA database will insure that these data are available to PI's, government agencies, and the interested public on a timely basis The database will allow direct comparisons of restoration and NRDA data, and provide an inventory of hydrocarbon sample, collection, storage, analysis, and results The continued use of the methods for hydrocarbon data evaluation and interpretation developed for the Exxon Valdez NRDA samples will insure direct comparability of future with previous samples, which

will substantially increase the probability that temporal trends in these data will be detected when actually present Principal investigators will be able to get assistance with chemical interpretation and mapping of hydrocarbon results from their project or other projects that relate to their project when needed Since many PI's are not chemists, this type of assistance is usually required for proper interpretation of hydrocarbon results

Technical Support This project will provide it's own technical support including chemical, mapping and database needs

Contracts No contracts are anticipated

Mitigation Measures No mitigation measures will be part of this study

Literature Cited

Carol-Ann Manen, James R Price, Sidney Korn and Mark G Carls 1993 (In Prep) Natural Resource Damage Assessment, Database Design and Structure NOAA Technical Memorandum NOS/ORCA

C Schedules and Planning

This project is an ongoing service task and therefore has few set milestone dates All of the methods, including computer software written specifically for these tasks, have already been developed, tested, and applied The requested funds are entirely for continuation of these services for additional data that will be produced by Restoration projects A final examination of hydrocarbon data will be performed for all hydrocarbon data received as of September 15, 1993, and will be summarized in a report that will be completed by September 30, 1993 Interpretations and maps of hydrocarbon data will be provided on request A publication describing the chemical interpretive methods will be completed in June 1993 A description of the database and CD rom disk containing the data is scheduled for release in April 1993 Sample data entry and interpretation depend on the timeframe of sample receipt, and analysis

D Environmental Compliance/Permit/Coordination Status

This is not a field study nor does it have any significant effect on the environment Consequently, an Environmental Impact Statement or Environmental Assessment need not be provided

All federal, state, and local laws are followed in the management of chemical analysis

E Performance Monitoring

The portion of this project examination of hydrocarbon data for systematic bias is, in itself, a performance monitoring function The performance of the methods developed for examination and interpretation of these hydrocarbon data have already been verified Database integrity is

assured by signed reviews of data entered by principle investigators We will continue to follow all quality assurance procedures outlined in NRDA efforts

F. Personnel Qualifications

Sid Korn
Education
BA 1966, Nasson College
Graduate Studies 1967, Institute of Marine Biology, University of Miami
Graduate Studies, 1967-68, Humboldt State University
Numerous additional coursework including, fish physiology, Dbase programming, project management, supervision
Relevant Experience
1989-1990 Assisted Jim Price in development of the NRDA database and the management of incoming samples and database management
1990-present Is the database manager of NRDA and restoration hydrocarbon data after the departure of Jim Price Responsibilities include supervision of data entry of sample and analytical data, processing and dissemination of data for principle investigators use, database management and design, setup and maintenance of GIS mapping system

Jeffrey W. Short

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

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

Stanley D. Rice
Principal Investigator, ABL Habitat Program Manager

Education
Received BA (1966) and MA (1968) in Biology from Chico State University, and PH D (1971) in Comparative Physiology from Kent State University

Relevant Experience

1971-present Employed at Auke Bay Fisheries Laboratory as a research physiologist, task leader, and Habitat Program Manager since 1986 Rice has researched oil effects problems since 1971, and has published over 70 papers, including over 50 on oil effects Studies have ranged from field to lab tests, behavioral to physiological to biochemical studies, from salmonids to invertebrates to larvae to meiofauna Rice has conducted and managed soft funded projects since 1974, including the Auke Bay Laboratory Exxon Valdez damage assessment studies since 1989 Activities since the oil spill have included leadership and management of up to 10 damage assessment projects, field work in PWS, direct research effort in some studies, establishment of state of the art chem labs and analyses in response to the spill, quality assurance procedures in biological-chemical-statistical analyses, establishment of hydrocarbon database management, servicing principal investigators and program managers in NOAA and other agencies with reviews and interpretations, provided direct input into agency decisions, interacted with other agencies in various ways (logistics coordination, critique experimental designs, interpret observations, etc)

Project Description Hydrocarbon data analyses and interpretation, database management and sample archiving for *Exxon Valdez* oil spill Restoration and NRDA samples and hydrocarbon data

Budget Category	Approved 1-Oct-92 28-Feb-93	Proposed* 1-Mar-93 30-Sep-93	Total FY 93	FY 94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond
Personnel	$0 0	$82 9	$82 9	$90 0				
Travel	$0 0	$6 2	$6 2	$8 3				
Contractual	$0 0	$0 0	$0 0	$0 0				
Commodities	$0 0	$4 0	$4 0	$4 0				
Equipment	$0 0	$0 0	$0 0	$0 0				
Capital Outlay	$0 0	$0 0	$0 0	$0 0				
Sub-total	$0 0	$93 1	$93 1	$102 3	$0 0	$0 0	$0 0	$0 0
General Administration	$0 0	$12 4	$12 4	$13 5				
Project Total	$0 0	$105 5	$105 5	$115 8	$0 0	$0 0	$0 0	$0 0
Full-time Equivalents (FTE)	0 0	1 4	1 4	1 5				

Amounts are shown in thousands of dollars

Budget Year Proposed Personnel

Position	Months Budgeted	Cost	Comment
P I Biologist GS11	5 0	$30 1	NOAA/ABL contribution Project coordination (Physiologist
Chemist GS11	4 0	$20 4	GS14, 1 mo), facility usage = $18 0K
Chemist GS09	4 0	$16 3	
Biologist GS11	2 0	$10 2	
NMFS Prog Manager GS12	1 2	$5 9	

* FY 93 is a transition year from the oil fiscal year to the federal fiscal year This project includes funding for January and February, 1993

Project Number· 93053
Project Title Hydrocarbon Data Technical Support
Agency National anic & Atmospheric Admin

FORM 2A
PROJECT
ETAIL

		Proposed
Travel	6 staff trips to Anchorage and elsewhere for inter and intra agency meetings & conferences	$6 2
Contractual		
Commodities	Mapping supplies ($2 5), computer software upgrades (Excel) ($1 0), office supplies ($0 5)	$4 0
Equipment		

20-Aug 92

199

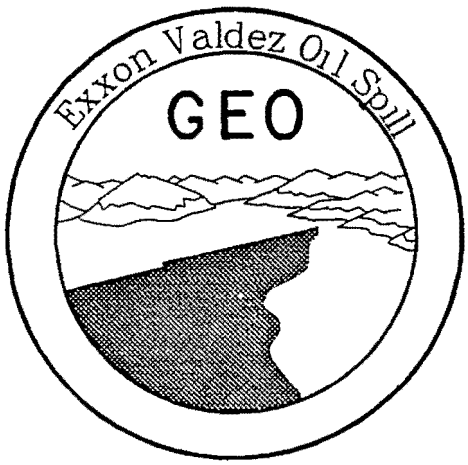
Project Number: 93053
Project Title. Hydrocarbon Data Technical Support
Agency. National Oceanic & Atmospheric Admin

FORM 2B
PROJECT
DET

93057

EXXON VALDEZ OIL SPILL

1993 Project Description



Technical Services Study Number 3

Damage Assessment

GIS Mapping and Analysis

Project Number 93057

April 27, 1993

1993 PROJECT DESCRIPTION, #93057
DAMAGE ASSESSMENT
GIS MAPPING AND ANALYSIS

Contents

List of Figures

1993 PROJECT DESCRIPTION, #93057
DAMAGE ASSESSMENT
GIS MAPPING AND ANALYSIS

Project Title. Damage Assessment GIS Mapping and Analysis

Project ID Number 93057

Project Type Technical Support

Project Leaders Dianne Lyles and Richard McMahon

Lead Agency Alaska Department of Natural Resources (ADNR)

Cost of Project 3/1/93 - 9/30/93, $67 5

Report Term 7 months (3/1/93 - 9/30/93)

Geographic Area GIS Analysis and Mapping performed in Anchorage (Use of data from field work of other studies performed throughout the entire EVOS area)

Signature of Project Leaders, Dianne Lyles _____

Richard McMahon _____

Signature of Trustee Representative, Marty Rutherford _____

B Introduction

The Alaska Department of Natural Resources (ADNR) GIS provides extensive multi-thematic GIS analysis and mapping required for Natural Resource Damage Assessment (NRDA) studies This includes direct support to principal investigators, statistical summaries of shoreline oiling compared to shoretype, habitat modeling for coastal habitat studies, bathymetric summaries for various marine mammal studies, and support maps for NRDA results and baseline information ADNR is currently a major information repository for *Exxon Valdez* Oil Spill (EVOS) damage assessment and restoration analysis and planning

C Project Description

1 Resources and/or Services

ADNR GIS provides statistical and spatial analysis, and GIS mapping support for approved NRDA projects Detailed maps and statistical reports are produced, data is frequently distributed Consistent, current, and quality control repository services are provided for this comprehensive geographic database

2 Objectives

a Wrap up NRDA studies with principal investigators This includes final maps and statistical summaries for final reports, publications and presentations,

b Complete statistical summaries report of shoreline oiling information with respect to land status and shoreline type, and publish as part of final report,

c Provide a reservoir of the most comprehensive geographic data in support of the NRDA studies, and assure transition to restoration,

d Assure consistency and quality of these data,

e Serve as a stable repository to protect the long term public interest of these data,

f Complete documentation and quality assurance procedures for baseline data,

g Complete final project report for NRDA Technical Services 3 (TS3), and

h Make copies of all maps and reports available to the public via the public oil spill library (CACI building)

3 Methods

a Existing shoreline oiling and land status data will be analyzed and summarized for statistical reports A copy of the most recent table summarizing shoreline oiling by shore type is included as Appendix 3

b Outstanding NRDA projects will proceed to completion as requested This consists of using the GIS and related hardware and expertise to synthesize complex data and create high quality maps Please refer to Figures 1 and 3 for examples of maps prepared for principal investigators

c Knowledge of the baseline data from technical staff will be summarized into a comprehensive report

d Products done in 1992 and 1993 will be summarized into a final TS3 report Please see Appendix 1 for an interim summary of damage assessment work Please see Appendix 2 for a matrix summary of products and correspondence Please refer to Appendix 2 of the companion restoration report for a list of maps completed between 3/1/92 and 2/28/93

4 Alternatives

a Do not complete projects or reports

b Extend deadline

c Complete project as planned

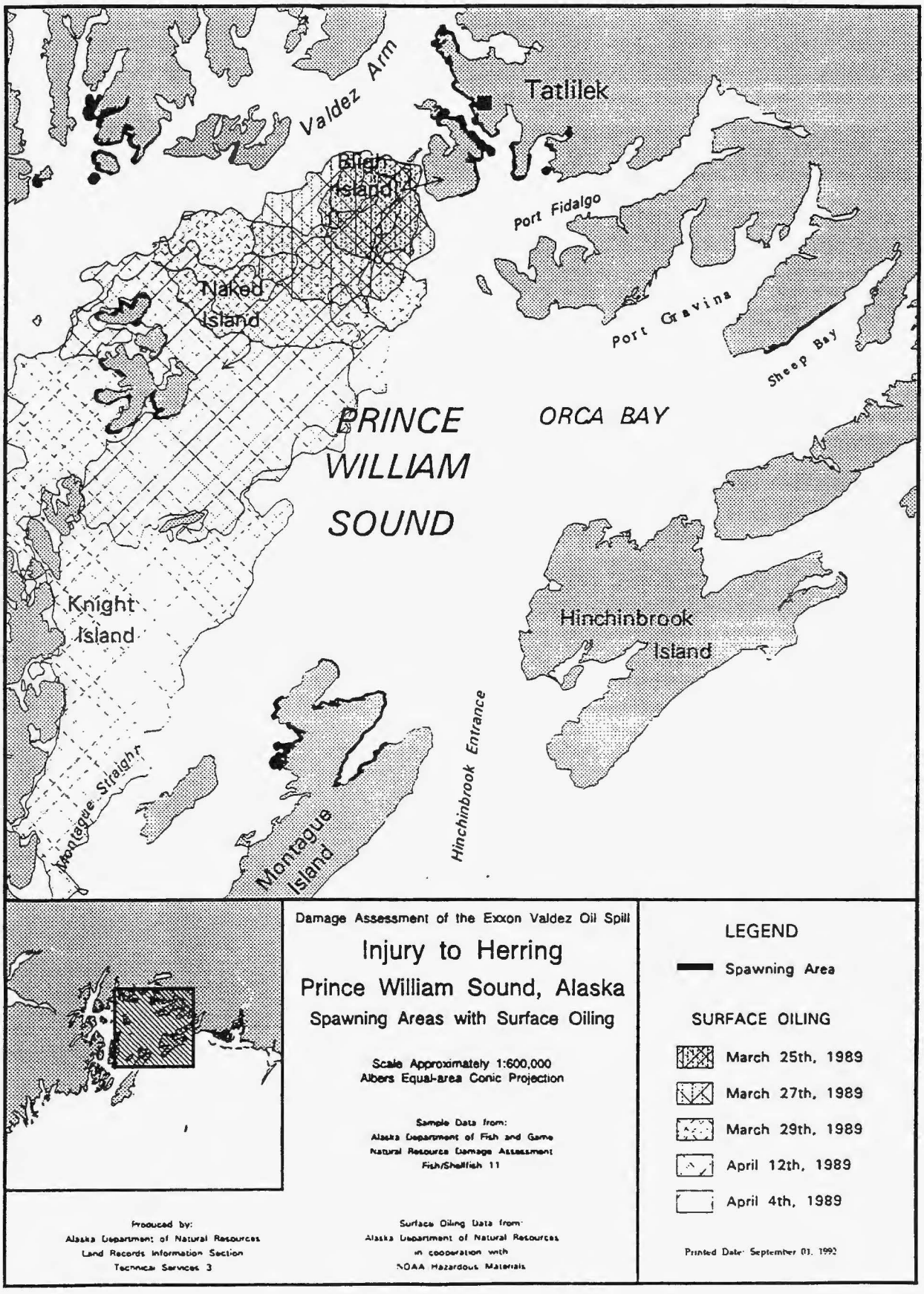
5 Location

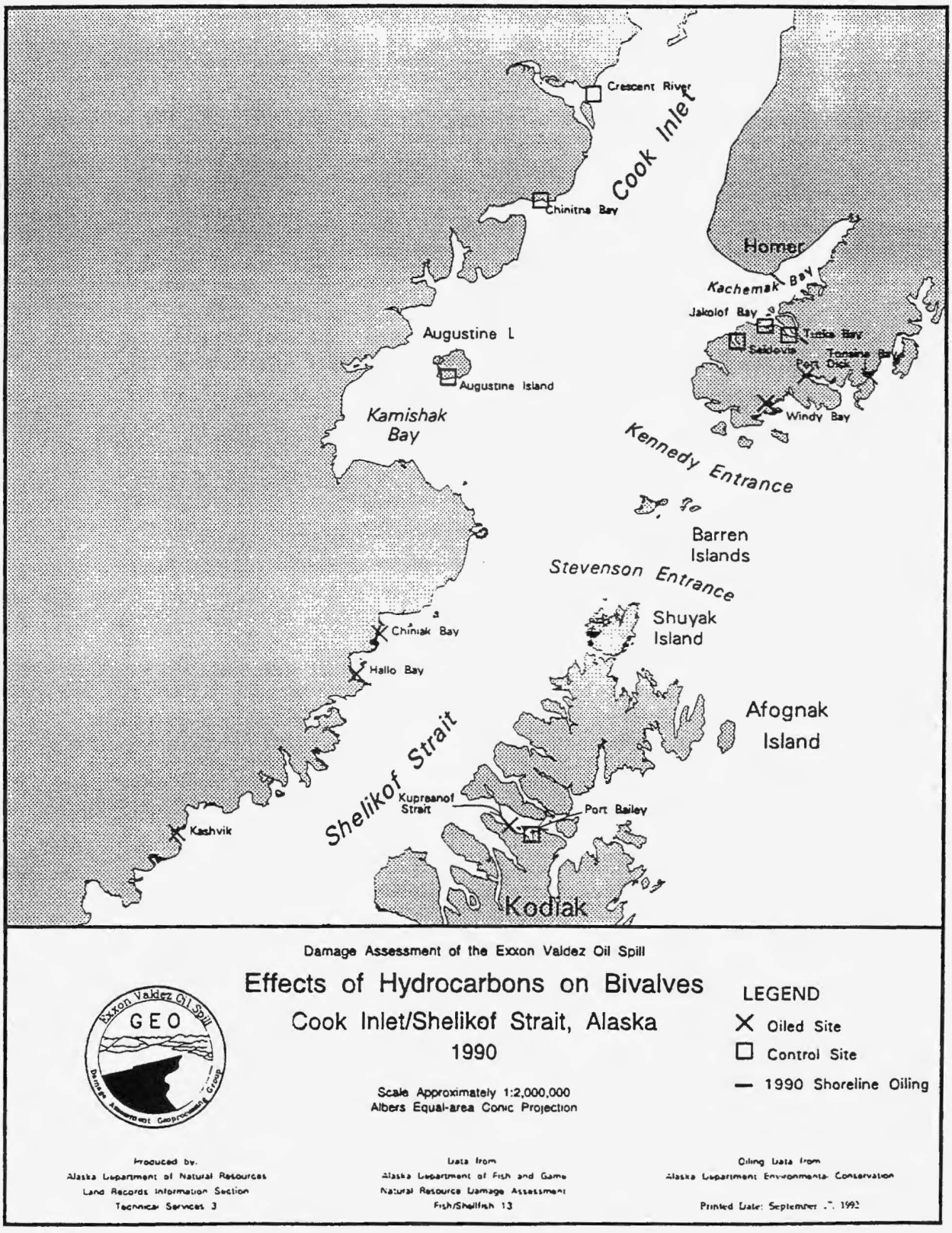
Technical Services 3 is in compliance of NRDA studies support As of date, no field work is scheduled or requested

6 Benefits

Products completed for PI's will facilitate their analysis and reports by providing clear graphic products, and consistent and defensible statistical information Maps will exemplify results in a clear and logical manner, and will complement tables and text

ADNR GIS has consistently worked to provide an integrated compilation of existing oiling data This includes extensive effort to assimilate all ADEC and Exxon shoreline oiling surveys which spanned four years and millions of dollars ADNR GIS also invested substantial effort into the interpretation and display of

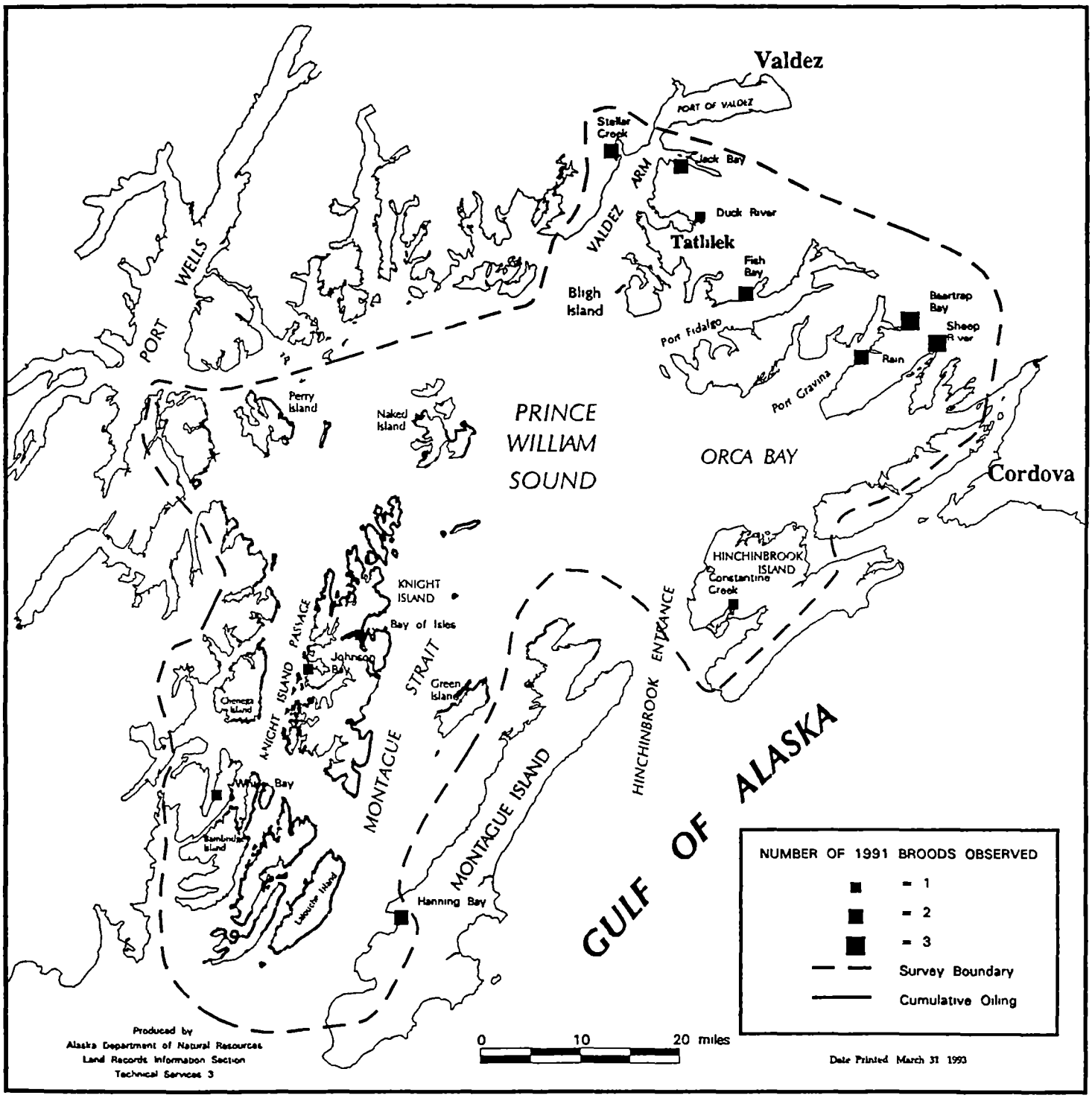

Valdez Arm
Tatlilek
Bligh Island
Port Fidalgo
Naked Island
Port Gravina
Sheep Bay
PRINCE WILLIAM SOUND
ORCA BAY
Knight Island
Hinchinbrook Island
Montague Straight
Hinchinbrook Entrance
Montague Island
Damage Assessment of the Exxon Valdez Oil Spill
Injury to Herring
Prince William Sound, Alaska
Spawning Areas with Surface Oiling
Scale Approximately 1:600,000
Albers Equal-area Conic Projection
Sample Data from:
Alaska Department of Fish and Game
Natural Resource Damage Assessment
Fish/Shellfish 11
Produced by:
Alaska Department of Natural Resources
Land Records Information Section
Technical Services 3
Surface Oiling Data from:
Alaska Department of Natural Resources
in cooperation with
NOAA Hazardous Materials
LEGEND
Spawning Area
SURFACE OILING
March 25th, 1989
March 27th, 1989
March 29th, 1989
April 12th, 1989
April 4th, 1989
Printed Date: September 03, 1992



1993 Project Description, #93057 (4/23/93)

Figure 2

(Harlequin Ducks)



1991 Brood

Figure 3

the NOAA HAZMAT surface oiling model Combined, these efforts on oiling were very useful to PI's who had the difficult task of separating oiled from control sites

A comprehensive report of the ADNR GIS oil spill efforts for damage assessment will be delivered to the NRDA Management Team and made available to the public This report will be beneficial to the restoration process for analysis and decision making It will benefit agencies and parties pursuing other related spatial analysis It will also serve to archive spatially related information on the oil spill The report will provide a summary of surface and shoreline oiling useful to the Environmental Impact Statement now under way

7 Technical Support

TS3 is a technical support service All support for this service is provided within ADNR, Land Records Information Section (Note Restoration projects directly benefit from existing ADNR GIS infrastructure The Land Records Information Section employs over 56 staff working in three main areas mainframe business programming, land status parcel mapping by status graphics, and GIS services The mainframe staff provide direct and current access to the department's Land Administration System, a complex database of land records, business transactions, appraisals, contracts, and classifications The status graphics unit provides the hydrographic base used to identify salmon streams This unit will also provide parcel level detail for lands tracked by the state status plat system The GIS project is responsible for resource valuations and comparative mapping necessary to meet the department's mission The deliverables created for oil spill clients all directly benefit from this ADNR infrastructure)

8 Contracts

No contracts are assigned at this time

9 Mitigation Measures
n/a

10 Literature cited
n/a

D Schedules and Planning

1 Finalize HAZMAT Trajectory Model Interpolation products and distribute by 4/1/93 Additional requests are predicted (done)

2 Update and assist in coastal habitat wrap-up projects funded through 6/30/93

a Final maps for algal studies due 5/28/93

b CH1 habitat type and cumulative oiling maps and slides due 3/25/93 (done)

c CH1 habitat model for *fucus* expected to be complete by 6/30/93

d Additional requests are expected

3 Complete final maps for clam studies report Draft due 3/31/93, with final (twenty-five copies of six maps) due 4/30/93

4 Generate and complete brood sites and mist nest result maps for harlequin duck studies by 4/2/93 (done)

5 Generate bathymetric summaries due 4/1/93 for various marine mammal studies (done)

6 Provide information for two shoreline oiling requests, statistics due 3/31/93, and current status due 4/15/93 Additional requests are expected

7 Investigating beach treatment for CH1 is ongoing until August, 1993 NOAA and ADNR are summarizing beach treatment actions

8 Final NRDA report will be completed by 9/30/93 The report will summarize thematic data collected during the oil spill, maps produced, and statistical summary reports Action between TNC to facilitate an appendix of NRDA data is underway Discussion within TS3 for data availability and distribution is also underway Methods for data distribution will be in place by the close of this funding period

E Environmental Compliance/Permit/Coordination Status

ADNR GIS is a technical services project, and is subordinate to the environmental compliance of the NRDA studies it supports

F Performance Monitoring

The management and technical staff for this project consist of the following, indented by order of command

- Section Chief
    - GIS Manager
        - GIS Analyst and Cartographer
        - GIS Analyst and Programmer
        - GIS System Administrator
            - Data Processing Clerk

ADNR, Land Records Information Section, GIS project is composed of a pool of advanced technical staff The oil spill project directly benefits from technical staff not directly tied to the oil spill project The GIS analyst and programmer has recently accepted a new position, an Analyst Programmer II register is currently being searched for a replacement Stable staffing, particularly at the project management level, guarantees institutional memory and the ability to correctly respond to all tasks

Quality control and assurance procedures are dependent on the source of the information obtained Some information is collected from agencies who are charged with keeping an inventory of that information, while other information must be generated and verified For example, ADNR may receive data of bald eagle nest site locations, which is inventoried by US Fish and Wildlife Services (USFWS) USFWS has their own GIS and means of quality assurance/quality control of data, and is cited as the source In the second case, a PI may deliver latitude/longitude information of sample sites ADNR GIS will send a check plot to the PI for verification No final mapping or analysis is done on this information until the sites and their summary attributes are verified The agency of the PI is cited as the source

G Personnel Qualifications

Dianne M Lyles, Data Processing Manager, Alaska Department of Natural Resources (ADNR) - Ms Lyles joined ADNR in 1985 She holds an MBA from IMEDE, University of Lausanne, Switzerland, and began her employment at ADNR with GIS experience from the oil industry Since 1985, starting as the manager of the department's GIS land status project, she has become (in 1989) the manager of a section of 60 data processing personnel that create and maintain ADNR's geographic, resource analysis, and revenue receipting land records information systems Three projects under Ms Lyles' direction (Land Status GIS Project - automated status mapping, Geographic Information System Project - statistical analysis and thematic resource mapping, and Business Programming Project - tabular system of land activity and associated revenues) bespeaks her experience relevant to GIS mapping and analysis on this project

Richard McMahon, GIS Project Manager, Alaska Department of Natural Resources (ADNR) - Mr McMahon has been with ADNR since 1978 He holds degrees in forestry from the Yale School of Forestry and Environmental Studies (emphasis on statistics and GIS) and the University of California at Berkeley Mr McMahon's experience includes inventory design, sampling, and mapping as a Forester for the

ADNR Division of Forestry, and GIS Project management since 1987 Relevant experience to this project includes his management of statistical analysis and thematic resource mapping for ADNR

Other Key Personnel

Primary personnel, besides project leaders noted above, include two Analyst/Programmers who have extensive programming and GIS experience since (and prior to) employment at ADNR Dorothy Mortenson and Randall Hall, hired by ADNR in 12/90 and 1/90 respectively, perform the analysis, programming, and cartographic work associated with this project Ms Mortenson has a degree in geography with emphasis in cartography and GIS methods Mr Hall has a degree in computer science

H Budget

3/1/93 - 9/30/93

Personnel	$53 0	
Travel	0	
Contractual	5 0	
Commodities	1 5	
Equipment	0	
Subtotal	$59 5	
General Admin	8 0	
TOTAL, 7 months	$67 5,	3/1/93 - 9/30/93

Personnel - During this seven month reporting period, this project is budgeted for the following staff labor 7 0 months cartographic and programming labor, 1 0 month system analyst labor, 1 0 month data processing clerical labor, and 1 5 months project management (including support towards DNR Trustee Representative costs)

Contractual - Budgeted contractual funds have been identified for maintenance and support services of GIS system software and hardware (SUN workstation network, CPU, and peripheral hardware, ESRI software including ARC/Info, Network, Tin, Cogo, and Grid, Versatec plotter, hardware, and software)

Commodities - This budget category provides funds for the project's office supplies and data processing supplies (color electrostatic plotter paper, chemicals, and toner, data cartridges and diskettes)

General Administration - Centralized support, as indirect costs to the project, include personnel administration, payroll processing, department financial services and procurement

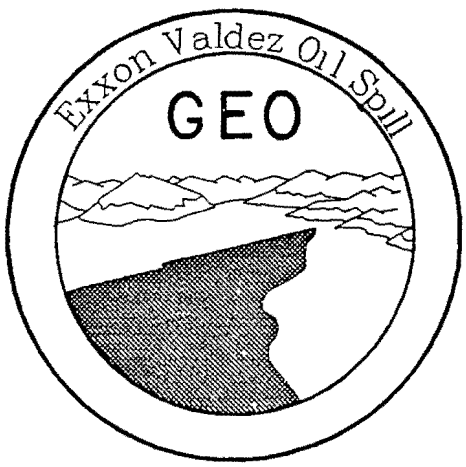
Future Funding Requirements

Note This project supports other studies' activities There is no documented request for future funding

93062

EXXON VALDEZ OIL SPILL

1993 Project Description



Technical Services Study Number 3

Restoration

GIS Mapping and Analysis

Project Number 93062

April 27, 1993

1993 PROJECT DESCRIPTION, # 93062
RESTORATION
GIS MAPPING AND ANALYSIS

Contents

List of Figures

1993 PROJECT DESCRIPTION, # 93062
RESTORATION
GIS MAPPING AND ANALYSIS

Project Title Restoration GIS Mapping and Analysis

Project ID Number 93062

Project Type Technical Support

Project Leaders Dianne Lyles and Richard McMahon

Lead Agency Alaska Department of Natural Resources

Cost of Project 3/1/93 - 9/30/93 $123 3
FFY94 through FFY95 (See Budget Section)

Report Term 7 months (3/1/93 - 9/30/93)

Geographic Area GIS Analysis and Mapping performed in Anchorage (Use of data from field work of other studies performed throughout the entire EVOS area)

Signature of Project Leaders, Dianne Lyles

Richard McMahon

Signature of Trustee Representative, Marty Rutherford _____

B Introduction

The Alaska Department of Natural Resources (ADNR) is the major public repository for digital data related to the *Exxon Valdez* Oil Spill (EVOS) The ADNR Geographic Information System (GIS) provides comprehensive, automated information for such themes as land status, chronological compilations of surface and shoreline oiling, shoreline type (ESI classification), habitat and land use themes, and many other base information sources With particular relevance to the land acquisition portion of restoration, ADNR has extensive experience dealing with the myriad land status implications that result from state and native selection rights, inholdings and access, and entitlement rights such as navigability and tidelands ADNR GIS also has extensive experience providing the multi-thematic GIS analysis and mapping that are required for restoration planning, habitat protection, timberland assessment, and land acquisition

C Project Description

1 Resources and/or Services

ADNR GIS provides statistical and spatial analysis, and GIS mapping support for approved restoration projects These include requests directly from principal investigators as well as requests from the Restoration Team and their planning support staff The primary products include spatial analysis of two or more resource themes, resultant map series and statistics, graphic portrayal of sample results comparing oiled and control sites, and data preparation and transmittal to other users of the GIS database Consistent, current, and quality control repository services are provided for this compendium of geographic information

2 Objectives

a Provide the Trustee Council and others with the ability to better understand complex issues,

b Design GIS products specifically tailored for team decision-making process,

c Provide direct technical support to Principal Investigators funded on restoration projects,

d Produce and disseminate maps and analytical products for participants in the restoration process,

e Provide a reservoir of the most comprehensive geographic data in support of the restoration process,

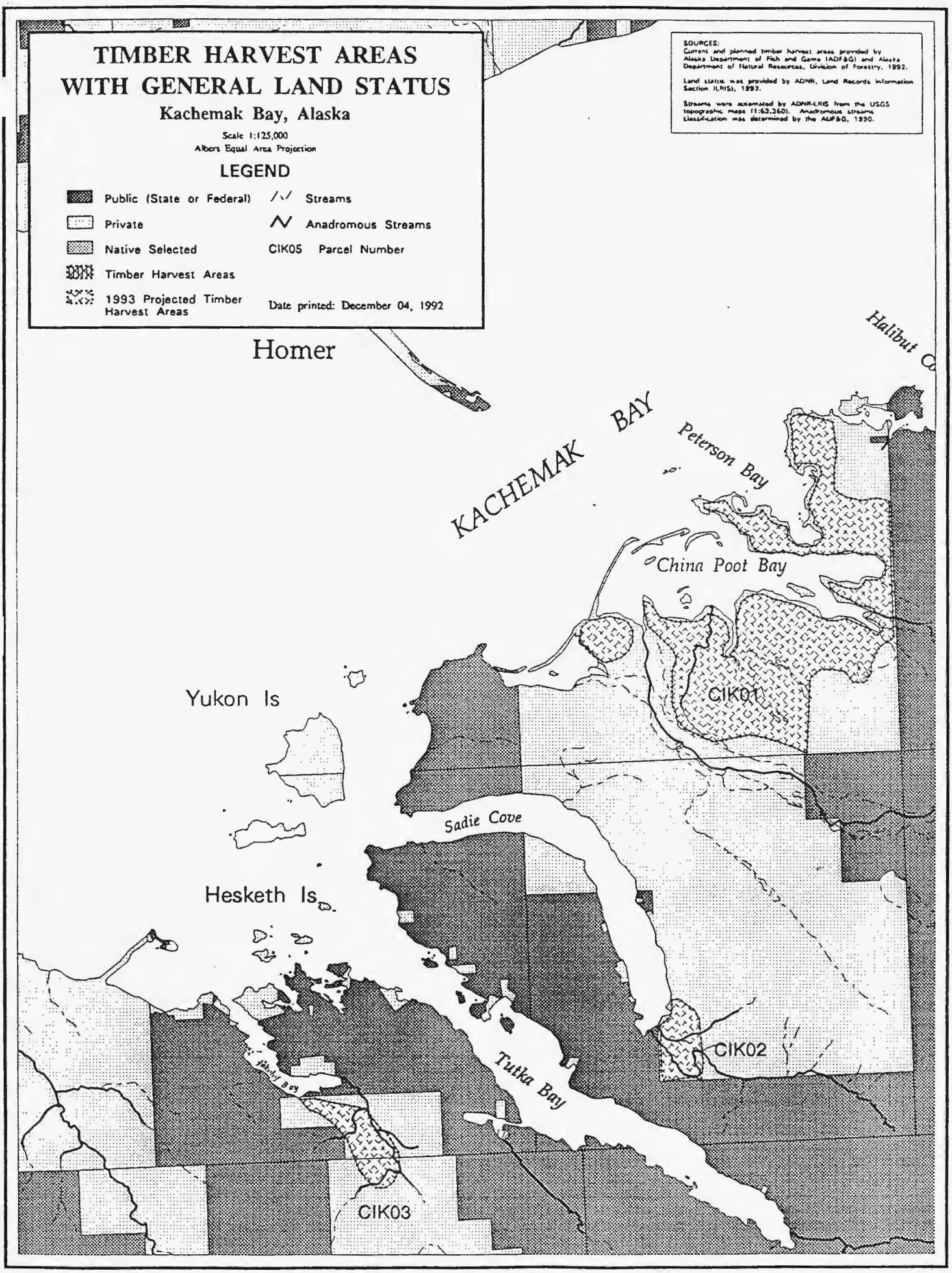
f Assure consistency and quality of these information resources, and

g Serve as a stable repository to protect the long term public interest of these data

3 Methods

ADNR GIS will work directly with the Trustee Council, Restoration Team, principal investigators, restoration planners, and Environmental Impact Statement (EIS) authors directing the approved Restoration projects to assess necessary GIS and analysis support Please see Figures 1 and 2 for examples of GIS mapping in support of restoration Please refer to Appendix 2 for a complete list of maps prepared during the reporting period The Restoration Team has provided a tentative list of themes These themes are referenced and evaluated below

Base Coastline, survey grids, cities, quads, etc	-	Complete
Land ownership	-	Mostly complete, precision and currency may need to be updated and revised to consider specific project needs Parcel detail requires substantial effort
Hydrography	-	Currently being completed, 1 63,360, portions of KAP area outstanding only
Hypsography	-	60m resolution of PWS, 1,000m resolution of remaining area 100m available with processing requirement
Vegetation	-	Currently have general land cover for most of the area Detailed forest cover for Chugach National Forest, public lands
Anadromous streams	-	Currently integrating this information with the hydrography above Most is complete, with the rest currently scheduled for completion
Wildlife habitat	-	Some information available via damage assessment studies Habitat information for uplands will need to be acquired, converted and processed as requested, this work may require extensive effort ADF&G lead agency
Surface Oiling	-	Complete
Shoreline oiling	-	Complete
Easements	-	Complete for state lands, need to acquire for other lands, convert, and process
Land use activities	-	Some information available Need to acquire, convert, and process from various sources, as requested



1993 Project Description, #93062 (4/23/93)

Figure 1

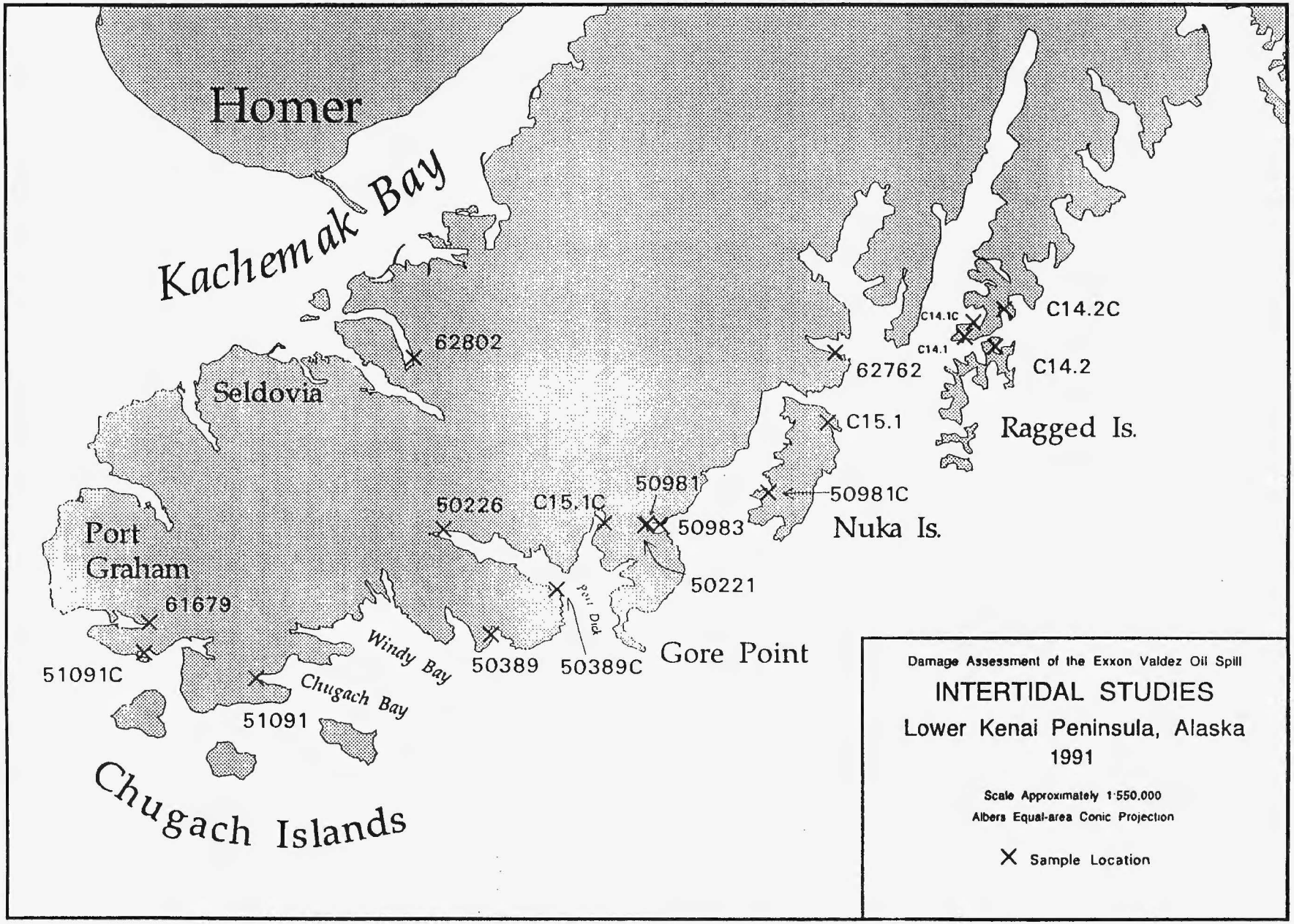

Homer
Kachemak Bay
62802
Seldovia
Port Graham
61679
51091C
Windy Bay
Chugach Bay
51091
Chugach Islands
50226
C15.1C
50981
50983
50221
Port Dick
50389
50389C
Gore Point
C15.1
62762
C14.1C
C14.2C
C14.1
C14.2
Ragged Is.
50981C
Nuka Is.
Damage Assessment of the Exxon Valdez Oil Spill
INTERTIDAL STUDIES
Lower Kenai Peninsula, Alaska
1991
Scale Approximately 1:550,000
Albers Equal-area Conic Projection
X Sample Location

Figure 2

Bathymetry	-	Complete as of date 100m resolution
Timber harvest	-	Mostly complete Slight modifications in process to keep current

Analysis and representation of generalized data themes, such as vegetation, land use, and habitat, will be coordinated with and reviewed by the contributing agencies This type of information coordination, in addition to work with the primary GIS users, is anticipated with the USFS, ADF&G, USF&WS, native corporations, and ADEC Other coordination efforts may be necessary to integrate broad resource agency information into restoration studies

4 Alternatives

a Contract with the Private Sector - An outside consultant could be contracted to conduct the GIS analysis and mapping needs for the restoration process The individual consultant will not be familiar with the people, project, or the limits of the data The consultant is less likely to receive the most current information as it becomes available The relationship with the historical support group at ADNR would have to be clearly defined Cost benefit is undetermined

b Build a GIS within another agency - If GIS is new to the agency, the agency would have to progress through the admittedly complex learning curve The level of service to the restoration community would substantially decline during this learning period If the agency currently holds expertise in this arena, staffing and project management would be of initial concern, but the transition period would not be as long as the above option

c Continue funding ADNR GIS as a restoration project This alternative builds on the historical and institutional ties developed over the past four years This alternative takes advantage of the mature GIS facility located within ADNR This alternative guarantees product delivery, maintains stable staffing, and represents the highest productivity for the limited funding for GIS support This is the alternative currently supported

5 Location

Technical Services 3 is in compliance of NRDA studies support As of date, no field work is scheduled or requested

6 Benefits

Using GIS for restoration project support will allow the most informed analysis of geographically dependent information Using ADNR GIS will allow the current economies of highly specialized personnel, database access, and

system and project management to transition from the historic damage assessment themes to the restoration focus ADNR has access to, both directly and through multi-agency contacts, land use planning and land cover databases Complex restoration alternatives may be rapidly evaluated using a GIS approach This utility of GIS was evident in the mapping and analysis performed as part of the imminent threat habitat assessment GIS visibility analysis was also instrumental to the arguments used in support of the Kachemak Bay Purchase and Sale Agreement Please refer to Figures 1 and 2 for examples of report quality maps

7 Technical Support

TS3 is a technical support service All support for this service is in-house at ADNR (Note Restoration projects directly benefit from existing ADNR GIS infrastructure The Land Records Information Section employs over 56 staff working in three main areas mainframe business programming, land status parcel mapping by status graphics, and GIS services The mainframe staff provide direct and current access to the department's Land Administration System, a complex database of land records, business transactions, appraisals, contracts, and classifications The status graphics unit provides the hydrographic base used to identify salmon streams This unit will also provide parcel level detail for lands tracked by the state status plat system The GIS project is responsible for resource valuations and comparative mapping necessary to meet the department's mission The deliverables created for oil spill clients all directly benefit from this ADNR infrastructure)

8 Contracts

No contracts are assigned at this time

9 Mitigation Measures
n/a

10 Literature cited
n/a

D Schedules and Planning

Schedule and planning for the restoration process is ultimately dependent on the needs and requests of the customer base Currently, we can make the following projections

1 Restoration Planning Draft restoration plan to be published in early summer To date, this group has relied upon GIS to provide map documents for reports, meetings, public comments, and briefings Demand has been high and is

projected to remain high

2 Federal Draft Environmental Impact Statement This companion document to the restoration plan will provide something of a synthesis of the damage assessment studies from the layman's perspective GIS products are projected to assist with this task

3 Coastal Habitat Support Several GIS projects are under way to support the extensive efforts of scientists working on the restoration of the inter-tidal ecosystems which were most severely impacted by the spill

4 Land Acquisition Significant efforts have been made to create summary documents describing the locations and relative threats to habitat on nominated land This work has involved close working relations with the ADNR Division of Forestry and the Department of Fish and Game Since acquisition has consistently received high priority from the public, we expect this work load to remain high

5 Database Compendium ADNR will work closely with the Nature Conservancy to complete a detailed compilation of information resources collected as part of the public response to the spill

6 Other PI Support Damage assessment studies which received GIS support but are not currently funded for restoration may need support if funding is received This includes work on harlequin ducks and clams

E Environmental Compliance/Permit/Coordination Status

ADNR GIS is a technical services project, and is subordinate to the environmental compliance of the restoration projects it supports

F Performance Monitoring

The management and technical staff for this project consist of the following, indented by order of command

- Section Chief
    - GIS Manager
        - GIS Analyst and Cartographer
        - GIS Analyst and Programmer
        - GIS System Administrator
            - Student Intern
            - Data Processing Clerk

ADNR, Land Records Information Section, GIS project is comprised of a pool of

advanced technical staff The oil spill project directly benefits from technical staff not directly tied to the oil spill project The GIS analyst and programmer has recently accepted a new position, an Analyst Programmer II register is currently being searched for a replacement Stable staffing, particularly at the project management level, guarantees institutional memory and the ability to correctly respond to all tasks

Quality control and assurance procedures are dependent on the source of the information obtained Some information is collected from agencies who are charged with keeping an inventory of that information, while other information must be generated and verified For example, ADNR may receive data of bald eagle nest site locations, which is inventoried by US Fish and Wildlife Services (USFWS) USFWS has their own GIS and means of quality assurance/quality control of data, and is cited as the source In the second case, a PI may deliver latitude/longitude information of sample sites ADNR GIS will send a check plot to the PI for verification No final mapping or analysis is done on this information until the sites and their summary attributes are verified The agency of the PI is cited as the source

G Personnel Qualifications

Dianne M Lyles, Data Processing Manager, Alaska Department of Natural Resources (ADNR)

Ms Lyles joined ADNR in 1985 She holds an MBA from IMEDE, University of Lausanne, Switzerland, and began her employment at ADNR with GIS experience from the oil industry Since 1985, starting as the manager of the department's GIS land status project, she has become (in 1989) the manager of a section of 60 data processing personnel that create and maintain ADNR's geographic, resource analysis, and revenue receipting land records information systems Three projects under Ms Lyles' direction (Land Status GIS Project - automated status mapping, Geographic Information System Project - statistical analysis and thematic resource mapping, and Business Programming Project - tabular system of land activity and associated revenues) bespeaks her experience relevant to GIS mapping and analysis on this project

Richard McMahon, GIS Project Manager, Alaska Department of Natural Resources (ADNR)

Mr McMahon has been with ADNR since 1978 He holds degrees in forestry from the Yale School of Forestry and Environmental Studies (emphasis on statistics and GIS) and the University of California at Berkeley Mr McMahon's experience includes inventory design, sampling, and mapping as a Forester for the ADNR Division of Forestry, and GIS Project management since 1987 Relevant experience to this project includes his management of statistical analysis and thematic resource mapping for ADNR

Other Key Personnel

Primary personnel, besides project leaders noted above, include two Analyst/Programmers who have extensive programming and GIS experience since (and prior to) employment at ADNR Dorothy Mortenson and Randall Hall, hired by ADNR in 12/90 and 1/90 respectively, perform the analysis, programming, and cartographic work associated with this project Ms Mortenson has a degree in geography with emphasis in cartography and GIS methods Mr Hall has a degree in computer science

H Budget

3/1/93 - 9/30/93

Personnel	$93 1	
Travel	0	
Contractual	7 0	
Commodities	5 2	
Equipment	5 0	
Subtotal	$110 3	
General Admin	13 0	
TOTAL, 7 months	$123 3,	3/1/93 - 9/30/93

Personnel - During this seven month reporting period, this project is budgeted for the following staff labor 10 5 months cartographic and programming labor, 3 5 months GIS student intern labor, 1 month system analyst labor, 3 5 months data processing clerical labor, and 2 0 months project management

Contractual - Budgeted contractual funds have been identified for maintenance and support services of GIS system software and hardware (SUN workstation network, CPU, and peripheral hardware, ESRI software including ARC/Info, Network, Tin, Cogo, and Grid, Versatec plotter, hardware, and software)

Commodities - This budget category provides funds for the project's office supplies and data processing supplies (color electrostatic plotter paper, chemicals, and toner, data cartridges and diskettes)

Equipment - Funds have been identified for disk storage capacity expansion to house restoration data

General Administration - Centralized support, as indirect costs to the project, include personnel administration, payroll processing, department financial services, and procurement

Future Funding Requirements

Note This project supports other studies' activities Future years' budgets are

projected based on this project's applications' support to other studies

FFY94 (10/1/93 - 9/30/94), $242 5 projected
FFY95 (10/1/94 - 9/30/95), $254 7 projected
FFY96 (10/1/95 - 9/30/96), undetermined, see note above

93063

DETAILED RESTORATION PROJECT DESCRIPTION
1993 FIELD SEASON

Project Title:	SURVEY AND EVALUATION OF INSTREAM HABITAT AND STOCK RESTORATION TECHNIQUES FOR ANADROMOUS FISH
Study ID Number:	93063
Project Type:	Restoration Manipulation and Enhancement
Project Leaders:	Mark Willette, ADF&G, Cordova Nick Dudiak, ADF&G, Homer Lorne White, ADF&G, Kodiak
Lead Agencies:	Alaska Department of Fish and Game, Fisheries Rehabilitation Enhancement and Development Division
Cost:	$59,400
Study Dates:	March 1, 1993 - October 31, 1993

Project Leader Date

Project Manager Date

B. INTRODUCTION

The Exxon Valdez Oil Spill (EVOS) severely damaged wild pink and chum salmon populations in Prince William Sound (PWS). Various amounts of oil were deposited in intertidal habitats where up to 75% of the pink salmon spawning occurs. Salmon eggs deposited in 1989 and all subsequent years have been contaminated and direct egg mortality has been documented. The incidence of somatic, cellular, and genetic abnormalities was higher among alevins and fry in oiled creeks. Wild salmon fry were further damaged when they entered the nearshore marine environment and consumed oil-contaminated prey. This caused reduced growth and fry-to-adult survival, because predators targeted the smaller, slower growing fish. Migration patterns indicated that nearly all the salmon fry exiting PWS passed through heavily oiled habitats in southwestern PWS. Recently detected genetic damages may further reduce the productivity and fitness of wild salmon populations in PWS for many years to come.

This project will develop project designs for appropriate and cost-effective salmon spawning habitat restoration and enhancement projects. The project was initiated in oil year 3 by the Alaska Department of Fish and Game (ADF&G). The project area includes PWS, Lower Cook Inlet (LCI), and Kodiak Island. Results from ongoing genetic monitoring will be used to determine the most appropriate restoration techniques for stocks in oiled areas. If genetically discreet stocks are identified within the oiled area, restoration efforts will concentrate on locally restoring or replacing damaged habitat or stocks. If genetically discreet stocks are not identified within the oiled area, restoration efforts will focus on replacing damaged habitat and stocks within the EVOS impact area using the most cost-effective methods.

Specific study sites were identified in oil year 3 from previous reports, aerial photographs, aerial surveys, and ground surveys. In oil year 4, additional study sites were identified and more intensive investigations were conducted at some sites identified in oil year 3. Appropriate restoration or enhancement techniques may include spawning channels and improvement of fish passage through fish ladders, or step-pool structures to overcome physical or hydrological barriers. These measures will provide salmon access to oil-free spawning habitat to replace oil-impacted spawning areas.

C. PROJECT DESCRIPTION

This is an ongoing project currently evaluating various sites in PWS and LCI for application of established spawning habitat restoration and enhancement techniques. The project is essential to responsibly develop project proposals and designs to restore and replace damaged salmon spawning habitat. The project was initially funded in September 1991 near the end of the field season in PWS. Field activities in 1991 focused on evaluation of 41 sites for fry rearing

and construction of fish passes. Field activities in 1992 focused on evaluation of 15 sites for construction of spawning channels. The ADFG currently has standpipes equipped with water temperature/level recorders at selected sites to obtain data on groundwater stability and water temperatures. The equipment must be in place throughout the winter to determine minimum temperatures and water levels at each site. Additional funds were approved in FY93 to retrieve the equipment placed in the field, analyze data, and prepare the final report and specific project designs. This study plan will briefly describe previous project activities and additional work that must be completed to close out the project.

Resources and/or Services:

This project is focused on restoration or replacement of damaged pink and chum salmon stocks and their spawning habitats.

Objectives:

1. Review existing literature and databases, determine preliminary restoration techniques for specific sites, and identify sites where field studies are needed.

2. Conduct field studies at specific sites to collect additional data needed to evaluate restoration techniques.

3. Compile available data and select the most appropriate fish restoration projects.

4. Collect additional field data, if necessary, to develop project design and cost estimates, and write proposals for specific projects.

Methods:

Objective 1:

A review of existing literature and databases was conducted to identify potential habitat restoration sites in the EVOS impact area. In addition, the survival rates of pink and chum salmon in natural streams, in the ocean, and resulting from various enhancement techniques was also summarized along with project costs. These data were incorporated into a benefit-cost analysis to determine the most cost effective wildstock restoration techniques in general. The information gathered from this review will be used to evaluate the cost effectiveness of various enhancement techniques for wild salmon populations in general. The results from this analysis will be used to focus restoration efforts on the most effective and beneficial techniques.

Spawning channel sites described in the literature were evaluated on the seasonal stability of groundwater height, groundwater temperature,

groundwater gradient, groundwater chemistry, flooding risk, availability of substrate, and availability of broodstock (Sanner 1982b). Streams identified as potential spawning channel sites from the literature review were further evaluated using aerial photographs and topographic maps. Data from topographic maps were used to estimate surface gradient and stream length. These variables are likely correlated with groundwater gradient and stability.

The feasibility of fry rearing at various streams was evaluated using aerial photographs, historical spawning escapement and pre-emergent fry index data collected by the ADFG, and shoreline oil-contamination maps constructed by the Alaska Departments of Natural Resources (ADNR) and Environmental Conservation (ADEC). Criteria used to evaluate potential fry rearing sites included the degree of oil contamination in intertidal spawning habitats, probable magnitude of fry outmigrations, availability of mooring sites for net pens, feasibility of operating fry weirs, and proximity of weir sites to net pen sites.

Salmon stocks that might be best restored by remote eggtakes were identified using historical salmon spawning escapement data, anadromous stream catalogs, and shoreline oil-contamination maps. Criteria used to evaluate remote eggtakes at these sites included degree of oil contamination, probable spawner abundance, and availability of mooring sites for net pens.

Objective 2:

All the potential sites identified from the literature review have been evaluated. Two potential fish pass sites were identified in PWS and six sites in the Kodiak area in oil year 3. Detailed investigations were conducted at these sites in oil year 4. The abundance of spawning salmon, barrier falls height, stream width, stream depth, stream gradient, and substrate type was estimated from aerial surveys. The information gained from these surveys was used to eliminate some streams from further consideration. More extensive ground surveys were conducted at sites that appeared suitable from aerial surveys. The following physical measurements were made during ground surveys. Barrier falls height was estimated with a clinometer and measuring tape. U.S. Forest Service stream habitat foot survey methods were used to estimate available spawning habitat above the barrier (Olsen and Wenger 1991). Additional winter field studies will be conducted at three potential fish pass sites in the Kodiak Island area. All field equipment will be retrieved, and the sites returned to their natural state.

Fifteen potential spawning channel sites were identified in PWS and one site in Lower Cook Inlet in oil year 3. The apparent size composition of the substrate, groundwater level, flooding risk, and ease of access was the criteria used to identify specific sites. Ground surveys were conducted at sites that appeared suitable from aerial surveys. A preliminary ground survey was conducted to determine flooding risk, the approximate depth of groundwater, and the size

composition of the substrate. If the area appeared to be unaffected by floods, the groundwater is shallower than 2 meters, and the substrate is composed largely of gravel or cobbles, additional survey work was conducted.

Standpipes were installed at the ten potential spawning channel sites identified in oil year 3. Standpipes were installed at each of these sites to a depth at least 2 m below the groundwater level, parallel to the surface gradient, along the most likely location of the spawning channel. The standpipes are constructed from 1.5 m sections of 5 cm diameter galvanized well pipe, with a sandpoint, and galvanized couplers. Electronic water temperature/level recording devices were installed on selected standpipes to monitor changes in groundwater height. Each standpipe was covered with insulation at the surface and marked with a pole and flag. Spawning channel study sites without water temperature/level monitoring devices will be surveyed during the winter months to measure groundwater heights and evaluate the extent of substrate freezing.

Electronic water temperature/level monitoring equipment will be retrieved in the spring of 1993. Data will be analyzed to evaluate groundwater stability and the probable rate of intragravel flow at potential spawning channel sites. The rate of intragravel flow is an important variable affecting egg-to-fry survival in salmon spawning beds (McNeil 1966). The characteristics of groundwater variability will be related to distance from the mainstem channel, substrate type, and drainage basin area and gradient. This analysis will provide insight into factors affecting groundwater flow and stability that will be useful for identifying other suitable spawning channel sites in the EVOS impact area.

Six potential fry rearing sites were identified in PWS and one site in LCI during oil year 3. Fry rearing study sites were surveyed from the air when the tide was at about the six foot level. A video camera was used during the aerial survey of each stream for later review. A ground survey was conducted to measure the distance across the stream channel, mean stream depth, and mid-channel current speed at the intended location of the fry weir. The estuarine area near the potential weir site was surveyed to locate a suitable area to moor net pens. The data collected at potential fry rearing sites will be summarized in the final report. No additional field studies will be conducted at these sites.

Objective 3:

After all necessary data has been collected, a weighted decision matrix will be used to establish priority among potential projects. Detailed proposals will be developed for projects that receive a high ranking. The following criteria (unweighted) will be used in the decision matrix:

1. oil spill damages to spawning habitats and salmon stocks,

2. the estimated increase in fish production resulting from the proposed project,
3 the importance of the estimated increase in fish production to subsistence, sport, and commercial user groups,
4. the estimated benefit/cost ratio of the proposed project,
5. the potential for the proposed project to maintain the genetic characteristics of the affected salmon population,
6. level of genetic damage within the stock,
7. demonstrated effectiveness of the restoration technique,
8. requirement for future project maintenance,
9. ability of the resource to recover naturally,
10. ability to document the success of the project,
11. compatibility of the proposed project with established land uses in the area, and
12. compatibility of the proposed project with regional salmon enhancement plans.

Objective 4:

Engineering designs will be developed for projects that receive a high ranking in the decision matrix. Additional field work may be required to collect engineering data needed for development of project designs. Engineers will be contracted to work on these projects as needed to collect engineering data and design structures. The level of detail included in project designs will be adequate to accurately assess the cost and benefits from the project. However, additional engineering design work will likely be required if funding is provided for project construction.

Alternatives:

There are two alternatives to this project. No action would involve not attempting to restore or replace damaged pink and chum salmon stocks and their spawning habitats. However, elevated egg mortality was documented in oiled spawning streams in 1992, so no action would result in continued reduced productivity among damaged salmon stocks. The second alternative to this project involves proceeding with instream habitat and stock restoration projects without first reviewing the options and identifying the most appropriate projects for specific sites. This alternative would likely result in projects with a low benefit/cost ratio.

Location:

This project will be conducted in Prince William Sound, Lower Cook Inlet, and the Kodiak Island area.

Benefits:

This project will identify sites within the EVOS impact area that are suitable for instream habitat and stock restoration projects. The

most appropriate type of project for each site will be identified, and benefit/cost ratios will be estimated. Completion of proposed projects will result in restoration or replacement of damaged salmon spawning habitats or stocks.

Technical Support:

No technical support will be required to complete this restoration project.

Contracts:

A contract will be needed for engineering support to complete this project. The only other contractual services will be for air charter and local utilities.

Mitigation Measures:

No mitigation measures will be required for this project. However, appropriate mitigation measures will be identified for each proposed instream habitat or stock restoration project.

Citations

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Sanner, C. 1982b. Potential spawning channel site selection survey, Coghill Lake area, Prince William Sound. USFS Report, 40p.

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D. SCHEDULES AND PLANNING

Date	Activity
Activities scheduled and budgeted for in this budget year.	
March & April	Conduct winter field studies at two fish pass and ten spawning channel study sites.
April & May	Retrieve standpipes and electronic water temperature recorders from ten spawning channel study sites.
June	Compile and evaluate data, select sites for development of detailed project proposals.
June & July	Collect additional engineering data if necessary for project designs. Preparation of final report and detailed project proposals including engineering designs
July 15	Submit draft report
July & Aug.	Peer review
September 30, 1993	A final report will be submitted 30 days after receipt of peer review comments

E. ENVIRONMENTAL COMPLIANCE:

The project qualifies for a categorical exclusion under the National Environmental Policy Act, because it does not involve any significant manipulation of biological resources or their habitats.

F. PERFORMANCE MONITORING:

A final report will be prepared including a description of results under each objective listed in the detailed project study plan. Proposals including engineering designs will be developed for projects that are recommended for development. Sufficient detail will be included in engineering design and cost estimates to accurately the assess the benefits and costs of each project.

G. PERSONNEL QUALIFICATIONS

Mark Willette: Master of Science, Fisheries Oceanography, 1985; Bachelor of Science, Fisheries Science, 1983, Area Biologist, ADF&G, FRED Division Cordova, March 1991-present. Conduct various fisheries enhancement projects

in PWS including limnological investigations of sockeye salmon producing lakes, and quality control of coded-wire tagging at private hatcheries. Principal Investigator on NRDA studies on juvenile salmon in PWS. Instructor/ Assistant Research Professor, University of Alaska Fairbanks, 1986-1991. Conduct various fisheries research projects. Design and implement a program of education, research, and public service in northwest Alaska.

Nick Dudiak: Bachelors of Science, Zoology, 1968; Area Biologist, Lower Cook Inlet, ADF&G FRED Division, 1977-present; Project Leader: Paint River fishway feasibility study, Chenik Lake sockeye salmon rehabilitation program, Leisure Lake sockeye salmon stocking and fertilization program, Tutka Hatchery pink and chum salmon evaluation program.

Lorne White: Bachelors of Science, Biology, 1973; Area Biologist, Kodiak, ADF&G FRED Division, 1987-present; Project Leader: Rehabilitation of sockeye salmon at Karluk Lake; Asst. Project Leader: Scallop mariculture feasibility study; Research Experience: evaluation of 15 proposed fish passes on Kodiak Island, fertilization, instream habitat studies related to hydroelectric development.

H. BUDGET

Personnel	29.3
Travel	0.3
Contractual	20.5
Commodities	3.5
Equipment	0.0
Capital Outlay	0.0
Subtotal	53.6
General Administration	5.8
Project Total	59.4

Project Description This is a closeout of an ongoing project (R 105) designed to evaluate various sites in EVOS impact area for application of established spawning habitat restoration and enhancement techniques Additional funds are needed in FY 93 to retrieve equipment currently in place in the field The project is currently focused on evaluation of fifteen sites for construction of spawning channels Standpipes and electronic water temperature/level recorders are being installed to obtain data on overwintering conditions at each site This data is essential for the responsible development of proposals and designs for spawning channels in this area The requested funds will be used to retrieve equipment, analyze data, and prepare detailed project proposals and designs

Budget Category	Approved 1-Oct-92 28-Feb-93	Proposed* 1-Mar-93 30-Sep-93	Total FY 93	FY 94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond
Personnel	$47 3	$29 3	$76 6					
Travel	$4 7	$0 3	$5 0					
Contractual	$31 1	$20 5	$51 6					
Commodities	$8 1	$3 5	$11 6					
Equipment	$20 2	$0 0	$20 2					
Capital Outlay	$0 0	$0 0	$0 0					
Sub-total	$111 4	$53 6	$165 0	$0 0	$0 0	$0 0	$0 0	$0 0
General Administration	$9 3	$5 8	$15 1					
Project Total	$120 7	$59 4	$180 1	$0 0	$0 0	$0 0	$0 0	$0 0
Full-time Equivalents (FTE)	0 5	0 7	1 2					

Amounts are shown in thousands of dollars

Budget Year Proposed Personnel

Position	Months Budgeted	Cost	Comment

For details, see 3A & 3B forms

* FY 93 is a transition year from the previously used oil fiscal year to the federal fiscal year This project also includes proposed funding for January and February, 1993

17 Jul 92

1993

Project Number 93063
Project Title Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for Anadromous Streams
Agency AK Dept of Fish & Game

FORM 2A PROJECT DETAIL

Project Description This is a closeout for an ongoing project (R 105) designed to evaluate various sites in EVOS impact area for application of established spawning habitat restoration and enhancement techniques Additional funds are needed in FY 93 to retrieve equipment currently in place in the field The project is currently focused on evaluation of fifteen sites for construction of spawning channels Standpipes and electronic water temperature/level recorders are being installed to obtain data on overwintering conditions at each site This data is essential for the responsible development of proposals and designs for spawning channels in this area The requested funds will be used to retrieve equipment, analyze data, and prepare detailed project proposals and designs

Budget Category	Approved 1-Oct-92 28-Feb-93	Proposed* 1-Mar-93 30-Sep-93	Total FY 93	FY 94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond
Personnel	$35 0	$29 3	$64 3					
Travel	$1 7	$0 3	$2 0					
Contractual	$31 1	$20 5	$51 6					
Commodities	$7 5	$3 5	$11 0					
Equipment	$20 2	$0 0	$20 2					
Capital Outlay	$0 0	$0 0	$0 0					
Sub-total	$95 5	$53 6	$149 1	$0 0	$0 0	$0 0	$0 0	$0 0
General Administration	$7 5	$5 8	$13 3					
Project Total	$103 0	$59 4	$162 4	$0 0	$0 0	$0 0	$0 0	$0 0
Full-time Equivalents (FTE)	0 3	0 7	1 0					

Amounts are shown in thousands of dollars

Budget Year Proposed Personnel

Position	Months Budgeted	Cost	Comment
Fisheries Biologist I	3 0	$12 5	
Fish & Wildlife Technician III	1 0	$4 0	
Fish & Wildlife Technician II	2 0	$6 1	
Engineer	2 0	$13 2	
Program Manager	0 5	$3 5	

* FY 93 is a transition year from the previously used oil fiscal year to the federal fiscal year This new project also includes proposed funding for January and February, 1993

17 Jul 92

1993

Project Number 93063
Project Title Survey and Evaluation of Instream Habitat and Stock Restoration Techniques for Anadromous Streams
Agency AK Dept of Fish & Game

FORM 3A SUB-PROJECT DETAIL

		Proposed
Travel	2 RTs Anchorage to Homer	$0 3
Contractual	Aircraft charter (12 0K) Aircraft will be chartered to visit each site and retrieve equipment Contract for Engineering Services (8 5K)	$20 5
Commodities	Supplies needed by the field crew when they visit each site to retrieve equipment Additional supplies will be needed when selected sites are revisited with the project engineer	$3 5
Equipment	No equipment is needed to complete the project	$0 0

93066

Attachment 3

DETAILED RESTORATION PROJECT DESCRIPTION

Project Title: Alutiiq Archaeological Repository Center

Project ID # 93066

Project Type: Artifact Repository, Museum, Culture Center

Project Leader(s): Rita Stevens (Kodiak Area Native Association Vice-President)
Rick Knecht (Kodiak Area Native Association Archaeologist)

Lead Agency. Alaska Department of Environmental Conservation

Cooperating Agencies: None

Cost F/Y 1993-94 $1,500 000 00

Startup Date 10/1/93 **Completion Date** 10/1/94

Geographic Area of Project Kodiak Island Area

Project Leader Signature _____
Rita Stevens

Project Manager Signature: _____
Rick Knecht

Alutiiq Archaeological Repository Center (93066)
Detailed Project Description

A Introduction

Archaeological resources were injured by the oil spill Sites and artifacts were oiled which interferes with study of the artifacts and radiocarbon dating to determine age. Looting and vandalism increased at sites because of increased opportunity as a result of the cleanup and increased knowledge of site locations

Unlike many of the resources which were injured by the oil spill and associated cleanup activities, archaeological sites are non-renewable They are the only records we have of the history of the prehistoric indigenous people of the spill area, records that when systematically excavated, can be interpreted by an archaeologist Injury to an archaeological site, removal of soil cover by trampling, holes left by looters; is comparable to injury to a library building When the roof is torn away, and the windows broken, the entire contents are gradually lost The *Exxon Valdez* Trustee Council has funded projects to restore some injured sites by replacing the disturbed cover on the sites and through erosion control, but some sites can only be restored through excavation of the sites and recovery of the artifacts The Kodiak Area Native Association has sponsored annual large-scale archaeological excavations in an effort to rescue threatened sites and artifacts. This project will provide a repository for safe, secure storage of recovered artifacts

The Kodiak Archipelago has the highest density of archaeological sites in the area affected by the 1989 *Exxon Valdez* oil spill A recent study, based on 5,000 miles of shoreline surveyed in the wake of the spill, was published in Arctic Anthropology (Erlandson et al 1992) The study showed that Kodiak has 2 6 times as many sites per kilometer of coastline as the Alaska Peninsula, 3 4 times as many as the outer Kenai Peninsula, and 4 7 times that of Prince William Sound Of the 22 sites known to have been impacted by vandalism in 1989, 17 were in the Kodiak region Site vandalism has greatly increased since the spill, at least partly because site locations became widely known in the wake of the oil spill cleanup A multi-agency panel of experts convened by the Trustee Council in June 1992 concluded a total of 112 archaeological sites suffered substantive injury from the oil spill cleanup or vandalism associated with the spill In addition, 59 sites suffered moderate to heavy oiling Roughly half of the 59 sites were also included in the 112 sites injured by cleanup or vandalism

In the interest of restoring and preserving Alaska's heritage, the *Exxon Valdez* Oil Spill Trustee Council and the Kodiak Area Native Association is establishing the Alutiiq Archaeological Repository Center, to be dedicated to the restoration and preservation of injured cultural resources, traditional Native culture, and public education to help reduce further vandalism A building of 5,000 square feet, located in the City of Kodiak, will house artifact storage facilities, lab space, and exhibits The Trustee Council will provide funds to build the repository Annual operating costs for the repository and annual restoration field work costs will be borne by the Kodiak Area Native Association

The Alutiiq Archaeological Repository Center will be a focal point for archaeological research and survey by universities, Native organizations, and government agencies, and as a regional repository for artifacts, maps, and data. The center will preserve the knowledge of traditional subsistence practices of the Native community, many of which were also disrupted by the oil spill. The project will be a permanent and valuable addition to the community and to the State of Alaska

B. Project Description

1. Resources

Large prehistoric human populations were nurtured by the abundant marine resources of the Gulf of Alaska Village sites, sometimes continuously occupied for thousands of years, dotted the coastlines, and have left some of the richest deposits of archaeological material still intact in the United States.

These sites are typically represented by large mounds of accumulated midden refuse, house remains, and artifacts They can range from ten meters to several kilometers in length and frequently exceed four meters in depth Although large, they are extraordinarily vulnerable to destruction by the combined forces of vandalism and marine erosion

2. Objectives

The primary objective of this project is to construct and furnish the Alutiiq Archaeological Repository Center, which will be dedicated to the preservation of cultural resources, traditional Native culture, and the

education of the public A building of approximately 5,000 square feet will be constructed in the City of Kodiak, and will house artifact storage facilities, laboratory space, and exhibits The project is limited to constructing and furnishing the Alutiiq Archaeological Repository Center Operating costs will be funded by the Kodiak Area Native Association

3. Methods

The Alutiiq Archaeological Repository Center will serve as a regional repository for artifacts, maps, and data recovered by salvage excavations, survey, and repair work done on injured sites This data base will be open to scholars as well as state and federal cultural resource managers

The repository will make it possible to safely store and study artifacts from sites injured by the *Exxon Valdez* oil spill. Kodiak Area Native Association has fielded a major archaeological project every year since 1983 Since 1989, the emphasis has been on restoration and recovery of sites that were injured by the oil spill and are suffering continuing injury from increased vandalism, looting and erosion. Where possible, injured sites have been protected from future vandalism and erosion by reburying the sites, but often the only available restoration alternative is to excavate the site to recover the artifacts and prevent further loss of artifacts, the accompanying information and cultural heritage. Future work will be coordinated with other Trustee Council projects

The need for the immediate construction of a repository can be clarified by exploring the quandary facing Kodiak Area Native Association personnel Should one recover artifacts that will otherwise be lost to vandalism, looting, and the vagaries of nature, but that face an uncertain future because of inadequate storage facilities? Kodiak Area Native Association has a collection of approximately 50,000 artifacts at this time, of which about one half are related to the *Exxon Valdez* oil spill[1] Storage facilities are already full to over-flowing and climate control equipment is inadequate for the number of artifacts already in storage Many sites related to the oil spill with tens of thousands of artifacts need to be recovered in the next few years before they are lost forever

Construction of a repository now will permit a systematic excavation of oil

[1]Artifacts related to the spill are artifacts that are from sites that were oiled, injured during cleanup or where vandalism and looting has increased because of the spill

spill injured sites on an annual basis and on a large scale. Kodiak Area Native Association has already secured funding for the 1994 season from private sources, and expects to field a crew of 20 archaeologists for a full three months in the summer of 1994 at injured sites This is by far the largest such project in the State of Alaska We expect the size of the collection to more than double in the next five years with all of the increase coming from injured sites. More than 75% of the collection will be oil spill related artifacts in less than five years In that same time period, Kodiak Area Native Association will have provided more than half of the funds necessary to build the repository, operate the repository, and implement restoration field projects.

After extensive research and consultation with engineering firms on a number of alternative building sites and construction options, Kodiak Area Native Association will minimize the construction cost per square foot thus maximizing the amount of floor space available for the repository by entering into a condominium agreement with Natives of Kodiak, Incorporated. Land acquisition, design and construction costs will be shared Maintenance costs will also be shared which will help in maintaining the long term benefits this project will provide to injured resources Costs for the building will be shared equally between Kodiak Area Native Association and Natives Of Kodiak, with the exception of special needs for climate control and security, and storage units and displays for artifacts in Kodiak Area Native Association's portion of the building. The Alutiiq Archaeological Repository Center will occupy the first floor of a two-story Class A, steel frame office building. The upper floor will be owned by Natives of Kodiak, Inc , who will use it for office space. The condominium agreement stipulates that Natives of Kodiak, Inc cannot utilize their space for any purpose that would be inappropriate for the museum environment Further, Kodiak Area Native Association has first purchase rights on the space on the second floor which will allow for easy expansion when conditions warrant The building will be designed to allow for an easy upgrade of the second floor to repository standards for climate control and other special requirements Both floors of the building will be designed and constructed to meet the required flammability standards

The lower floor will contain a common entry foyer, elevator lobby, and circulation stairs The remainder of the first floor would include the artifact storage, exhibit areas, laboratory space, administrative offices, and darkroom Each floor will have its own toilet facilities, janitor closet, and drinking fountain This will insure that the facility meet security requirements stipulated by federal standards for the curation of

archaeological collections Also to meet or exceed federal standards for artifact curation, the museum area will have special provisions for additional height (ten foot ceilings) in the display area, sophisticated temperature and humidity controls, a fire protection system, a security alarm system, and other provisions required for museum space

Roughly 60% of the floor space will be used for artifact storage, utilizing mechanical 'space saver' shelving, which takes 30% less space than conventional shelving Included in the artifact storage area will be an approximately 200 square foot space for processing artifacts, cleaning, cataloguing, and conservation. A smaller space will be used for a dark room. Storage cabinets will also be installed for storing field notes, photographs, videos, tapes, and other archival material A small space will also be provided for a darkroom Two small office spaces of roughly 100 square feet each are also planned for the artifact storage area.

The facility will meet all state and federal standards for climate control, security, and fire prevention to insure the long-term safety of the collection The collection will be made available to scholars and state and federal resource managers so that informed decisions can be made on cultural resource management

Exhibits, using about 30% of the floor space, will be open to the public, and will serve to increase the general knowledge of Native cultural heritage as well as the need to preserve and protect archaeological sites and artifacts As an educational tool, the facility will also help address less tangible but none the less real injuries from the spill, such as the preservation of traditional Native subsistence practices which were disrupted by the oil spill

4 Alternatives

Among the alternative approaches are

a Storing the materials at another repository

The University of Alaska-Fairbanks Museum currently curates archaeological collections in Alaska Their bill for the 200-300 pieces collected by the Exxon-Valdez Cultural Resource Program was $30,000 Space concerns at University of Alaska-Fairbanks facilities have reached a point where new construction is necessary to house new collections of any size In 1993 alone, Kodiak Area Native Association archaeologists recovered 10,000

artifacts from threatened sites Without cost-effective, local curation, we could never attempt the number of restoration projects we intend to fund ourselves and the artifacts would be lost

b Relying only on increased enforcement to prevent vandalism and looting.

Alternative b has, and is being pursued by a number of entities Because of the sheer number (2,000+) and remote location of archaeological sites around the archipelago, enforcement is extraordinarily expensive and difficult In fact, despite the large amount of money spent by federal and state agencies, there has never been a successful arrest for violation of ARPA, the Archaeological Resource Protection Act

5. Location

The building site consists of approximately 31,470 square feet of land, located at 215 Mission Road, Kodiak Alaska The legal description of the property is recorded as Lot 11A, Block 3, Kodiak Townsite Addition, according to Plat 87-36, Kodiak Recording District, Third Judicial District, State of Alaska.

Building costs are lower at this site than at any other available site which will permit construction of a bigger, better facility than at any other site This site is readily accessible both to the people of Kodiak and visitors which will maximize its effectiveness as an educational facility

The site is currently a vacant lot, cleared except for several alder bushes on the south boundary of the site It is located about two blocks from the center of downtown Kodiak, and is commercially zoned. The specific adjacent land use is as follows

North- An abandoned single family residence and a parking/storage area

Northeast- Erskine Avenue, a paved road, and a mortuary

East-Mission road, a paved roadway

Southeast - across Mission Road, Petro Marine Services bulk fuel plant, and the Russian Orthodox Church

South- Alaska Department of Fish and Game Building and Parking area

West- Baptist Church Parking lot

Northwest- Baptist Church and single family residence.

The site is included on U S. Geological Survey topographical map Kodiak (D-2) SE Quadrangle. The site is located on the southeast slope of a north-south trending hill The ground surface within the site boundaries slopes very slightly eastward and is almost level Since at least 1964, the site has been cleared repeatedly by heavy equipment and a large amount of fill has been deposited on the original soil surface. No significant cultural or natural resources will be impacted at this building site.

There are at present no alternative vacant lots in the downtown area of Kodiak available for this project A downtown location is important to the long-term success of this project due to the fact that visitors to Kodiak Island seldom bring automobiles with them, and are therefore on foot Alaska Native users of the facility will arrive from villages by air taxi, and a location convenient to other downtown destination is important for that reason

A 2.5 acre plot of undeveloped land on Near Island, across the Near Island channel from Kodiak has been explored as an alternative site for the project Because the land is currently covered by brush and trees and located on a steep hill, building costs at that location were estimated to exceed $300 per square foot

Construction costs at the Mission Road site are approximately $155 per square foot, which makes it possible to build a larger, more useful facility within the budget limits set by the *Exxon Valdez* Oil Spill Trustee Council The Mission Road site has been disturbed by earthmoving activity in the past, and construction there will not disturb the natural environment to the extent that the Near Island site would

6. Benefits

This is a one-time funding request which will establish a permanent facility which will address the cultural resource preservation needs of the region over the long term Locally based research, excavation, and curation is by far the most cost-effective way to address this problem The facility will make it possible to use the funding and expertise already in place on Kodiak It will be available to state and federal land managers who will need to make

informed decisions on cultural resource management

Exhibits, as well as a steady stream of new information based on excavation results, will provide an invaluable tool for public education. We also expect beneficial side effects on the growing visitor industry. Located in the Kodiak downtown area, near the Russian Orthodox church and a small municipal museum, the Alutiiq Archaeological Repository Center is only a few hundred yards walk from the state ferry dock

In summary, we feel that this project is the single most effective way to address the long term need to protect and share the rich cultural resources of the Kodiak Island region, as well as mitigate the damages incurred by the spill on these resources and the community The Alutiiq Archaeological Repository Center will be a permanent and valuable addition to the community and to the State of Alaska.

7. Technical Support

The Alutiiq Archaeological Repository Center will be constructed by the Kodiak Area Native Association with general oversight by the State of Alaska for the *Exxon Valdez* Oil Spill Trustee Council The capital construction procedures of the Division of Facility Construction and Operation, Alaska Department of Environmental Conservation, will be followed

The architectural/engineering firm of Unwin, Scheben, Korynta Huettl, Inc (USKH), located in Anchorage, Alaska will provide architectural services as well as civil engineering, mechanical engineering, electrical engineering, and structural engineering USKH will also handle bid administration, in cooperation with Kodiak Area Native Association and the State USKH has included the Portico Group of Seattle, Washington, as a special museum and visitor center consultant. The Portico group will also preform the landscape design for this project, using the services of Shannon & Wilson, who did the initial study on the property USKH also plans to utilize the services of Towne, Richards & Chaudiere, Inc , acoustical consultants, to provide positive and complete separation of the two major condominium owners, as well as separation between individual offices and other areas

Archaeological storage and laboratory equipment will be planned by Richard Knecht, archaeologist and project director for the Kodiak Area Native Association

8. Contracts

The architectural/engineering firm of Unwin, Scheben, Korynta Huettl, Inc (USKH), located in Anchorage, Alaska has been chosen by Kodiak Area Native Association from four Alaska firms who responded to a request for proposals, based on bottom line costs as well as records for bringing projects in on time and within budget. USKH will provide architectural services as well as civil engineering, mechanical engineering, electrical engineering, and structural engineering

Exhibit installation will be contracted to professional museum exhibit design firms The primary objective is to provide storage and processing space for artifacts. Exhibits are considered a secondary priority in budgetary planning, but will be installed according to the highest possible standards. Requests for proposals will be sent out when the building shell is near completion.

9. Mitigation Measures

According to documents filed as part of National Environmental Policy Act compliance, no mitigation measures will be needed to insure compliance with NEPA.

10. Literature Cited

Erlandson, Jon et al 1992
Spatial and Temporal Patterns in Alutiiq Paleodemography. *Arctic Anthropology*, Vol 29, No.2. pp 42-62

Kodiak Area Native Association 1993
Environmental Assessment, Alutiiq Archaeological Repository Project, Kodiak, Alaska

Unwin, Scheben, Korynta, Huettl, Inc 1993
Preliminary Fee Proposal, Natives of Kodiak Office Building

C. Schedules and Planning

Architectural firms have already been screened and one selected Negotiations between Kodiak Area Native Association and Natives of Kodiak

Alutiiq Archaeological Repository Center (93066)

on the condominium agreement are nearly concluded, with signature of a final draft pending final attorney review.

A milestone schedule for architectural design and construction, along with costs per phase is attached. Installation of exhibits, storage units, and other equipment is not included in this table A milestone chart for storage unit and exhibit installation will be submitted once drawings are completed We expect to install exhibits and space saver storage units beginning in August of 1994

D. Environmental Compliance/Permit/Coordination Status

An environmental assessment has been prepared by the Kodiak Area Native Association. The National Oceanic and Atmospheric Administration has reviewed the document and determined that it complies with the requirements of the National Environmental Policy Act

E. Performance Monitoring

Construction oversight will be coordinated by the architectural/engineering firm of Unwin, Scheben, Korynta Huettl, Inc (USKH) Funds will be handled by an independent accounting firm Bills will be paid when approved for payment by USKH in accordance with standard industry practice and the Department of Environmental Conservation capital construction procedure The Department of Environmental Conservation will provide general performance monitoring of the project to insure that department procedures are followed

F. Personnel Qualifications

Project Manager-Richard Knecht has directed programs in cultural preservation and archaeology for the Kodiak Area Native Association since 1987, and has been the director of the Alutiiq Culture Center since it was established in 1990 He is a member of the Society for Museum Anthropology, and has sat on the Alaska State Museum Collection Advisory Committee since 1988 Mr Knecht is a doctoral candidate in Anthropology at Bryn Mawr College, and holds a Master's degree in Anthropology from Bryn Mawr, and a BA in Anthropology from Michigan State He has directed major archaeological research programs on Kodiak Island every summer for

the past 11 years

G. Budget

Costs for the building will be shared equally between Kodiak Area Native Association and Natives of Kodiak, with the exception of special needs for climate control and security, and storage units and displays of artifacts in Kodiak Area Native Association's portion of the building. As of September 1993, the estimate of the total condominium cost is $2,385,000 Kodiak Area Native Association will contribute $1,287,500 and Natives of Kodiak will contribute $1,097,500 Kodiak Area Native Association will use an additional $207,500 for storage units and displays (see the following budget for additional information) Natives of Kodiak's assets now exceed $25,000,000, with liabilities of $10,000. They are fully prepared to participate in the project on a cash basis

Minimum annual operating expenses of the repository are estimated to be $100,000 per year. Kodiak Area Native Association will partially fund annual operating costs through ongoing commercial enterprises (approximately $100,000 per year) Native regional and village corporations contribute about $65,000 per year Grants from foundations and other sources have averaged over $100,000 per year since 1988. In addition, Kodiak Area Native Association intends to fund extensive restoration field work every summer for the foreseeable future.

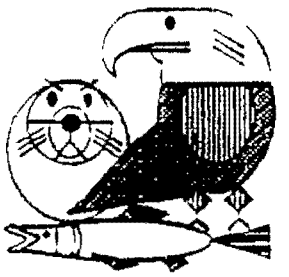
Aluting Archaeological Repository Center (93066)

Budget Summary

Funding Sources	KANA	NOK
Trustee Council Contribution to Repository	$1,500,000	
Natives of Kodiak Contribution to Upper Floor		$1,097,500
Total	$1,500,000	$1,097,500
Cost Estimate for Building		
Land Acquisition	$111,750	$111,750
Set-up Cost	$12,500	$12,500
Design, Engineering, and Inspection	$113,500	$113,500
Government Fees and Permits	$8,000	$8,000
Construction Cost	$813,750	$813,750
Start-up Assessment	$38,000	$38,000
Subtotal	**$1,097,500**	**$1,097,500**
Climate Control, Security and Fire Suppression for Repository	$170,000	
Subtotal	$1,287,500	$1,097,500
Funds Remaining for Storage Units and Displays	$207,500	
General Administration of Grant by State	$30,000	
Total	$1,500,000	$1,097,500

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 "G" Street, Anchorage, AK 99501
Phone: (907) 278-8012 Fax: (907) 276-7178



FAX COVER SHEET

To: Bob Spies Number:

From: Pamela Bergmann Date: 8 Oct 93

Comments: Total Pages: 14

Here is another copy of the DPD for the Kodiak Museum

Please let me know how soon Dumond can get you comments on this —

Thanks

Alutiiq Archaeological Repository Center (93066)

Budget Summary

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93067

Project Title	**PRINCE WILLIAM SOUND SALMON STOCK IDENTIFICATION AND MONITORING STUDIES**
Project ID#	93067
Project Type	Recovery Monitoring and Restoration
Project Leaders	Samuel Sharr, Alaska Dept Fish and Game Carol Peckham, Alaska Dept Fish and Game
Lead Agency	Alaska Dept Fish and Game
Cooperating Agency	Prince William Sound Aquaculture Corp Valdez Fisheries Development Association
Project Cost	FY 93 $388,400 FY94 $39,400
Start Date June 1, 1993	Finish Date 30 January 1993
Geographic Area of Project	Prince William Sound

Project Leaders

_____ _____
Samuel Sharr

_____ _____
Carol Peckham

Program Managers _____ _____

A. INTRODUCTION

Wild stock production of pink salmon in PWS has ranged from 10 to 15 million fish in recent years Much of the spawning for pink salmon (up to 75% in some years) occurs in intertidal areas Intertidal spawning areas are susceptible to marine contaminants and there is strong evidence the March 24, 1989, *Exxon Valdez Oil Spill* (EVOS) adversely affected spawning success and early marine survival in Prince William Sound (Sharr et al 1992, Willette and Carpenter 1993) Salmon stocks impacted by the Exxon Valdez Oil Spill (EVOS) are also heavily exploited in commercial, sport, and subsistence fisheries These stocks can most effectively be restored through stock specific management practices designed to reduce exploitation on impacted stocks The stocks in areas heavily impacted by the EVOS are present in fisheries dominated by hatchery and wild stocks from unaffected areas of the Sound (Attachments 1 and 2) The management of this mixed stock fishery has historically been based on maintaining good temporal and spatial distribution of spawning escapement for groups of stocks in eight major fishing districts The success of this management strategy relies upon the manager's ability to control stock specific exploitation rates Restoration premised on stock specific management of the commercial fishery for reduced exploitation of impacted stocks will require even more accurate inseason catch stock composition estimates if different harvest rates are to be achieved for damaged wild stocks versus unimpacted wild stocks or hatchery stocks

This project is designed to provide accurate, real time, catch contribution estimates for pink salmon stocks of Prince William Sound Accurate escapement estimates from ongoing ADF&G escapement monitoring projects will enable mangers to identify stocks which are experiencing escapement shortfalls Accurate and timely catch contribution estimates from this coded-wire tag recovery project will enable managers to identify times and areas where exploitation on depleted wild stocks can be minimized and still permit the harvest of surplus hatchery returns Post season analyses of the catch contribution estimates together with results from salmon escapement enumeration projects will provide stock specific estimates of total return and survival and enable managers to assess the effectiveness of stock specific management strategies

In the absence of improved stock specific management capabilities afforded by this project, salmon stocks in western PWS which have already been stressed and depleted by the oil impacts will potentially be over exploited in the commercial, sport and subsistence fisheries Population levels of stocks may be reduced below those needed for rapid recovery and in some instances may result in virtual elimination of impacted stocks If adequate stock monitoring programs are not in place, changes in fishing effort to areas of less oil impact could also result in over exploitation of otherwise healthy, unimpacted stocks

The foundations for this project were firmly established in feasibility studies which were conducted beginning in 1986 and extending through 1988 During the damage assessment process large scale tagging and recovery projects were instituted and perfected by Natural Resources Damage Assessment (NRDA) Fish/Shellfish (F/S) Study #3 Damage assessment funds were

expended for tagging hatchery releases of pink salmon in 1989 and 1990 and wild populations of pink salmon in 1990 and 1991 Tag recovery efforts for wild and hatchery pink salmon were funded by damage assessment funds in 1989, 1990, and 1991 and by restoration funds in 1992 Following the loss of funds for further tagging of hatchery stocks of pink salmon in 1990, the private non-profit aquaculture associations in Prince William Sound have continued to tag pink salmon releases at their own expense Tags applied to pink fry from the four pink salmon hatcheries in Prince William Sound in 1992 must still be recovered If recovery efforts proposed here are not instituted in 1993 important restoration and population monitoring data will be irretrievably lost Prince William Sound Aquaculture Corporation, Valdez Fisheries Development Association, and the Alaska Department of Fish and Game have pooled their resources to come up with approximately half of the funds required to field a full fledged pink salmon tag recovery effort in 1993 This project proposal is for matching funds to complete tag recovery efforts and data analyses in 1993

Results of this study will provide estimates of hatchery and wild stock contributions to commercial harvests, hatchery cost recovery harvests, hatchery brood stocks and wild stock escapements Stock specific catch contributions will be by date and fishing district and will be used inseason by fisheries managers to reduce effort on damaged stocks and target effort on healthy hatchery returns Post season analyses of current year, as well as historic tag recovery data, will be coupled with escapement data for wild stocks to make estimates of wild stock total returns and survival These data are important as a tool for assessing the effectiveness of various management strategies Post season analyses of tagging data will also identify trends in the temporal and spatial distributions of stocks in the fisheries These data are important for fisheries managers who must anticipate the effects of fishing strategies in future years if depleted stocks are to be protected Stock specific management strategies for oiled populations and other populations affected by altered fisheries management will be developed using tagging data in conjunction with escapement data Similar analyses which incorporated data from coded-wire tagging projects funded by the Natural Resources Damage Assessment and Restoration processes were used successfully in the past to justify time and area fishery closures and effectively reduce exploitation on oiled stocks in portions of southwestern PWS in 1990, 1991, and 1992 Serious escapement shortfalls were avoided despite intense fishing pressure on surplus hatchery fish in adjacent areas

B. PROJECT DESCRIPTION

This project is designed to provide estimates of hatchery and wild fish contributions to commercial and cost recovery fisheries in Prince William Sound These estimates will allow fisheries managers to lessen interceptions of wild fish in mixed stock fisheries The project is funded by the Alaska Department of Fish and Game, Prince William Sound Aquaculture Corporation, Valdez Fisheries Development Association, and the Oil Spill Trustee Council The project will be administered and supervised by the Alaska Department of Fish and Game

1 RESOURCES and/or SERVICES

Pink Salmon *Oncorhyncus gorbuscha* in Prince William Sound, Alaska

2. OBJECTIVES

(1) sample approximately 20% of the pink salmon catches from commercial and cost recovery fisheries in PWS for coded wire tags,

(2) sample approximately 95% of the hatchery pink salmon brood stock in PWS for coded-wire tags,

(3) assess the feasibility of using the number of adipose clips observed to estimate temporal and spatial contributions of tagged hatchery stocks of pink salmons to PWS commercial and hatchery harvests,

(4) make inseason estimates of the temporal and spatial contributions of tagged hatchery stocks of pink salmon to PWS commercial and hatchery harvests based on the number of tags detected in adipose clipped fish which are recovered during catch sampling,

(5) provide timely inseason estimates of hatchery and wild stock contributions to harvests by time and area to fisheries managers so they can closely regulate exploitation of injured wild stocks,

(6) use data from fully decoded tags recovered from commercial catches, cost recovery harvests, and hatchery brood stock to verify or adjust inseason contribution estimates,

(7) estimate marine survival rates for each uniquely coded hatchery release group and,

(8) write a final report which summarizes temporal and spatial distributions of hatchery and wild contributions to commercial and cost recovery harvests in PWS, survival estimates by stock, and fisheries management actions taken to reduce the exploitation on wild stocks based on in season catch stock composition estimates

3. METHODS

a Tag Recovery

(1) Commercial Catches

The Alaska Department of Fish and Game will oversee the recovery of coded-wire tagged fish in commercial salmon harvests in Prince William Sound The recovery samples will be from a stratified sample (Cochran 1977) Fisheries will be stratified by district and discrete time segments The recovery will be further stratified by processor as described in Peltz and Geiger (1988) For each time and area specific stratum, 15% of the pink salmon catch will be scanned for fish with a missing adipose fin Catch sampling will be done in four fish processing facilities in Cordova, one facility in Whittier, and three facilities in Valdez When feasible, sampling will occur at facilities in Kodiak, Kenai, Anchorage, and Seward and on large floating processors All deliveries by fish tenders to these facilities will be monitored by radio and by daily contact with processing plant dispatchers to ensure that the catch deliveries being sampled are district specific

Scanning commercial pink salmon catches for coded-wire tags involves visually selecting adipose clipped fish from a mixture of unclipped and clipped fish on a conveyor belt Samplers will select fish on the basis of whether they have a good view of the adipose fin region, negative sampling bias may occur by consistent exclusion of tagged fish This possible sampling bias will be periodically tested for by comparing the tag recovery rates of sampled fish to recovery rates in a complete censuses of sampled loads of fish

(2) Hatchery Sales Harvests

In addition to catch sampling at the processing facilities, approximately 15% of the fish in the hatchery terminal harvest areas will be scanned for fish missing adipose fins Because sales

harvests are processed a the same processing facilities as commercial harvests, methods and means of sampling sales harvest will be identical to those described for commercial catches

(3) Hatchery Brood Stocks

Brood stock sampling is critical to estimating hatchery and wild contributions Due to differential mortality between tagged and untagged fish as well as differential tag loss between release groups the tag expansion factor at release for hatchery fish may no longer accurately reflect the tag expansion factor in the adult population Theoretically, brood stock are composed of 100% fish which originated from the hatchery where sampling occurs and are representative of returns from each fry release group Based on this assumption, tag recovery rates from brood stock can be used to adjust the initial tag expansions for each tagged hatchery release group

There will be a brood stock tag recovery effort at each of the four hatchery facilities where tags were initially applied Technicians will be stationed at each of these hatcheries to scan the brood stock during egg take After the salmon are manually spawned, technicians will use visual and tactile methods to scan approximately 95% of the fish Total number of fish scanned and total number of fin-clipped fish found will be recorded on a daily basis Heads and their corresponding data sheets will be picked up on a regular basis and returned to Cordova for editing and shipping to the Juneau tag lab

b Data Analysis

(1) Estimates of Valid Tags

Following the application of tags at hatcheries, the total number of fry with valid tags was estimated as

$$T_{vt} = (T_t - M_{ot})(1 - L_{ot})\, C \quad , \qquad (1)$$

where

T_t = total number of fish tagged from group *t*,
M_{ot} = overnight mortality of tagged group *t* fish,

L_{ot} = overnight tag loss rate of group *t* fish,
C = good clip rate

At least one hatchery facility includes a term for short term mortality of tagged fish from treatment group t during saltwater rearing (S_t) The number of tagged fish released for that facility becomes

$$T_{vt} = (T_t - M_{ot} - S_t)(1 - L_{ot})\ C \qquad (2)$$

(2) Post Season Contribution Estimates

The first step in the coded-wire tag analysis will be to estimate the harvest of salmon from each tag lot, in units of adult salmon Adult salmon from these tagged lots will be recovered in the common property fishery, the hatchery cost recovery fishery, and the adult brood stock For the hatchery stock, a modification of the methods described in an ADF&G technical report by Clark and Bernard (1987) will be used The specific methods, estimators, and confidence interval estimators are described in ADF&G technical reports on two previous studies of pink salmon in Prince William Sound Peltz and Geiger (1988), and Geiger and Sharr (1989) Additional references on methods of tagging pink salmon in Prince William Sound can be found in Peltz and Miller (1988) In the case of the wild stocks, the methods and estimators and necessary assumptions are described by Geiger (1988)

The basic principle behind the estimates can be described as follows The contribution of a particular tag lot to a particular fishery stratum, is estimated by multiplying the number of tags recovered in the structured recovery survey, by both the inverse of the proportion of the catch sampled (the inverse sampling rate), and by the inverse of the proportion of the tag lot that was actually tagged (the inverse tag rate) The escapement (brood stock) of each tag lot will be estimated using methods unique to the particular situation After the contribution to each fishery is estimated for the tag lot, the survival is estimated by summing the estimated harvest of the tag lot in each fishery, and the estimated escapement (brood stock), and dividing by the estimated number of fish in the release group represented by the tag code

Total catches stratified by week, district, and processor will be obtained from summaries of fish sales receipts (fish tickets) issued to each fisherman The total hatchery contribution to the commercial and hatchery cost recovery harvest is the sum of the estimates of contributions in all week, district, and processor strata

$$\hat{C}_t = \Sigma_i X_{ti} (N_i / S_i) p_t^{-1} \quad (3)$$

where

$\hat{C}_t$ = catch of group t fish,
X_{ti} = number of group t tags recovered in ith strata,
N_i = number of fish caught in ith strata,
S_i = number of fish sampled in ith strata,
p_t = proportion of group t tagged

For sampled strata, we used a variance approximation which ignores covariance between release groups (Geiger 1988)

$$V(\hat{C}_t) = \Sigma_i X_{ti}(N_i/S_i p_t)^2[1-(N_i/S_i p_t)^{-1}] \quad (4)$$

The assumptions necessary to estimate C and the associated variances and confidence intervals are as follows

(1) the numbers of tagged fish and untagged fish are known exactly,

(2) the tagged sample of the original hatchery tag group is a simple random sample,

(3) the tags do not affect the fish with respect to the items under study (survival, timing, homing, etc),

(4) none of the tags or marks are lost,

(5) the number of fish in the fishery and the number of fish in the fishery sample are known exactly,

(6) the sample of the fishery is a simple random sample (i e every fish in the collection of fish under consideration has an exactly equal probability of selection independent of every other fish in the sample), and

(7) all marks are observed and all tags are decoded

The average tag recovery rate for all processors in a week and district will be used to estimate hatchery contribution in catches delivered to processors not sampled for that district and week Variances associated with unsampled strata will not be calculated

(3) Inseason Hatchery Contributions

Inseason estimates of hatchery contributions of pink salmon will be generated for fishery openings using three basic methods Each method has unique advantages which make it appropriate to certain situations

The simplest and most timely method will be based upon a relationship between the presence of adipose fin clips and tags in the snout Sharr et al (1993) showed that this method is too imprecise to use in years when returns of tagged populations are low but may be useful during years of hatchery stock abundance

A slightly slower, but more precise and reliable method is based on numbers of tags detected (undecoded) in heads using a magnetic detector rather than on extracted and fully decoded tags To derive inseason estimates based upon numbers of undecoded tags, assumptions concerning expansion factors and adjustment factors are required (Equation 3) For the early season fishery, fish from the early run hatchery returns to Solomon Gulch hatchery are assumed to be the only hatchery fish present and the average tag expansion factor for all tag groups released from that facility in 1992 will be used The tag loss adjustment factor will be the average adjustment factor for returns to that hatchery since 1988 For fishery openings on late run hatchery returns, fish from Prince William Sound Aquaculture Corporation facilities are assumed to be the only hatchery contributors and the tag expansion factor will be calculated as the average of all expansion factors associated with tags released at the A F Koernig, W H Noerenberg and Cannery Creek hatcheries in 1992 The tag loss adjustment factor will be the average of the historical adjustment factors for the same three hatcheries since 1987 Calculations of inseason contributions will proceed along similar lines to those used to generate postseason results (Equation 3)

A third inseason method will use a subset of data from extracted and fully decoded tags The data analysis is identical to that used for post season methods but uses data from a smaller sample of the

population to facilitate head shipments and head processing turn around time Sharr et al (1993, Restoration Study 60A) determined that this method may be less accurate than the detected tag method for overall inseason hatchery versus wild contribution estimates because of small sample sizes Nevertheless, because the method permits the use of tag code specific expansion factors and facility specific historical tag loss adjustment factors, it has the advantage of providing catch contribution estimates which are hatchery-specific

4. ALTERNATIVES

Some alternatives to the classic coded wire tag recovery program which relies on fully decoded tags for inseason results have already bee incorporated into this project Inseason contribution estimates in 1993 will be based on either the number of adipose clips or numbers of detected tags These numbers can be obtained much more rapidly than information from fully decoded tags and will dramatically increase the speed of inseason data analyses However, thorough post season analysis of decoded tag data is still essential to verify and adjust inseason results

Alternatives to the coded wire tag method of determining stock contributions have been investigated These alternatives include scale pattern analyses, otolith marking, genetic analysis, and run reconstruction modeling

The Alaska Department of Fish and Game has investigated the possibility that natural differences may exist between hatchery and wild fish with respect to growth patterns on scales or other hard body parts No discriminating differences in natural growth patterns have been found On the other hand, mechanically induced thermal marking of otoliths holds great promise as a future stock identification tool for Prince William Sound wild and hatchery stocks The tool has been used successfully on a smaller scale in other locations along the Pacific coast but has never been attempted on the massive scale which would be required in Prince William Sound The Alaska Department of Fish and Game has submitted proposals to the Alaska Science and Technology Foundation and to the Trustee Council for Prince William Sound pink salmon otolith marking and recovery feasibility studies

Run reconstruction modeling is a valuable tool which can describe general trends in stock timing and distribution A preliminary run reconstruction model was proposed and constructed for Prince william Sound as part the of NRDA and Restoration process (Restoration Study 28) The present model has provided some valuable information about wild stock exploitation rates, but a much longer, more

quantitative time series of stock specific timing and distribution data is required to perfect this model The Alaska Department of Fish and Game has submitted a restoration proposal for an adult tagging program which could supply this time series of data A completed run reconstruction model could provide great assistance to managers in the future, if it is perfected, but will never fully replace the need for year specific inseason stock contribution data

The concept of applying distinct genetic marks to hatchery populations in Prince William Sound has been suggested and may hold some promise as a future stock identification tool However, such a mark would require several generations of development time and it is unlikely that identification of the mark could ever be timely or inexpensive enough for inseason management use

5. LOCATION

Sampling of salmon catches from commercial and cost recovery fisheries will occur in shore based processing plants in Cordova, Valdez, Whittier, and Kodiak Extraction and decoding of tags will be accomplished by the ADF&G coded wire tag lab in Juneau All data analyses will be completed in Cordova with assistance from Anchorage based Alaska Department of Fish and Game biometrics staff

6. BENEFITS

Pink salmon are the most numerous of the salmon species which spawn in PWS They act as a vital transport mechanism for energy and nutrients from the high seas to the nearshore and upland areas adjacent to more than one thousand streams around the perimeter of the sound Furthermore, wild pink salmon are the cornerstone of the fisheries industry which dominates the PWS economy Sustained production of wild pink salmon populations is essential to the health and maintenance of many other fish, bird, marine mammal, terrestrial mammals and human populations which reside in PWS

Results of the Damage to Eggs and Pre-Emergent Fry Project (NRDA F/S Study 2 and Restoration Study 60C, Sharr et al 1992) indicate that salmon embryos in oiled streams have exhibited a much higher mortality than embryos from comparable unoiled streams since 1989 Results of the Run Reconstruction Project (Restoration F/S Study 28) indicate that the annual adult returns from the southwestern portion of PWS alone may still be hundreds of thousands of fish lower than expected as a result of chronic damage from increased mortalities in embryos from oiled streams and from reduced growth and survival among juveniles rearing in oiled portions of the sound This level of chronic population level damage may result in severe over exploitation and drastic reductions in spawning escapement to affected streams Ultimately, if corrective measures are

not taken, these populations may be in danger of extinction This project will provide a tool for fisheries managers to use in efforts to protect damaged wild populations from commercial fisheries which target on large hatchery returns in western PWS Marine, freshwater, and upland ecosystems in and around affected streams will benefit as will local fisheries which ultimately depend upon the restoration and long term health of wild populations

7. TECHNICAL SUPPORT

ADF&G will supply biometrics support to ensure that project methods and data analyses will provide inseason stock contribution estimates at levels of accuracy and precision required for management of wild stocks in PWS

8. CONTRACTS

Matching funds from Prince William Sound Aquaculture Corporation and Valdez Fisheries Development Association will be conveyed to Alaska Department of Fish and Game through cooperative aggreements (see attached)

9. MITIGATION MEASURES

No mitigation measures are required for this project

10. LITERATURE CITED

Clark, J E , D R Bernard 1987 A compound multivariate binomial hypergeometric distribution describing coded microwire tag recovery from commercial salmon catches in southeastern Alaska Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 261

Cochran, William G 1977 Sampling Techniques, 3rd ed John Wiley and Sons, New York, New York

Geiger, H J 1988 Parametric bootstrap confidence intervals for estimates of fisheries contribution in salmon marking studies Proceedings of the international symposium and educational workshop on fish-marking techniques University of Washington Press, Seattle In press

Geiger, H J , and S Sharr 1989 A tag study of pink salmon from the Solomon Gulch Hatchery in the Prince William Sound fishery, 1988 Alaska Department of Fish and Game, Division of Commercial Fisheries In press

Geiger, H J , B G Bue, S Sharr, A C Wertheimer, and M T Willette 1993 A life history approach to estimating the damage to prince William Sound pink salmon from the Exxon Valdez oilspill Natural Resource Restoration Study Number 28, Alaska Department of Fish and Game, Juneau

Peltz, L , and H J Geiger 1988 A study of the effect of hatcheries on the 1987 pink salmon fishery in Prince William Sound, Alaska Alaska Department of Fish and Game, Division of Commercial Fisheries In press

Peltz, L , and J Miller 1988 Performance of half-length coded-wire tags in a pink salmon hatchery marking program Proceedings of the international symposium and educational workshop on fish-marking techniques University of Washington Press, Seattle In press

Sharr, S , T M Willette, C J Peckham, D G Sharp, J L Smith, D G Evans, and B G Bue, 1993 Coded wire tag studies on Prince William Sound salmon Natural Resource Damage Assessment Fish/Shellfish Study Number 3, Alaska Department of Fish and Game, Cordova

Sharr, S , T M Willette, C J Peckham, D G Sharp, J L Smith, D G Evans, and B G Bue, 1993 Coded wire tag studies on Prince William Sound salmon Natural Resource Restoration Study Number 60A, Alaska Department of Fish and Game, Cordova

Sharr, S , B Bue, S D Moffitt, and A Craig Injury to salmon eggs and pre-emergent fry in Prince William Sound Natural Resources Damage Assessment Fish/Shellfish Study Number 2, Alaska Department of Fish and Game, Cordova

Volk, E C, S L Shroder, and K L Fresh Inducement of unique otolith banding patterns as a practical means to mass-mark juvenile Pacific salmon American Fisheries Society Symposium 7 203-215

C. SCHEDULES AND PLANNING

Date(s)	Activity
June 20 - Sept 10, 1993	Tag recoveries in commercial fisheries, cost recovery harvests, and brood stocks Inseason catch stock composition estimates by time and area for management of commercial and cost recovery fisheries

Nov 30, 1993 Draft Report

Jan 30, 1994 Final Report

D. ENVIRONMENTAL COMPLIANCE/PERMIT/COORDINATION STATUS

All sampling activities for this project occur within fish processing plants or fish hatcheries and require no environmental compliance ADF&G will coordinate with PWSAC and VFDA with respect to locating samplers in their respective fish hatcheries

E. PERFORMANCE MONITORING

ADF&G will be responsible for all data collection, analyses, and report writing in this project ADF&G is also responsible for integration of information from this project into their inseason fisheries management decisions The ADF&G Principal Investigator will design the study, oversee data collection, and provide the ADF&G Area Management Biologist for salmon (Donaldson) with inseason catch contribution estimates for hatchery and wild stocks and make recommendations about management actions required to reduce exploitation on damaged wild stocks

The Principal Investigator (PI) for the project is a Fisheries Biologist III (Sharr) with the Alaska Department of Fish and Game The PI will be responsible for writing project operational plans, administering project budgets, quality control of data collection, supervising data analyses and, co-authoring final reports The PI will be assisted by a Fisheries Biologist II Project Leader (PL) (Peckham) who will hire project personnel, supervise day to day project operations, maintain data quality, assist in data analyses, and coauthor final reports The PL will be assisted by a Fisheries Biologist The PL will assume responsibility for day to day sampling activities in Cordova, on floating processors, and at hatcheries The assistant will supervise sampling activities in processing plants and the hatchery in Valdez Crews at each port city will have Fisheries Technician III crew leaders The remainder of each crew will be Fisheries Technician I's and II's Each day, two persons on each crew will scan pink salmon at each processing plant Under the supervision of the PL and the Fisheries Biologist I assistant a Fisheries Technician III in Cordova will conduct daily data logging, editing and archiving activities The PI or PL will visit each port a minimum of once every two weeks to answer questions, and provide quality control supervision

In the catch, terminal harvest, and brood stock, the total number of fish scanned and the total number of fish with missing adipose fins will be recorded The heads will be removed from fish with missing adipose fins Each head will be tagged with uniquely numbered strap tags Recovered heads will be assembled and pre-processed in the Cordova area office Heads will then be sent to the FRED Division Coded-Wire Tag Laboratory in Juneau for decoding, and data

posting

A statewide coded-wire tag lab is located in Juneau and operated by the Commercial Fisheries Management and Development Division of ADF&G Coded-wire tag sampling forms will be checked for accuracy and completeness Sampling and biological data will first be entered onto the laboratory's data base Next, the heads will be processed This involves removing and decoding the tags, and entering the tag code and the code assigned in the recovery survey into the database Samples will be processed within five working days of receipt Sampling information and tag codes entered into the data base will be available for analysis the following morning Data will be automatically transferred from Juneau to Cordova Electronic mail access from Juneau to Cordova will permit rapid inseason transmission of decoded tag data from the tag lab back to the project PI's in Cordova who can then provide inseason information to fisheries managers for inseason management actions Catch and sampling information will be integrated with tag codes to automatically calculate in-season and post-season hatchery contribution estimates A historic database of coded-wire tag information from Prince William Sound tagging and tag recovery programs will be maintained and will be easily accessible by managers and researchers

Personnel policy, purchasing practices, field camp operations, safety procedures, and project administration will be in compliance the ADF&G Division of Commercial Fisheries Manual of Standard Operating Procedures (SOP) Data collection procedures are similar to those used in NRDA F/S Study #3 These procedures have been thoroughly reviewed by the NRDA peer review process and approved by the Management Team

F. PERSONNEL QUALIFICATIONS

Fisheries Biologist III Principal Investigator - Samuel Sharr

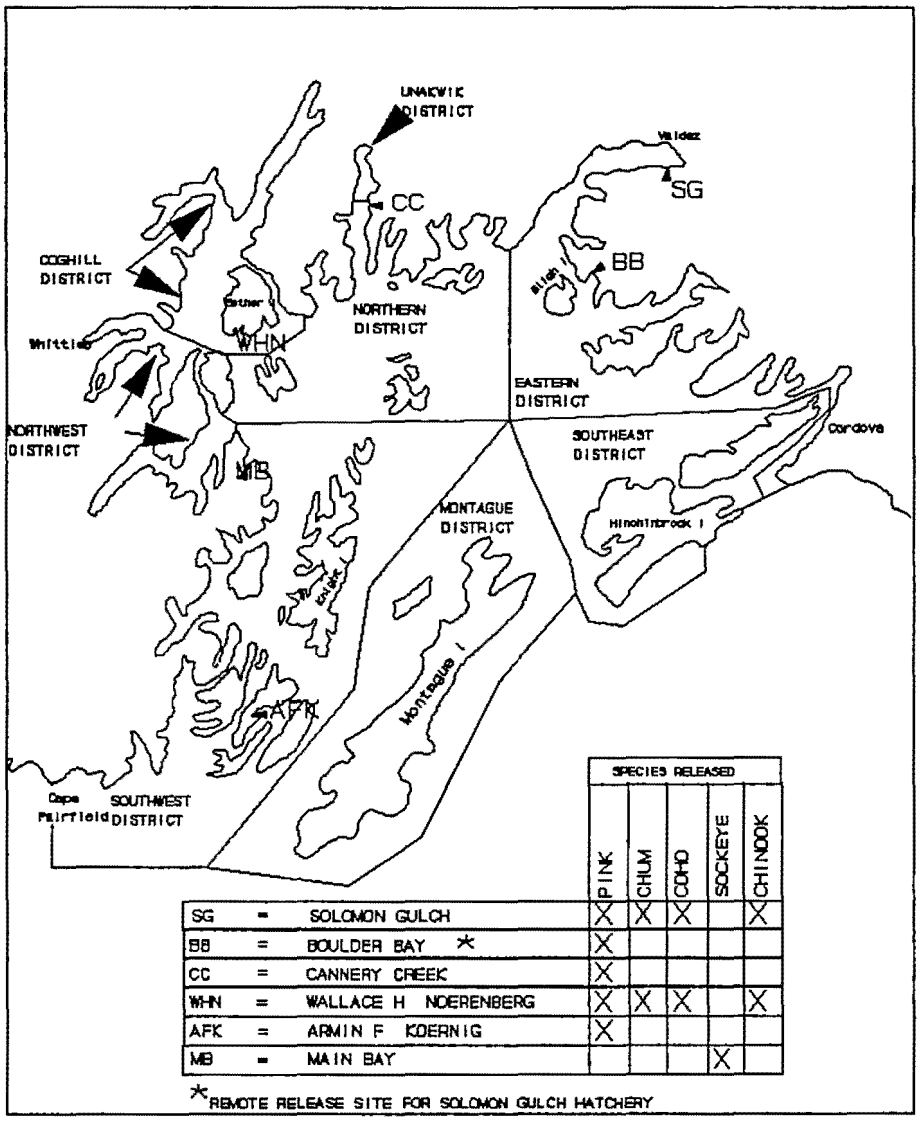
Mr Sharr received a Bachelor of Science degree in biology from the University of Washington in 1968 He has been a research biologist for ADF&G since 1979 and has worked on PWS salmon and herring since 1981 He assumed his present position as the ADF&G, Division of Commercial Fisheries, Biologist III, PWS Area Finfish Research Project Leader in 1986 In this capacity, Mr Sharr oversees all the salmon and herring research conducted by the Division of Commercial Fisheries in PWS His involvement with the PWS salmon escapement aerial survey program dates from the early 1980's Mr Sharr has supervised a total re-edit of the historic aerial and ground survey data and designed a new RBASE data base for inseason escapement analyses Mr Sharr wrote the original operational plans for NRDA F/S Studies 1,2 and, 3 and has been the Principal Investigator for those projects since their inception

Fisheries Biologist II Project Leader - Carol Peckham

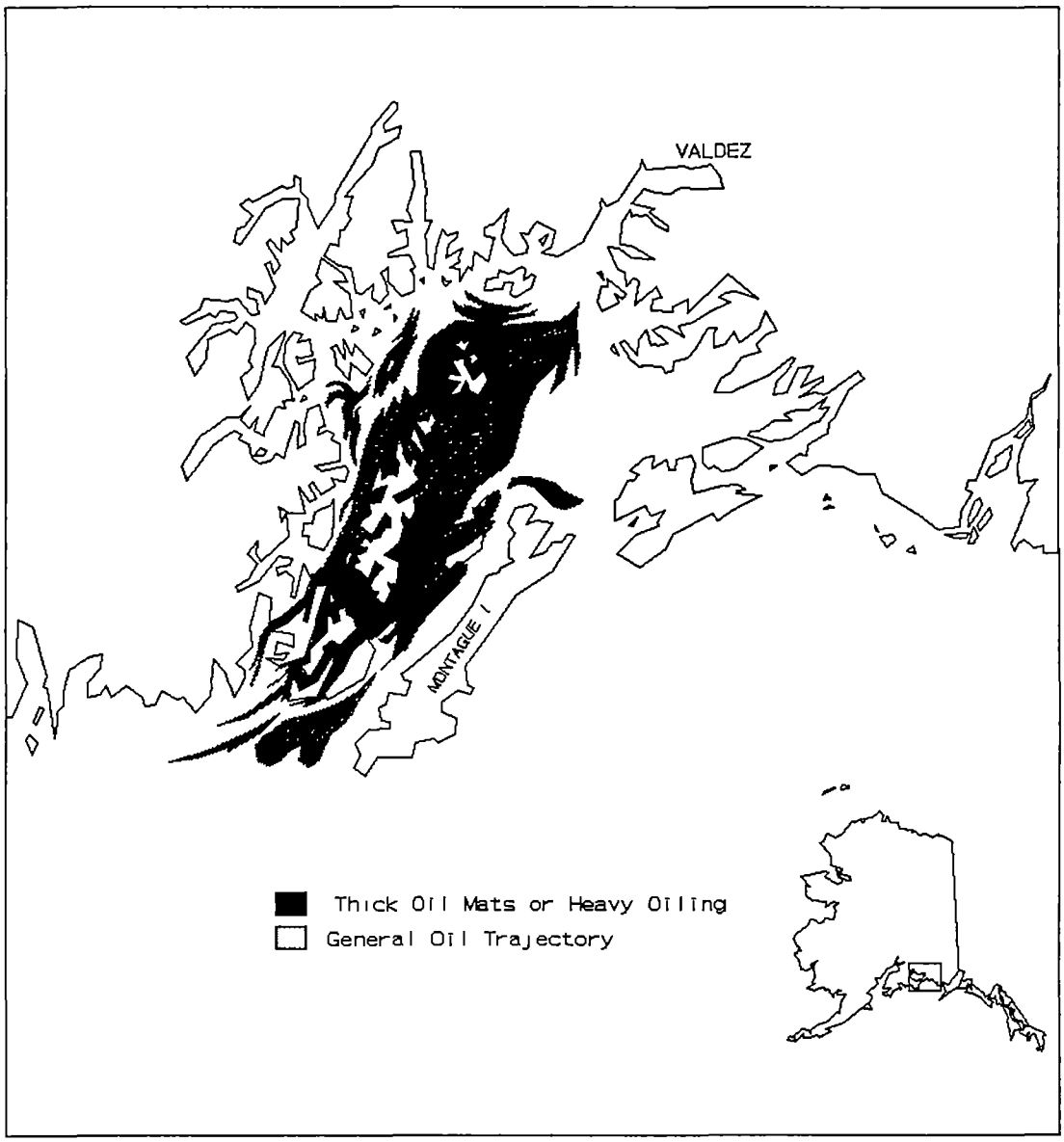
Ms Peckham has a Bachelor of Science in Wildlife Biology from the University of Alaska and completed all course work requirements for a Masters degree in statistics She has been

employed by ADF&G since 1984 As a college intern for the ADF&G Stock Biology Group, Ms Peckham gained valuable experience in a wide variety of biological sampling and stock identification techniques in Cook Inlet and Prince William Sound Ms Peckham has been involved in coded-wire tag recovery activities in PWS since their inception, and, since 1987, she has been the Fisheries Biologist in charge of coded-wire tag recovery operations for PWS salmon She has excelled in that capacity Her experience includes supervision of sampling activities spread throughout south central Alaska She has co-authored several reports in the ADF&G Technical Data Report series and she was a coauthor of the NRDA F/S Study #3 interim status reports for 1991 and 1992 and Damage Assessment completion report for 1992

G. PROJECT BUDGET (See attached)



Attachment 1 Fishing districts and hatcheries of Prince William Sound, Alaska



Attachment 2 Trajectory of oil plume through Prince William Sound, Alaska, 1989

EXXON VALDEZ TRUSTEE COUNCIL

Project Description This project recovers coded–wire tags from adult pink salmon tagged as fry at four hatcheries in Prince William Sound It makes estimates of wild and hatchery catch contributions, total returns, and survival rates In season catch contribution estimates for hatchery and wild fish permit fisheries managers modify time and area fishing patterns to protect oil damaged wild pink salmon stocks

Budget Category	Approved 01–Oct–92 28–Feb–93	Proposed 01–Mar–93 30–Sep–93	Total FY 93	FY 94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond	
Personnel	0	$155 0	$155 0						
Travel	0	$9 6	$9 6						
Contractual	0	$20 4	$20 4						
Commodities	0	$10 3	$10 3						
Equipment	0	$0 0	$0 0						
Capital Outlay	0	$0 0	$0 0						
Sub–total	0	$195 3	$195 3						
General Administration	0	$24 7	$24 7						
Project Total	0	$220 0	$220 0						
Full–time Equivalents (FTE)		3 7	3 7						

Budget Year Proposed (FY 93 – 01 Jan thru 30 Sept) Personnel

Position	Months Budgeted	Cost	Comment
FIELD & CORDOVA OFFICE PERSONNEL			
Program Manager – Anchorage	0 5	$3,750	
FB II Project Leader – Cordova	2 0	$9,709	
1 F&W Technician II – Cordova	1 5	$5,227	FY 93 Only – Includes overtime
1 F&W Technician III – Cordova	1 0	$5,234	FY 93 Only – Includes overtime
2 F&W Technician II – Kenai	2 0	$12,170	FY 93 Only – Includes overtime
1 F&W Technician II – Seward	1 5	$5,227	FY 93 Only – Includes overtime
3 F&W Technician – Valdez	6 5	$26,401	FY 93 Only – Includes overtime
1 F&W Technician II – Whittier	1 5	$4,860	FY 93 Only – Includes overtime
1 F&W Technician III – Juneau	2 0	$7,120	FY 93 Only
2 F&W Technician II – Juneau	8 0	$25,838	FY 93 Only
4 F&W Technician II – Juneau	11 5	$37,408	FY 93 Only
3 F&W Technician II – Juneau (non–perms)	6 0	$12,017	FY 93 Only

1993

Project Number
Project Title Coded Wire Tag Recovery in Prince William Sound Pink Salmon
Agency ADF&G

FORM 3A
AGENCY
DETAIL

EXXON VALDEZ TRUSTEE COUNCIL

	Proposed
Travel	
Supervisory trips Cordova to Whittier, Valdez, Kodiak Per diem included	$9 6
Contractual	
Air charter for supervisory trips to hatcheries	$12 2
Office rental (Valdez, Whittier)	$5 0
Vehicle Leasing	$3 2
Commodities	
Sampling gear, including rain gear, knives, balance, tweezers, sampling kits, gloves	$10 3
Equipment	

1993

Project Number
Project TitleCoded Wire Tag Recovery in Prince William Sound Pink Salmon
Agency ADF&G

FORM 3B
AGENCY
DETAIL

09–Jun–93

TOTAL BUDGET – ALL CONTRIBUTORS COMBINED

Project Description This project recovers coded–wire tags from adult pink salmon tagged as fry at four hatcheries in Prince William Sound It makes estimates of wild and hatchery catch contributions, total returns, and survival rates In season catch contribution estimates for hatchery and wild fish permit fisheries managers modify time and area fishing patterns to protect oil damaged wild pink salmon stocks The project is receiving funding from the Alaska Department of Fish and Game, Prince William Sound Aquaculture, Valdez Fisheries Development Association, and the Trustee Council There are details (forms 3A and 3B) for each agency attached

Budget Category	Approved 01–Oct–92 28–Feb–93	Proposed 01–Mar–93 30–Sep–93	Total FY 93	FY 94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond	
Personnel	0	$317 1	$317 1	$39 4					
Travel	0	$9 6	$9 6						
Contractual	0	$20 4	$20 4						
Commodities	0	$10 3	$10 3						
Equipment	0	$0 0	$0 0						
Capital Outlay	0	$0 0	$0 0						
Sub–total	0	$357 4	$357 4	$39 4					
General Administration	0	$31 0	$31 0						
Project Total	0	$388 4	$388 4	$39 4					
Full–time Equivalents (FTE)		7 3	7 3	0 7					

Budget Year Proposed (FY 93 – 01 Jan thru 30 Sept) Personnel

Position	Months Budgeted	Cost	Comment

For details, see 3A & 3B forms

1993	Project Number Project Title Coded Wire Tag Recovery in Prince William Sound Pink Salmon Agency ADF&G	FORM 2A PROJECT DETAIL

09–Jun–93

ALASKA DEPARTMENT OF FISH AND GAME

Project Description This project recovers coded–wire tags from adult pink salmon tagged as fry at four hatcheries in Prince William Sound It makes estimates of wild and hatchery catch contributions, total returns, and survival rates In season catch contribution estimates for hatchery and wild fish permit fisheries managers modify time and area fishing patterns to protect oil damaged wild pink salmon stocks

Budget Category	Approved 01–Oct–92 28–Feb–93	Proposed 01–Mar–93 30–Sep–93	Total FY 93	FY 94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond	
Personnel	0	$42 2	$42 2	$39 4					
Travel	0	$0 0	$0 0						
Contractual	0	$0 0	$0 0						
Commodities	0	$0 0	$0 0						
Equipment	0	$0 0	$0 0						
Capital Outlay	0	$0 0	$0 0						
Sub–total	0	$42 2	$42 2	$39 4					
General Administration	0	$0 0	$0 0						
Project Total	0	$42 2	$42 2	$39 4					
Full–time Equivalents (FTE)		0 7	0 7	0 7					

Budget Year Proposed (FY 93 – 01 Jan thru 30 Sept) Personnel

Position	Months Budgeted	Cost	Comment
FIELD & CORDOVA OFFICE PERSONNEL			
1 Fisheries Biologist II Project Leader – Cordova	2 0	$9,709	FY 93 (2 months, $9 7 K), FY 94 (3 months, $14 6K)
1 Fisheries Biologist I –Cordova	4 0	$21,200	FY 93 Only – Includes Overtime
1 F&W Technician III – Cordova	1 0	$4,244	FY 93 Only – Includes Overtime
1 F&W Technician II – Juneau	1 0	$7,081	FY 93 Only – Includes Overtime
1 F&W Technician III – Juneau	0 0	$0	FY 94 Only (3mm, $10 7K)
2 F&W Technician II – Juneau	0 0	$0	FY 94 Only (2mm each, $14 2K)

1993

Project Number
Project Title Coded Wire Tag Recovery in Prince William Sound Pink Salmon
Agency ADF&G

FORM 3A
AGENCY
DETAIL

09–Jun–93

PRINCE WILLIAM SOUND AQUACULTURE CORPORATION

Project Description This project recovers coded–wire tags from adult pink salmon tagged as fry at four hatcheries in Prince William Sound It makes estimates of wild and hatchery catch contributions, total returns, and survival rates In season catch contribution estimates for hatchery and wild fish permit fisheries managers modify time and area fishing patterns to protect oil damaged wild pink salmon stocks

Budget Category	Approved 01–Oct–92 28–Feb–93	Proposed 01–Mar–93 30–Sep–93	Total FY 93	FY 94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond	
Personnel	0	$95 0	$95 0						
Travel	0	$0 0	$0 0						
Contractual	0	$0 0	$0 0						
Commodities	0	$0 0	$0 0						
Equipment	0	$0 0	$0 0						
Capital Outlay	0	$0 0	$0 0						
Sub–total	0	$95 0	$95 0						
General Administration	0	$5 0	$5 0						
Project Total	0	$100 0	$100 0						
Full–time Equivalents (FTE)		2 4	2 4						

Budget Year Proposed (FY 93 – 01 Jan thru 30 Sept) Personnel

Position	Months Budgeted	Cost	Comment
FIELD & CORDOVA OFFICE PERSONNEL			
12 F&W Technicians – Cordova	20 5	$65,358	FY 93 Only – Includes Overtime
1 F&W Technician – Whittier	2	$6,527	FY 93 Only – Includes Overtime
2 F&W Technician – Valdez	5	$18,729	FY 93 Only – Includes Overtime
1 F&W Technician – Kodiak	1 0	$4,368	FY 93 Only – Includes Overtime

1993

Project Number
Project Title Coded Wire Tag Recovery in Prince William Sound Pink Salmon
Agency ADF&G

FORM 3A
AGENCY
DETAIL

09–Jun–93

VALDEZ FISHERIES DEVELOPMENT ASSOCIATION

Project Description This project recovers coded–wire tags from adult pink salmon tagged as fry at four hatcheries in Prince William Sound It makes estimates of wild and hatchery catch contributions, total returns, and survival rates In season catch contribution estimates for hatchery and wild fish permit fisheries managers modify time and area fishing patterns to protect oil damaged wild pink salmon stocks

Budget Category	Approved 01–Oct–92 28–Feb–93	Proposed 01–Mar–93 30–Sep–93	Total FY 93	FY 94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond	
Personnel	0	$24 9	$24 9						
Travel	0	$0 0	$0 0						
Contractual	0	$0 0	$0 0						
Commodities	0	$0 0	$0 0						
Equipment	0	$0 0	$0 0						
Capital Outlay	0	$0 0	$0 0						
Sub–total	0	$24 9	$24 9						
General Administration	0	$1 3	$1 3						
Project Total	0	$26 2	$26 2						
Full–time Equivalents (FTE)		0 5	0 5						

Budget Year Proposed (FY 93 – 01 Jan thru 30 Sept) Personnel

Position	Months Budgeted	Cost	Comment
FIELD & CORDOVA OFFICE PERSONNEL			
3 F&W Technicians – Valdez	6 5	$24 9	FY 93 Only – Includes Overtime

1993

Project Number
Project Title Coded Wire Tag Recovery in Prince William Sound Pink Salmon
Agency ADF&G

FORM 3A
AGENCY
DETAIL

09–Jun–93

93068

Project Title	**PRINCE WILLIAM SOUND SALMON STOCK IDENTIFICATION AND MONITORING STUDIES**
Project ID#	93068
Project Type	Recovery Monitoring and Restoration
Project Leaders	Samuel Sharr, Alaska Dept Fish and Game Carol Peckham, Alaska Dept Fish and Game
Lead Agency	Alaska Dept Fish and Game
Project Cost	FY 93 $126 4 FY94 $0 0
Start Date June 1, 1993	Finish Date September 30, 1993
Geographic Area of Project	Prince William Sound

Project Leaders

_____ _____
Samuel Sharr

_____ _____
Carol Peckham

Program Managers _____ _____

A. INTRODUCTION

Recent wild stock production in Prince William Sound (PWS) has included from 800 to 900 thousand chum salmon, 300 to 500 thousand sockeye salmon and 10 to 20 thousand coho and chinook salmon Up to 75% of wild pink and chum salmon spawn in intertidal areas with the greatest proportion of intertidal spawning occurring in streams flowing into the southwestern portion of PWS Oil from the *Exxon Valdez Oil Spill* (EVOS) was deposited in intertidal spawning areas for pink and chum salmon and may have adversely affected spawning success and early marine survival for these species in Prince William Sound (Sharr et al 1992, Willette and Carpenter 1993) In addition, emergent fry and smolt of all salmon species from throughout PWS migrated through and reared in areas contaminated by oil The suite of injuries already identified have led to a decline in the size and overall well being of wild pink salmon populations and these effects may persist for several years Adult returns and tag recoveries for sockeye, chum, and chinook which return at older ages are not complete and the full extent of damage to these species is not yet known Salmon stocks impacted by the EVOS are heavily exploited in commercial, sport, and subsistence fisheries and their restoration can most effectively be realized through stock specific management practices designed to reduce such exploitation on impacted stocks The damaged populations exist in fisheries dominated by hatchery and wild stocks from unaffected areas of the Sound (Attachments 1 and 2) The management of this mixed stock fishery has historically been based on maintaining good temporal and spatial distribution of spawning escapement for groups of stocks in eight major fishing districts and its success has relied upon the manager's ability to control stock specific exploitation rates Restoration premised

on such a management strategy will require even more accurate inseason catch stock composition estimates if lower harvest rates are to be achieved for damaged wild stocks versus unimpacted wild stocks or hatchery stocks

This project is designed to provide accurate, real time, catch contribution estimates for salmon stocks of Prince William Sound Accurate escapement estimates from ongoing ADF&G escapement monitoring projects will enable managers to identify stocks which are experiencing escapement shortfalls Accurate and timely catch contribution estimates from this coded-wire tag recovery project will enable managers to identify times and areas where exploitation on depleted wild stocks can be minimized and still permit the harvest of surplus hatchery returns Post season analyses of the catch contribution estimates together with results from salmon escapement enumeration projects will provide stock specific estimates of total return and survival and enable managers to assess the effectiveness of stock specific management strategies

In the absence of improved stock specific management capabilities afforded by this project, salmon stocks in western PWS which have already been stressed and depleted by the oil impacts will potentially be over exploited in the commercial, sport and subsistence fisheries Population levels of stocks may be reduced below those needed for rapid recovery and in some instances may result in virtual elimination of impacted stocks If adequate stock monitoring programs are not in place, changes in fishing effort to areas of less oil impact could also result in over exploitation of otherwise healthy, unimpacted stocks

The foundations for this project were firmly established in feasibility studies which were conducted beginning in 1986 and extending through 1988 During the damage assessment process large scale tagging and recovery projects were instituted and perfected by Natural Resources Damage Assessment (NRDA) Fish/Shellfish (F/S) Study #3 Damage assessment funds were expended for tagging hatchery releases of sockeye, coho and chinook salmon in 1989 and 1990 and releases of chum salmon in 1990 Tag recovery efforts for wild and hatchery salmon were funded by damage assessment funds in 1989, 1990, and 1991 Some age classes of these tagged stocks will still be returning in 1993 If recovery efforts proposed here are not instituted in 1993 important restoration and population monitoring data will be irretrievably lost Funding was also provided for the Coghill Restoration Project for 1993 In order to assess the success of this project sockeye tags need to be recovered Without a method to segregate the wild Coghill sockeye stock from the hatchery stocks there will be no way to determine the numbers of Coghill sockeye returning to Coghill Lake Therefore, we won't know whether the Coghill stock is recovering or whether it is still declining

Results of this study will provide estimates of hatchery and wild stock contributions to commercial harvests, hatchery cost recovery harvests and hatchery brood stocks Stock specific catch contributions will be by date and fishing district and will be used inseason by fisheries managers to reduce effort on damaged stocks and target effort on healthy hatchery returns Post season analyses of current year, as well as historic tag recovery data, will be coupled with escapement data for wild stocks to make estimates of wild stock total returns and survival These data are important as a tool for assessing the effectiveness of various management strategies Post

season analyses of tagging data will also identify trends in the temporal and spatial distributions of stocks in the fisheries These data are important for fisheries managers who must anticipate the effects of fishing strategies in future years if depleted stocks are to be protected Stock specific management strategies for oiled populations and other populations affected by altered fisheries management will be developed using tagging data in conjunction with escapement data Similar analyses which incorporated data from coded-wire tagging projects funded by the Natural Resources Damage Assessment and Restoration processes were used successfully in the past to justify time and area fishery closures and effectively reduce exploitation on oiled stocks in portions of southwestern PWS in 1990, 1991, and 1992 Serious escapement shortfalls were avoided despite intense fishing pressure on surplus hatchery fish in adjacent areas

B. PROJECT DESCRIPTION

This project is designed to provide estimates of hatchery and wild fish contributions to commercial and cost recovery fisheries in Prince William Sound These estimates will allow fisheries managers to monitor the size and health of wild salmon populations and lessen interceptions of wild fish in mixed stock fisheries The project will be administered and supervised by the Alaska Department of Fish and Game

1 **RESOURCES and/or SERVICES**

Sockeye Salmon *Oncorhyncus nerka*, Chum Salmon *O keta*, Chinook Salmon *O tshawytscha*, and Coho Salmon *O kasutch* in Prince William Sound, Alaska

2. OBJECTIVES

(1) sample 25% of the sockeye, chum, chinook and coho salmon catches from commercial and cost recovery fisheries in PWS for coded wire tags,

(2) sample approximately 95% of the hatchery sockeye, chum, chinook and coho salmon brood stock in PWS for coded-wire tags,

(3) make inseason estimates of the temporal and spatial contributions of tagged hatchery stocks of sockeye, chum, chinook and coho salmon to PWS commercial and hatchery harvests based on the number of tags detected in adipose clipped fish which are recovered during catch sampling,

(4) provide timely inseason estimates of hatchery and wild stock contributions to harvests by time and area to fisheries managers so they can closely regulate exploitation of injured wild stocks,

(5) use data from fully decoded tags recovered from commercial catches, cost recovery harvests, and hatchery brood stock to verify or adjust inseason contribution estimates and,

(6) estimate marine survival rates for each uniquely coded hatchery release group where possible

3. METHODS

a Tag Recovery

(1) Commercial Catches

The Alaska Department of Fish and Game will oversee the recovery of coded-wire tagged fish in commercial salmon harvests in Prince William Sound The recovery samples will be from a stratified sample (Cochran 1977) Fisheries will be stratified by district and discrete time segments The recovery will be further stratified by processor as described in Peltz and Geiger (1988) For each time and area specific stratum, 25% of the sockeye, chum, chinook and coho salmon catch will be scanned for fish with a missing adipose fin Catch sampling will be conducted in four fish processing facilities in Cordova, one facility in Whittier, three facilities in Valdez and one facility in Anchorage When feasible,

sampling will occur at facilities in Kodiak, Kenai and Seward and on large floating processors All deliveries by fish tenders to these facilities will be monitored by radio and by daily contact with processing plant dispatchers to ensure that the catch deliveries being sampled are district specific

Scanning commercial salmon catches for coded-wire tags involves visual and tactile assessments of sampled fish on a fresh-frozen line for clipped adipose fins Technicians will sample fish on the basis of whether they have a good view of the adipose fin region

(2) Hatchery Sales Harvests

In addition to catch sampling at the processing facilities, approximately 30% of the fish in the hatchery terminal harvest areas will be scanned for fish missing adipose fins Because sales harvests are processed at the same processing facilities as commercial harvests, methods and means of sampling sales harvest will be identical to those described for commercial catches

(3) Hatchery Brood Stocks

Brood stock sampling is critical to estimating hatchery and wild contributions Due to differential mortality between tagged and untagged fish as well as differential tag loss between release groups the tag expansion factor at release for hatchery fish may no longer accurately reflect the tag expansion factor in the adult population Theoretically, brood stock are composed of 100% fish which originated from the hatchery where sampling occurs and are representative of returns from each fry release group Based on this assumption, tag recovery rates from brood stock can be used to adjust the initial tag expansions for each tagged hatchery release group For species such as sockeye, chum and chinook, which return at different ages, this brood stock information is collected and accumulated and then applied when all age classes of each brood year have returned

There will be a brood stock tag recovery effort at each of the three hatchery facilities where tags were initially applied to sockeye, chum, chinook and coho salmon Technicians will be stationed at each of these hatcheries to scan the brood stock during egg take After the salmon are manually spawned, technicians will use visual and tactile methods to scan approximately 95% of the fish Total number of fish scanned and total number of fin-clipped fish found

will be recorded on a daily basis Heads and their corresponding data sheets will be picked up on a regular basis and returned to Cordova for editing and shipping to the Juneau tag lab

b Data Analysis

Post Season Contribution Estimates

The first step in the coded-wire tag analysis will be to estimate the harvest of salmon from each tag lot, in units of adult salmon Adult salmon from these tagged lots will be recovered in the common property fishery, the hatchery cost recovery fishery, and the adult brood stock For the hatchery stock, a modification of the methods described in an ADF&G technical report by Clark and Bernard (1987) will be used The specific methods, estimators, and confidence interval estimators are described in ADF&G technical reports on two previous studies of pink salmon in Prince William Sound Peltz and Geiger (1988), and Geiger and Sharr (1989)

The basic principle behind the estimates can be described as follows The contribution of a particular tag lot to a particular

fishery stratum, is estimated by multiplying the number of tags recovered in the structured recovery survey, by both the inverse of the proportion of the catch sampled (the inverse sampling rate), and by the inverse of the proportion of the tag lot that was actually tagged (the inverse tag rate) The escapement (brood stock) of each tag lot will be estimated using methods unique to the particular situation After the contribution to each fishery is estimated for the tag lot, the survival (where estimable) is estimated by summing the estimated harvest of the tag lot in each fishery, and the estimated escapement (brood stock), and dividing by the estimated number of fish in the release group represented by the tag code

Total catches stratified by week, district, and processor will be obtained from summaries of fish sales receipts (fish tickets) issued to each fisherman The total hatchery contribution to the commercial and hatchery cost recovery harvest is the sum of the estimates of contributions in all week, district, and processor strata

$$\hat{C}_t = \Sigma_i X_{ti} (N_i / S_i) p_t^{-1} \quad (3)$$

where

$\hat{C}_t$ = catch of group *t* fish,

X_{ti} = number of group *t* tags recovered in *i*th strata,

N_i = number of fish caught in *i*th strata,

S_i = number of fish sampled in *i*th strata,

p_t = proportion of group *t* tagged

For sampled strata, we used a variance approximation which ignores covariance between release groups (Geiger 1988)

$$V(\hat{C}_t) = \Sigma_i X_{ti}(N_i/S_i p_t)^2[1-(N_i/S_i p_t)^{-1}] \quad (4)$$

The assumptions necessary to estimate C and the associated variances and confidence intervals are as follows

(1) the numbers of tagged fish and untagged fish are known exactly,

(2) the tagged sample of the original hatchery tag group is a simple random sample,

(3) the tags do not affect the fish with respect to the items under study (survival, timing, homing, etc),

(4) none of the tags or marks are lost,

(5) the number of fish in the fishery and the number of fish in the fishery sample are known exactly,

(6) the sample of the fishery is a simple random sample (i e every fish in the collection of fish under consideration has an exactly equal probability of selection independent of every other fish in the sample), and

(7) all marks are observed and all tags are decoded

The average tag recovery rate for all processors in a week and district will be used to estimate hatchery contribution in catches delivered to processors not sampled for that district and week Variances associated with unsampled strata will not be calculated

4. ALTERNATIVES

Some alternatives to the classic coded wire tag recovery program which relies on

fully decoded tags for inseason results have already been incorporated into this project Inseason contribution estimates in 1993 will be based on either the number of adipose clips or numbers of detected tags These numbers can be obtained much more rapidly than information from fully decoded tags and will dramatically increase the speed of inseason data analyses However, thorough post season analysis of decoded tag data is still essential to verify and adjust inseason results

Alternatives to the coded wire tag method of determining stock contributions have been investigated These alternatives include scale pattern analyses, otolith marking, genetic analysis, and run reconstruction modeling

The Alaska Department of Fish and Game has investigated the possibility that natural differences may exist between hatchery and wild fish with respect to growth patterns on scales or other hard body parts No discriminating differences in natural growth patterns have been found On the other hand, mechanically induced thermal marking of otoliths holds great promise as a future stock identification tool for Prince William Sound wild and hatchery stocks The tool has been used successfully on a smaller scale in other locations along the Pacific coast but has never been attempted on the massive scale which would be required in Prince William Sound

The concept of applying distinct genetic marks to hatchery populations in Prince William Sound has been suggested and may hold some promise as a future stock identification tool However, such a mark would require several generations of development time and it is unlikely that identification of the mark could ever be timely or inexpensive enough for inseason management use

5. LOCATION

Sampling of salmon catches from commercial and cost recovery fisheries will occur in shore based processing plants in Cordova, Valdez, Whittier, and Anchorage There will also be sampling in Seward, Kenai, and aboard floating processors if significant numbers of Prince William Sound salmon are processed at those locations Extraction and decoding of tags will be accomplished by the ADF&G coded wire tag lab in Juneau All data analyses will be completed in Cordova with assistance from Anchorage based Alaska Department of Fish and Game biometrics staff

6 BENEFITS

Despite being numerically overshadowed by hatchery stocks in recent years, wild stocks of sockeye, chum, chinook and coho salmon are much more important to the PWS ecosystem and continue to play a vital role in the commercial salmon

fishery Sockeye, chinook and coho salmon also play important roles in diverse freshwater ecosystems around PWS Sustained production of wild salmon populations is essential to the health and maintenance of many other fish, bird, marine mammal, terrestrial mammals and human populations which reside in PWS

This project will provide a tool for fisheries managers to use in efforts to protect damaged wild populations from commercial fisheries which target on large hatchery returns in western PWS Marine, freshwater, and upland ecosystems in and around affected streams and lakes will benefit as will local fisheries which ultimately depend upon the restoration and long term health of wild populations

7. TECHNICAL SUPPORT

ADF&G will supply biometrics support to ensure that project methods and data analyses will provide inseason stock contribution estimates at levels of accuracy and precision required for management of wild stocks in PWS

8. CONTRACTS

No contracts will be needed for this project ADF&G will administer and

supervise the project

9. MITIGATION MEASURES

No mitigation measures are required for this project

10. LITERATURE CITED

Clark, J E , D R Bernard 1987 A compound multivariate binomial hypergeometric distribution describing coded microwire tag recovery from commercial salmon catches in southeastern Alaska Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 261

Cochran, William G 1977 Sampling Techniques, 3rd ed John Wiley and Sons, New York, New York

Geiger, H J 1988 Parametric bootstrap confidence intervals for estimates of fisheries contribution in salmon marking studies Proceedings of the international symposium and educational workshop on fish-marking techniques University of Washington Press, Seattle In press

Geiger, H J , and S Sharr 1989 A tag study of pink salmon from the Solomon Gulch Hatchery in the Prince William Sound fishery, 1988 Alaska Department of Fish and Game, Division of Commercial Fisheries In press

Geiger, H J , B G Bue, S Sharr, A C Wertheimer, and M T Willette 1993 A life history approach to estimating the damage to prince William Sound pink salmon from the Exxon Valdez oilspill Natural Resource Restoration Study Number 28, Alaska Department of Fish and Game, Juneau

Peltz, L , and H J Geiger 1988 A study of the effect of hatcheries on the 1987 pink salmon fishery in Prince William Sound, Alaska Alaska Department of Fish and Game, Division of Commercial Fisheries In press

Peltz, L , and J Miller 1988 Performance of half-length coded-wire tags in a pink salmon hatchery marking program Proceedings of the international symposium and educational workshop on fish-marking techniques University of Washington Press, Seattle In press

Sharr, S , T M Willette, C J Peckham, D G Sharp, J L Smith, D G Evans, and B G Bue, 1993 Coded wire tag studies on Prince William Sound salmon Natural Resource Damage Assessment Fish/Shellfish Study Number 3,

Alaska Department of Fish and Game, Cordova

Sharr, S , T M Willette, C J Peckham, D G Sharp, J L Smith, D G Evans, and B G Bue, 1993 Coded wire tag studies on Prince William Sound salmon Natural Resource Restoration Study Number 60A, Alaska Department of Fish and Game, Cordova

Sharr, S , B Bue, S D Moffitt, and A Craig Injury to salmon eggs and pre-emergent fry in Prince William Sound Natural Resources Damage Assessment Fish/Shellfish Study Number 2, Alaska Department of Fish and Game, Cordova

Volk, E C, S L Shroder, and K L Fresh Inducement of unique otolith banding patterns as a practical means to mass-mark juvenile Pacific salmon American Fisheries Society Symposium 7 203-215

C. SCHEDULES AND PLANNING

Date(s)	Activity
May 15 - Sept 30, 1993	Tag recoveries in commercial fisheries, cost recovery harvests, and brood stocks Inseason catch stock composition estimates by time and area for management of commercial and cost recovery fisheries
November 30, 1993	Draft summary report
January 15, 1994	Final Report

D. ENVIRONMENTAL COMPLIANCE/PERMIT/COORDINATION STATUS

All sampling activities for this project occur within fish processing plants or fish hatcheries and require no environmental compliance ADF&G will coordinate with PWSAC and VFDA with respect to locating samplers in their respective fish hatcheries

E. PERFORMANCE MONITORING

ADF&G will be responsible for all data collection, analyses, and report writing in this project ADF&G is also responsible for integration of information from this project into their inseason fisheries management decisions The ADF&G Principal Investigator will design the study, oversee data collection, and provide the ADF&G Area Management Biologist for salmon (Donaldson) with inseason catch contribution estimates for hatchery and wild stocks and make recommendations about management actions required to reduce exploitation on damaged wild stocks

The Principal Investigator (PI) for the project is a Fisheries Biologist III (Sharr) with the Alaska Department of Fish and Game The PI will be responsible for writing project operational plans, administering project budgets, quality control of data collection, supervising data analyses and, co-authoring final reports The PI will be assisted by a Fisheries Biologist II Project Leader (PL) (Peckham) who will hire project personnel, supervise day to day project operations, maintain data quality, assist in data analyses, and coauthor final reports The PL will be assisted by a Fisheries Biologist I The PL will assume responsibility for day to day sampling activities in Cordova, on floating processors, and at hatcheries The assistant will supervise sampling activities in processing plants and the hatchery in Valdez Crews at each port city will have Fisheries Technician III crew leaders The remainder of each crew will be Fisheries Technician I's and II's Under the supervision of the PL and the Fisheries Biologist I assistant a Fisheries Technician III in Cordova will conduct daily data logging, editing and archiving activities The

PI or PL will visit each port a minimum of once every two weeks to answer questions, and provide quality control supervision

In the catch, terminal harvest, and brood stock, the total number of fish scanned and the total number of fish with missing adipose fins will be recorded The heads will be removed from fish with missing adipose fins Each head will be tagged with uniquely numbered strap tags Recovered heads will be assembled and pre-processed in the Cordova area office Heads will then be sent to the FRED Division Coded-Wire Tag Laboratory in Juneau for decoding, and data posting

A statewide coded-wire tag lab is located in Juneau and operated by the Commercial Fisheries Management and Development Division of ADF&G Coded-wire tag sampling forms will be checked for accuracy and completeness Sampling and biological data will first be entered onto the laboratory's data base Next, the heads will be processed This involves removing and decoding the tags, and entering the tag code and the code assigned in the recovery survey into the database Samples will be processed within five working days of receipt Sampling information and tag codes entered into the data base will be available for analysis the following morning Data will be automatically transferred from Juneau to Cordova Electronic mail access from Juneau to Cordova will permit rapid inseason transmission of decoded tag data from the tag lab back to the project PI's in Cordova who can then provide inseason information to fisheries managers for inseason management actions Catch and sampling information will be integrated with tag codes to automatically calculate in-season and post-season hatchery

contribution estimates A historic database of coded-wire tag information from Prince William Sound tagging and tag recovery programs will be maintained and will be easily accessible by managers and researchers

Personnel policy, purchasing practices, field camp operations, safety procedures, and project administration will be in compliance the ADF&G Division of Commercial Fisheries Manual of Standard Operating Procedures (SOP) Data collection procedures are similar to those used in NRDA F/S Study #3 These procedures have been thoroughly reviewed by the NRDA peer review process and approved by the Management Team

F. PERSONNEL QUALIFICATIONS

Fisheries Biologist III Principal Investigator - Samuel Sharr

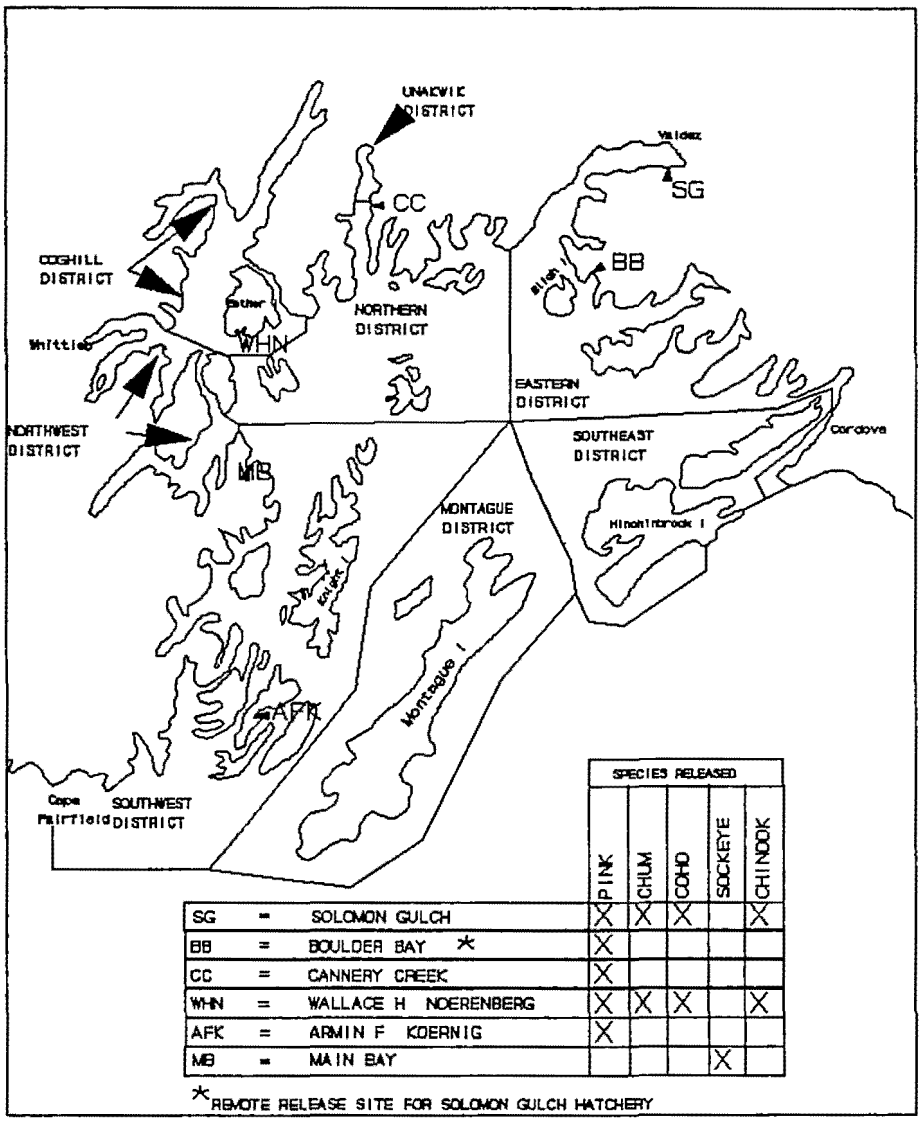
Mr Sharr received a Bachelor of Science degree in biology from the University of Washington in 1968 He has been a research biologist for ADF&G since 1979 and has worked on PWS salmon and herring since 1981 He assumed his present position as the ADF&G, Division of Commercial Fisheries, Biologist III, PWS Area Finfish Research Project Leader in 1986 In this capacity, Mr Sharr oversees all the salmon and herring research conducted by the Division of Commercial Fisheries in PWS His involvement with the PWS salmon escapement aerial survey program dates from the early 1980's Mr Sharr has supervised a total re-edit of the historic aerial

and ground survey data and designed a new RBASE data base for inseason escapement analyses Mr Sharr wrote the original operational plans for NRDA F/S Studies 1,2 and, 3 and has been the Principal Investigator for those projects since their inception

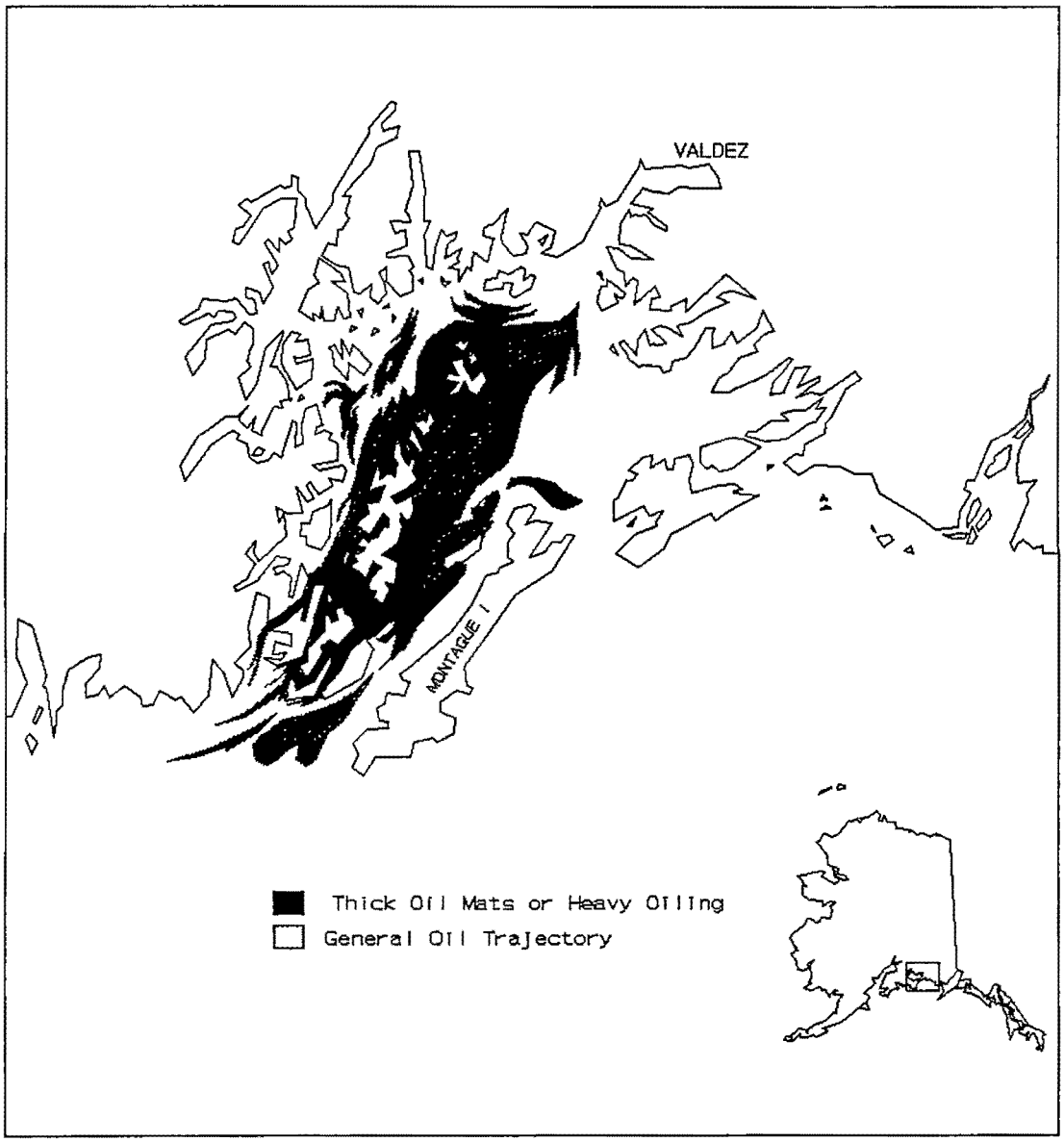
Fisheries Biologist II Project Leader - Carol Peckham

Ms Peckham has a Bachelor of Science in Wildlife Biology from the University of Alaska and completed all course work requirements for a Masters degree in statistics She has been employed by ADF&G since 1984 As a college intern for the ADF&G Stock Biology Group, Ms Peckham gained valuable experience in a wide variety of biological sampling and stock identification techniques in Cook Inlet and Prince William Sound Ms Peckham has been involved in coded-wire tag recovery activities in PWS since their inception, and, since 1987, she has been the Fisheries Biologist in charge of coded-wire tag recovery operations for PWS salmon She has excelled in that capacity Her experience includes supervision of sampling activities spread throughout south central Alaska She has co-authored several reports in the ADF&G Technical Data Report series and she was a coauthor of the 1991 NRDA F/S Study #3 interim status report

G. PROJECT BUDGET (See attached)



Attachment 1 Fishing districts and hatcheries of Prince William Sound, Alaska



Attachment 2 Trajectory of oil plume through Prince William Sound, Alaska, 1989

EXXON VALDEZ TRUSTEE COUNCIL

Project Description This project recovers coded–wire tags from adult sockeye, chum, chinook and coho salmon tagged as fry at three hatcheries in Prince William Sound It makes estimates of wild and hatchery catch contributions, total returns, and survival rates In season catch contribution estimates for hatchery and wild fish permit fisheries managers modify time and area fishing patterns to protect oil damaged wild pink salmon stocks

Budget Category	Approved 01–Oct–92 28–Feb–93	Proposed 01–Mar–93 30–Sep–93	Total FY 93	FY 94	FY 95	FY 96	FY 97	Sum FY 98 & Beyond	
Personnel	0	$106 0	$106 0						
Travel	0	$1 1	$1 1						
Contractual	0	$2 8	$2 8						
Commodities	0	$0 6	$0 6						
Equipment	0	$0 0	$0 0						
Capital Outlay	0	$0 0	$0 0						
Sub–total	0	$110 5	$110 5						
General Administration	0	$15 9	$15 9						
Project Total	0	$126 4	$126 4						
Full–time Equivalents (FTE)		2 6	2 6						

Budget Year Proposed (FY 93 – 01 Jan thru 30 Sept) Personnel

Position	Months Budgeted	Cost	Comment
FIELD & CORDOVA OFFICE PERSONNEL			
Program Manager	0 5	$3,750	
Fisheries Biologist II Project Leader – Cordova	1 0	$4,855	
Fisheries Biologist I – Cordova	0 0	$1,200	Overtime only
F&W Technician III – Cordova	1 0	$4,908	Includes overtime
F&W Technician III – Valdez	1 0	$4,908	Includes overtime
2 F&W Technician II – Cordova	8 0	$22,574	Includes overtime
3 F&W Technician II – Valdez	6 5	$18,341	Includes overtime
1 F&W Technician II – Whittier	1 0	$4,147	Includes overtime
1 F&W Technician II – Anchorage	3 0	$8,465	Includes overtime
1 F&W Technician III – Juneau	2 0	$7,120	Includes overtime
3 F&W Technician II – Juneau	7 5	$25,523	Includes overtime

1993

Project Number
Project Title CWT Recovery in PWS Chinook, Sockeye, & Chum Salmon
Agency ADF&G

FORM 3A
AGENCY
DETAIL

09–Jun–93

	Proposed
Travel	
Supervisory trips Cordova to Whittier, Valdez, Kodiak Per diem included	$1 1
Contractual	
Air charter for supervisory trips to hatcheries	$1 2
Office rental (Valdez, Whittier)	$0 6
Vehicle Leasing	$1 0
Commodities	
Sampling gear, including rain gear, knives, balance, tweezers, sampling kits, gloves	$0 6
Equipment	

1993	Project Number Project Title CWT Recovery in PWS Chinook, Sockeye, & Chum Salmon Agency ADF&G	FORM 3B AGENCY DETAIL

09-Jun-93