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RESTORATION IMPLEMENTATION PROJECT WORK PLAN

Project Title:	Restoration Survey for Wild Pink and Chum Salmon
Project Number:	3
Project Leaders:	Mark Willette, Fishery Biologist, ADFG Nick Dudiak, Fishery Biologist, ADFG Lorne White, Fishery Biologist, ADFG
Lead Agencies:	Alaska Department of Fish and Game U.S. Department of Agriculture, Forest Service
Cost of Proposal:	$ 156,200
Dates of Implementation:	July 1, 1991 to June 30, 1992

Mark E Willette — 5-24-91
Project Leader — Date

Tom Kron — 5-29-91
Supervisor — Date

Michael Pullen — 5-31-91
OSIAR Division Director — Date

I. INTRODUCTION

As a first phase of an oil-spill restoration project for pink and chum salmon, this study will identify the appropriate fisheries enhancement techniques for specific salmon stocks potentially impacted by the Exxon Valdez oil spill (EVOS). Detailed proposals will be developed for the most feasible and beneficial projects. Enhancement of unimpacted pink and chum salmon stocks will also be investigated as a means to replace damaged stocks. The study area will include Prince William Sound, the Eastern Kenai Peninsula/Lower Cook Inlet, and the Kodiak Archipelago. Appropriate enhancement techniques may include spawning channels and improvement of fish passage through stream channelization or fish ladders to overcome physical or hydrological barriers. These measures will provide oil-free spawning habitat to replace oil-impacted spawning areas. Additional wild salmon stock restoration measures may include stream-side incubation boxes, or remote egg-taking and incubation of the stocks at existing hatcheries for ultimate fry release in oil-impacted streams.

The extensive Natural Resource Damage Assessment (NRDA) studies conducted in the region were not designed to evaluate specific fish restoration options. Therefore, certain biological, hydrological, and engineering data must be collected to identify appropriate enhancement techniques, estimate project costs, and develop detailed project proposals.

II. PROJECT DESCRIPTION

The restoration survey will be conducted in four phases:

(1) selection of potential fish restoration sites,

(2) collection of additional field data as needed,

(3) selection of the most desirable fish restoration projects, and

(4) development of detailed project proposals.

Potential fish restoration sites will be selected after a thorough review of all previous fisheries rehabilitation and enhancement work conducted in the EVOS impact area (Sheridan 1965; Sweet 1975; Doyle 1978; Blanchet 1979; Sanner 1982a; Sanner 1982b; Quimby and Dudiak 1986; Boyle and Dudiak 1986). In addition, relevant NRDA studies, fishery production data (ADFG),

anadromous stream catalogs (ADFG), and aerial photographs (USFS) will be reviewed. The following criteria will then be applied to evaluate potential restoration techniques at selected sites (not in order of priority):

1. oil-spill damage to spawning habitats and 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 cost/benefit ratio of the proposed project,

5. the compatibility of the proposed project with established land uses in the area,

6. the potential for the proposed project to maintain the wild characteristics of the affected salmon population, and

7. consistency with guidance from regional planning process.

This analysis will serve primarily to identify gaps in the data needed to evaluate potential projects. Field sampling programs will then be developed to collect the data needed to fully apply the project evaluation criteria.

The following physical and biological measurements will be made as needed on selected streams to determine technical feasibility and estimate project costs and benefits: Stream dimensions and gradient will be measured with a surveyor's transit. Stream depth will be measured with a staff gauge along longitudinal and lateral transects of the stream. Discharge will be estimated from current speed measurements along stream cross-sections. Maps of substrate type will be constructed from visual stream surveys. Water temperature fluctuations during the year will be monitored with temperature loggers. Water chemistry samples will be collected for measurement of alkalinity, hardness, pH, dissolved solids, and metals. Dissolved oxygen concentration will be measured with electronic oxygen meters. Intragravel water temperature will be measured with intragravel probes. If fish population estimates are not available from the ADFG, Commercial Fisheries Division, visual stream surveys will be conducted to estimate the abundance of pink and chum salmon.

Following field data collection, more thorough project

evaluations will be conducted using the criteria listed above. At this point, sufficient information should exist to adequately determine which projects are most desirable. Detailed proposals will then be developed for the projects identified at this stage. Some additional engineering data may be collected for the detailed project plans.

III. SCHEDULES AND PLANNING

Project activities will continue throughout the year (Table 1). The restoration survey will be managed independently by project leaders in Cordova, Homer, and Kodiak. After an initial review of existing information, project leaders will meet to identify and prioritize sites for field studies in their area. After field sampling, the project leaders, the hydrologist, and the engineers will meet to identify the most desirable projects and begin development of detailed project proposals.

The day-to-day operations of the project will be carried out by various fishery biologists and technicians in the Alaska Dept. of Fish and Game (Table 2). These personnel will be supervised by the project leaders in their area. A hydrologist and engineer from the U.S. Forest Service will assist in development of detailed project proposals. Float planes will be used for transportation to specific study sites. Rubber rafts and small skiffs will be used for surface transportation as needed.

Table 1: Schedule of project activities in FY 92.

	Month											
Activity	Jl	Ag	Sp	Ot	Nv	Dc	Jn	Fb	Mr	Ar	My	Jn
Site Selection	X											
Field Sampling	X	X	X	X		X		X				
Data Analysis				X	X	X	X	X				
Project Selection								X				
Proposal Writing									X	X	X	X

Table 2: Allocation of tasks to various project personnel in FY 92.

Position	Months	Duties
Anchorage (USFS)		
Hydrologist	1	develop design specifications
Engineer	1	develop design specifications
Cordova (ADFG)		
FBIII	1	project management, data analysis, proposals
FBII	4	logistics, field supervision, data analysis
FTII	3	equipment maintenance, field sampling
FTII	3	equipment maintenance, field sampling
Homer (ADFG)		
FBIII	1	project management, data analysis, proposals
FBI	3	logistics, field sampling, data analysis
FTII	2	equipment maintenance, field sampling
Kodiak (ADFG)		
FBIII	1	project management, data analysis, proposals
FBI	3	logistics, field sampling, data analysis
FTII	2	equipment maintenance, field sampling

IV. NEPA/Permit Status

A National Environmental Policy Act (NEPA) analysis is not needed for this project. Fish populations and habitats will not be significantly disrupted by field sampling. However, proposals for restoration projects will include appropriate NEPA analyses and documentation.

V. BUDGET

100 - Personal Services

Location	Class	Months	Salary		Total
Cordova	FBIII	1	5.0		5.0
Cordova	FBII	4	4.5		18.0
Cordova	FTII	3	2.9		8.7
Cordova	FTII	3	2.9		8.7
Homer	FBIII	1	5.0		5.0
Homer	FBI	3	4.2		12.6
Homer	FTII	2	2.9		5.8
Kodiak	FBIII	1	5.0		5.0
Kodiak	FBI	3	4.2		12.6
Kodiak	FTII	2	2.9		5.8
				Total	87.2

200 - Travel		
2 RT Cordova-Anchorage		0.5
2 RT Homer-Anchorage		0.5
2 RT Kodiak Anchorage		0.5
	Total	1.5

300 - Contractual		
air charter		42.5
phone/postage/misc office		1.0
equipment repair		1.0
hydrology and engineering (USFS)		10.0
	Total	54.5

400 - Supplies		
scientific supplies		7.5
field sampling supplies		4.0
office supplies		1.0
data processing supplies		0.5
	Total	13.0

500 - Equipment
none

Grand Total 156.2

VI. MONITORING

As part of this restoration survey, no population monitoring will be conducted to assess project effectiveness. However, proposals

for actual restoration projects will include descriptions of methods for population monitoring.

VII. PERSONNEL QUALIFICATIONS

Mark Willette: Masters of Science, Fisheries Oceanography, 1985; Bachelors of Science, Fisheries Science, 1983; Area Biologist, Prince William Sound, ADFG FRED Division, March 1991-present; Project Leader: Early marine salmon injury assessment in Prince William Sound, F/S Study #4; Asst. Research Professor/Instructor, Northwest Alaska, University of Alaska, School of Fisheries and Ocean Sciences, 1986-1991. Asst. Project Leader: An ecosystem model of Kasegaluk Lagoon, Cooperative Fisheries and Oceanographic Studies on early marine fishes.

Nick Dudiak: Bachelors of Science, Zoology, 1968; Area Biologist, Lower Cook Inlet, ADFG 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, ADFG 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 fishpasses on Kodiak Island, limnology of 25 lakes for evaluation of stocking and fertilization, instream habitat studies related to hydroelectric development.

VIII. REFERENCES

Blanchet, D. 1979. Potential fisheries enhancement projects for Prince William Sound. USFS Report, 29p.

Boyle, L. and N. Dudiak. 1986. Tutka Lagoon hatchery 1981 adult return evaluation, AFDG FRED Report 61.

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Sanner, C. 1982a. Economic evaluation of fishways constructed in the Anchorage ranger district, Chugach Forest. USFS Report, 2 pp.

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Sheridan, W. 1965. Salmon habitat improvement reconnaissance Prince William Sound, Cordova and Anchorage ranger districts. USFS Report, 7 pp.

Sweet, M. 1975. Fish habitat improvement information for the Alaska region 10. USFS Report, 12 pp.

Quimby, A. and N. Dudiak. 1986. Paint River fish pass feasibility studies, 1978-1983. ADFG FRED Report 72.

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MONTAGUE ISLAND CHUM SALMON POPULATION RESTORATION

Project # 3

DRAFT

PROJECT LEADER:	David Schmid, Fisheries Biologist
Assisting Personnel:	Robin Irving, Fisheries Biologist Ken Hodges, Fisheries Technician
LEAD AGENCY:	USDA - Forest Service
COOPERATING AGENCIES:	Alaska Department of Fish and Game, FRED Division Prince William Sound Aquaculture Corporation
COST OF PROPOSAL:	USDA-FS: $20,000 (annually) ADF&G: $35,000 (annually) PWSAC: $40,000 (annually)
DATES OF PROJECT IMPLEMENTATION:	June 1, 1991 through September 30, 1998
LOCATION OF PROJECT IMPLEMENTATION:	Western Montague Island (Alaska Department of Fish and Game Stream numbers 707, 711, 739, 741, and 745, USGS Seward Quadrangle A-1)

5/1/91

David E. Schmid
Fisheries Biologist

5/1/91

Mark J. Madrid
District Ranger

Introduction

Prior to the 1964 earthquake, Montague Island streams accounted for nearly 8% of the total wild stock chum salmon (Oncorhynchus, keta) production in Prince William Sound. Habitat alterations caused by the earthquake uplift led to the virtual extirpation of chum salmon stocks on the Island. Pink salmon stocks have returned to historic levels suggesting that spawning conditions have stabilized and that chum salmon production is presently limited only by lack of broodstock.

The Exxon Valdez oil spill impacted pink and chum salmon spawning habitat by oiling intertidal areas in Prince William Sound. Oiled pink salmon streams showed a 70 percent greater mortality of salmon eggs in 1989 and 50 percent greater mortality in 1990. While chum salmon mortality was not specifically measured, they spawn in the same habitat as pink salmon and were probably similarly impacted.

In order to accelerate natural recovery of chum salmon streams on Montague Island, and replace habitat and salmon populations lost from the oil spill, stocking efforts will be expanded to include all historic chum salmon producing streams on the Island. Cooperators will include Alaska Department of Fish and Game (ADF&G), and Prince William Sound Aquaculture Corporation (PWSAC).

The project will include monitoring of past stocking efforts in Chalmers River in 1991-1993, where a four year cooperative chum salmon stocking effort was completed in 1990. The stocking effort proved successful when more than 1,000 four year old adult chum salmon were observed spawning in the Chalmers river in 1990, and will serve as a model for comparison. Preparation for expanded stocking efforts of other streams on the Island will take place in 1991-1992. Based on the findings, stocking efforts will begin in 1993 and continue through 1996. Monitoring of the expanded stocking program will be conducted in 1995-1998.

Chum salmon emergent fry will be produced by PWSAC at the Armin F. Koernig Hatchery, Port San Juan, Prince William Sound. A percentage of the fry will be marked with coded wire tags by PWSAC personnel before being released. Spring fry transplants will be a joint effort by all cooperators. Chum salmon fry survival will be evaluated by ADF&G in early spring as part of their annual fry index surveys. Adult escapement surveys will be conducted by US Forest Service personnel in late summer. In addition, any planning efforts, data analysis, and report writing will be coordinated by the U.S. Forest Service project leader.

The successful completion of this project could produce an average annual surplus of 58,000 chum salmon to the common property fishery worth $550,000 (assuming $.95/lb with 10 lb. mean adult weight). Making additional chums available from Montague Island would redirect commercial fishing effort away from other oil impacted stream systems in PWS.

Project Description

The proposed project is targeted at restoring self-sustaining populations of chum salmon on Montague Island, Prince William Sound. Streams known to produce Chum salmon historically include ADF&G stream numbers 707, 711, 739, 741 and 745 (figures 2 and 3). The Chalmers River, ADF&G stream number 741 was stocked during 1987 through 1990, and will be used as a comparison for the other four streams.

The adult chum salmon return (escapement) surveys conducted in Chalmers river indicate that the stocking efforts were successful. In 1987, 100,200 emergent fry were stocked at the mouth of the river. In 1989 about 500 three year old fish and in 1990 over 1,000 four year old chum salmon returned to Chalmers River to spawn (Ostroski, 1989 and Weintraub, 1990).

U. S. Forest Service personnel will continue to monitor adult returns to the Chalmers River until 1994. In addition ADF&G will sample alevin densities within the spawning gravels each year between March and April beginning in 1992 (ADF&G, 1991). From this they will be able to assess the overwinter survival of the eggs in the river, and make predictions on adult returns to the system.

Based on the success of the Chalmers river project, stocking efforts will be expanded to the other historical chum producing streams on Montague Island. Increased fry production will be required at PWSAC hatcheries to accomodate the desired stocking levels for this project. Logistics involved in transport of the additional fry will be more demanding. Chum salmon fry are able to osmoregulate to changes in salinity rather quickly so it is possible to transport the fish directly from the hatchery to the brackish waters at the mouth of the stream systems with very low mortality (Hale, 1981). Therefore large numbers of fry can be moved very efficiently in a short time period.

In addition to the fry stocking efforts in the Chalmers River, other methods for increasing chum production were explored. Habitat improvement projects were examined that involve creating berms, and instream structures to improve spawning habitat. However the Chalmers river is a very high energy system with flood flows over 600 cubic feet per second per square mile. Historic aerial photos of the area show that the channel migrates both frequently and significantly. It would be an intimidating river for successful installation of fisheries improvement measures, (D.Blanchet, pers. communication) therefore these methodologies were abandoned.

The other stream systems identified as chum producing streams are similar in character to the Chalmers river. Habitat improvement may not be successful due to high flows and erosive power of Montague streams. Also habitat components needed for successful chum salmon production are present (Hale, 1981). However there is a lack of adequate brood stock. As proposed by this project, transplanting of stocks over a four year period would provide the seed stock needed to sufficiently sustain natural runs of chum salmon, and would help to accelerate natural recovery of the Island fish populations after the habitat degradation caused by the oil spill.

An estimated escapement of 1,000 adult chum to each stream, and a surplus of 58,000 fish to the common property fishery is the initial goal of the project.

However, these figures may be modified following an assessment of available habitat in each of the streams. Stocking densities will be determined by ADF&G.

The brood stock for the fry stocking efforts will be from Port Fidalgo due to the similarity in run timing of the original Montague stocks. These were the same stocks used for transplanting in the Chalmers River. Green egg takes in Port Fidalgo streams will be conducted by PWSAC personnel. Fertilized eggs will be transported to the hatchery where they will be incubated to emergent stage. Emergent fry will be transported from the hatchery to the streams in large aeration tanks via charter vessel.

Monitoring of the streams will begin three years after stocking has occured. They will be monitored in the same manner as Chalmers river; U. S. Forest personnel will conduct escapement surveys of the streams, and ADF&G personnel will sample alevin densities within the spawning gravels. Monitoring will continue for a five year period. Data analysis and report writing will be done in the fall and winter each year by the project leader.

Schedules and Planning

Beginning in 1993, chum salmon fry will be stocked in each of the chum streams on Montague Island and continue until 1995. PWSAC personnel will insert coded wire tags in the snout of a percentage of the fry to be released. Fry stocking will take place in the spring between May 1 and May 15, each year. It will be a joint effort between all cooperaters. Escapement surveys will be conducted by Forest Service personnel in July and August each year beginning in 1996 and continue until 1998 to monitor success of the project. ADF&G will sample alevin densities within the spawning areas of creek number 707, 711, 739 and 745 beginning in 1994. These surveys will be conducted in March and April each year as part of ADF&G's annual fry surveys of Prince William Sound (ADF&G, 1991). Coded wire tag recovery will be conducted by ADF&G personnel within the canneries during the commercial fishing seasons (July - September) beginning in 1996. Data analysis will be completed by September 30 each year of monitoring and incorporated into summary reports by December 31 each year.

NEPA / Permit Status:

A Fish Transport Permit (FTP) will be required each time fish or fish eggs are transported from one location to another. FTP's are issued by ADF&G and obtaining the permit will be the responsibility of the hatchery manager. A Permit Alteration Request (PAR) will require approval from the Commisioner of ADF&G if the chum salmon fry demand for this project exceeds the current permited level of hatchery production.

Any NEPA documentation will be completed by the project leader beginning in October 1991.

Budget:

Project Name: Montague Island Chum Salmon Population Restoration

Unit: Cordova Ranger District **Fiscal Year:** 1991

Begin Work: June 1, 1991 **End Work:** September 30, 1991

Manpower (Name: GS, WG, or VOL.)	Days	Rate	Planned Costs (To Be Financed)
Schmid	25	165	4,125
Irving	25	145	3,625
Hodges	20	130	2,600
Fish Tech.	20	110	2,200

Per Diem, Travel, and Meals	
Field Per Diem (3 @ 15 days @ $15/day)	675

Materials and Supplies	Quanity	Unit Price	
Misc. Field Gear			1,100

Flights / Charter / Rent	Daily or Unit Rate	
Beaver Flights (16 hrs.)	$350/hr.	5,600

TOTAL PLANNED COST	19,925

Monitoring:

Field work to be conducted in 1991 involves monitoring previous stocking efforts in Chalmers river. Fry survival rates will be determined by ADF&G during the spring census from the 1991 spawning population. Returning adult chum salmon will be surveyed by FS crews to estimate the percent survival from stocked fry to retuning adults. Escapement surveys will be conducted throughout the chum run (July - August). In addition, coded wire tag data will be analyzed by ADF&G using the methods described by Sharr, et al, 1990.

Personnel Qualifications:

David E. Schmid, District Fisheries/Watershed Staff Officer

General Background: B.S. Degree in Fisheries and Natural Resource Management from University of Wisconsin - Stevens Point.

10 years related work experience with the USDA - Forest Service.

6 years experience in fisheries habitiat enhancement in Prince William Sound.

3 years of resposibility for planning, managing and implementing District fisheries programs for Glacier and Cordova Ranger Districts in Prince William Sound.

REFERENCES

Alaska Department of Fish and Game, FRED Division, 1985. Montague Island chum salmon reintroduction, brief project proposal. ADF&G, Cordova, Alaska, unpub.

Hale, Stephen S., 1981. Freshwater habitat relationships chum salmon (Oncorhynchus, keta). Alaska Department of Fish and Game, Habitat Division, Resource Assessment Branch, Anchorage, Alaska.

McNeil, William J., 1966. Effect of the spawning bed environment on reproduction of pink and chum salmon. Bureau of Commercial Fisheries Biological Laboratory, Auke Bay, Alaska.

Ostrowski, Tom and Ken Hodges, 1989. Chalmers River chum escapement and survey stream # 227-20-17410. US Forest Service, Cordova Ranger District, unpub.

Prince William Sound Aquaculture Corporation, 1975. Salmon Culture Program. Cordova, Alaska.

Sharr, Sam and Larry Peltz. Coded wire tag studies on Prince William Sound Salmon. 1990. State/Federal Natural Resource Damage Assessment Draft Preliminary Status Report.

Weintraub, Ellen and Don Youkey, 1990. Chalmers River salmonid escapement stream # 227-20-17410. US Forest Service, Cordova Ranger District, unpub.

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PIGOT BAY
CHUM SALMON SPAWNING CHANNEL
WORK PLAN

Project ID Number 3

Project Leader: Kate Wedemeyer,

Lead Agency: US Forest Service

Cooperating Agencies: Alaska Department of Fish and Game

Cost of proposal: $94,000 - US Forest Service
$6,000 - Alaska Department of Fish and Game

Date of project implementation: June and July 1991

Location of project: Pigot Bay, Port Wells, Prince William Sound

Cliff Fox
District Fish and Wildlife Staff

John Dorio
District Ranger

Introduction

The US Forest Service will construct a 2,500 foot long channel in an old flood channel of Pigot River in Pigot Bay, Prince William Sound to provide additional spawning habitat for chum and pink salmon. The Alaska Department of Fish and Game FRED Division will assist in the planting of adult chum salmon from nearby streams in Pigot Bay to develop a self sustaining run. The construction is scheduled for summer, 1991 with planting of adult salmon commencing in fall 1991 and continue through a full biological chum salmon cycle of four years.

This project, over its 25 year life, will produce an estimated 72,000 chum salmon. Pink salmon will also spawn in the channel. The habitat produced will contribute to the replacement of pink and chum salmon spawning habitat damaged from the oil spill. Pigot Bay is within the oil spill area but was not impacted by oil. The increased production of fish will contribute to maintaining the wild genetic stock in Prince William Sound, replace fish lost from production in oil impacted streams and benefit commercial and sport fishing.

Since 1977,the Canadian Department of Fisheries and Oceans has undertaken a program to develop artificial spawning channels using groundwater sources (Lister, et al, 1980). Artificial spawning channels have also been constructed in Alaska including several on the Copper River Delta and Kenai Peninsula with proven success.

Project Description

An opportunity to create spawning salmon habitat in Pigot Bay was first identified in 1983. Salmon populations in Pigot River decreased after the 1964 earthquake as a result of loss of habitat. It is possible to increase populations above current levels by constructing a spawning channel that intercepts groundwater and provides additional spawning area. The project is located adjacent to the mouth of Pigot River which flows into Pigot Bay, T.9N., R.6E., Section 21, in Prince William Sound approximately 14 miles northeast of Whittier, Alaska.

A 2,500 foot long by 14 foot wide channel will be excavated to a depth of two feet below the groundwater table. The maximum depth of excavation will be 8 feet at the upper end, grading to as low as 1-2 feet at the lower end. Several rock gabions will be placed along the channel to slow down the flow of water and maintain a 0.2% gradient.

The intercepted groundwater will create a year round source of fresh water in the channel creating 35,000 square feet of new spawning habitat. The channel will follow an old stream channel of Pigot Creek. Three hundred adult chum salmon will be captured from adjacent streams and placed in the channel to spawn. These fish will supplement natural straying into the channel from Pigot River. After five years returning salmon should occupy all the spawning habitat available.

Possible limiting factors in the freshwater and nearshore environment of chum salmon include freezing of the eggs, limited food resources in the estuaries, and lack of spawning habitat. All indications support the hypothesis that the limiting factor in this case (Pigot Bay) is a lack of spawning habitat. While

chum salmon rear in estuaries (Wertheimer, 1990) rearing habitat does not appear to be a limiting factor in light of the increased production in PWS with the hatchery fish released there over the past decade.

A 1983 biological assessment indicates that there is 167,000 ft sq of existing spawning habitat in Pigot Bay streams which produce an annual average of 31,000 pink salmon and 3,500 chum salmon (Nelson 1983). Historically the systems produced over 100,000 pink salmon and 8,000 chum salmon. The currently available spawning habitat is probably being used to its maximum and cannot support additional fish.

Several alternative designs and approaches for constructing a spawning channel were evaluated. This included designs that account for the digging behavior of chums and resulting bank erosion. Placing riprap along the channel banks, a common procedure when constructing salmon spawning channels, was rejected due to cost and environmental concerns. Instead the sideslopes were designed at a 3:1 slope so that the digging action would not release as much material into the channel. Creating a long meandering channel without the need for drop structures was also evaluated. It was rejected because it would move the channel out of the old stream channel and would increase the possibility of freezing at the lower end of the channel. Alternative sites outside of Pigot Bay were also evaluated. An environmental analysis was conducted on the project and the environmental assessment is available for public review at the Glacier Ranger District office in Girdwood, the Office of the Forest Supervisor in Anchorage, and the Office of the Regional Forester in Juneau

Because this project is situated in a Wilderness Study Area, special consideration was given to the design, evaluation and selection of the project to preserve the natural and rustic character. Non-mechanized and non-motorized methods of moving the 15,000-18,000 yards of material that would be required during construction were considered but determined to be not reasonable means of constructing the channel.

The three possibilities considered in the bioenhancement of the new spawning channel were: 1) allow naturally straying chum salmon to populate the channels, 2) plant eggs or 3) capture adults returning to nearby streams and transplant them to the new channel. Based on the recommendation of state fish and game personnel, the third option was chosen. Approximately 300 spawners from nearby Meacham and Swanson Creeks will be captured and transported to the new spawning channel.

An adequate volume water flow and sufficient velocity through the redds is the most critical factor in the success of spawning habitat. Because the exact volume of groundwater supply to the channel will not be known until it is built, there is a possibility of failure. There is also a possibility that that only portions of the channel will provide suitable spawning habitat. Confidence in the project is based on groundwater data collected (via stand pipes) over the past three winters. The placement of the new channel in a former flood channel gives further confidence that the project will work (Metzger, Alao-Macleod, 1987). However, a large margin for failure due to parts of the channel not working or freezing is factored into the benefit cost calculation.

Total expected production of the project over its twenty-five year life span is 72,000 chum salmon. The benefits include a theoretical return of 1650 adult chum salmon each year from years five thru nine (from the original 300 fish transplanted each year from year one thru four), and 4667 adult chum salmon each year thereafter fully seeding the available habitat for the rest of the twenty-five year life of the spawning channel. Each fish was considered to weigh an average of 8.6 pounds. Price is based on a running average analysis to compute average commercial ex-vessel prices of salmon for 1985. This price of $0.55 per pound was then increased by 4% per year to estimate the 1990 base price which was used in the discounting and present net value calculations.

Costs used in the benefit/cost analysis represent only an estimated cost of the construction contract and does not include planning or design costs. Benefits from increased pink salmon production were not included in the calculation.

Using commercial values for chum salmon, the economic analysis for this project is displayed in Table 1. The benefit/cost analysis is based on an estimated initial cost of $60,000, 3 years of bioenhancement at $6,000 and $2,000/year maintenance for year 5-25, the total cost is $120,000.

Table 1. Discounted commercial benefits, costs, and present net values for the Pigot Bay spawning channel.

	Total	4% discount	10% discount	PNV 4%	PNV 10%*
Costs	$120,000	$175,276	$ 78,924	$ 84,166	$ 43,724
Benefits:	$569,123	$308,644	$139,312	$175,276	$ 84,166

*PNV = present net value

Technical Support

The primary technical support has been the hydrologist and fisheries engineer working on the project during the design phase. They will also be required during the construction and monitoring phases of the project.

Schedules and Planning

CRITICAL PATH FOR CONSTRUCTION

May 28, 1991 - Contract awarded and contractor prepares for construction
(30 days)

June 28, 1991 - Construction begins
(2 1/2 weeks)

July 15, 1991 - End of time window for construction

August 20,1991 - Begin collecting and transporting fish for bioenhancement

June, 1992-2018 - Maintenance of channel

August, 1992-6 - Collect and transport fish for bioenhancement

Aug-Sept, 1997 - Monitor adult escapement and spawning success in the channel

NEPA/Permit Status

An Environmental Assessment and Finding of No Significant Impact has been completed and is available at the Forest Supervisor's office in Anchorage and District Ranger's office in Girdwood.

The project was reviewed by the State of Alaska Division of Governmental Coordination and found to be consistent with the Alaska Coastal Management Program as long as certain stipulations made to address ADF&G's Title 16 related concerns were followed. Stipulations included limiting in-water work in the Pigot River to May 15 to July 15 to avoid adverse impacts on the natural salmon runs in the Pigot river; excavating so that excavated material cannot be accidentally reintroduced into the newly created spawning channel; bank cuts, slopes, fills and other exposed earth be stabilized and revegetated with natural vegetation; a draft monitoring plan be developed and that the Department of Fish and Game be notified at least five days prior to beginning of construction to arrange a site inspection.

The Army Corps of Engineers has determined that a Department of Army Section 404 (Clean Water Act) permit is not required. No other permits are required to implement the project.

Budget

Design Phase	$34,000
Construction	$60,000
Bioenhancement	$6,000/ year for 4 years
Maintenance	$2,000/ year
Monitoring	$2,000/ year

Monitoring

Monitoring will consist of annual inspections to determine the effectiveness of the channel design in withstanding sluffing created by the salmon digging into the banks and aerial escapment counts. The aerial escapement counts will be verified with annual on the ground surveys conducted in August. Stand pipes will be reinstalled and checked annually to determine the winter groundwater depth. This will give an indication of possible egg freezing that may be occurring.

Aerial escapement counts are a standard procedure conducted by ADF&G and is currently conducted on streams in Pigot Bay annually. Ground surveys to count returning fish are also standard monitoring procedures that will be employed to determine the effectiveness of the project.

Stand pipes are devices that record the lowest point the groundwater reaches during the winter. Checking the stand pipes in the spring is an effective way of determining how low the water got and if eggs in the channel were exposed to freezing.

The results of the monitoring studies are reported in an annual monitoring report.

Personnel Qualifications

Kate Wedemeyer, the project manager, is currently the Fisheries Biologist on the Glacier Ranger District, Chugach National Forest. She has a MS in Fisheries Biology and Natural Resource Management and 15 years experience in the field working for ADF&G, US Fish and Wildlife Service and US Forest Service.

Dave Blanchet is a hydrologist for the US Forest Service. He has a GS in geology and advanced work in watershed sciences. He has 15 years experience working as a hydrologist for the Forest Service and US Geological Survey.

Vanessa Alao-Macleod is a Fisheries Engineer for the US Forest Service. She has a BS in civil engineering and ten years experience as an engineer including six years working on fisheries related projects.

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