PUBLIC HEARING
ON

DRAFT PROPOSAL FOR HATCHERY DEVELOPMENT AT BARANOF LAKE

November 13, 1986
7:00 p.m.

Sitka, Alaska
Shee Atika Hotel

I. Welcoming Speech and Introductions

II. Video Presentation on Baranof Lake Site

III. Presentation of Proposal for Hatchery Development

IV. Question Period

V. Public Comment

MEMORANDUM

State of Alaska

DEPARTMENT OF FISH AND GAME

TO: Interested Public

DATE: October 24, 1986

FILE NO.:

TELEPHONE NO.: 465-4100

SUBJECT: Public Review of "Proposal for Hatchery Development at Baranof Lake"

FROM: Don W. Collinsworth DWC
Commissioner
Department of Fish and Game

Enclosed is a draft copy of the "Proposal for Hatchery Development at Baranof Lake." The draft is for public review and will be presented at a public hearing to be held at 7:00 p.m. on November 13, at the Shee Atika Hotel in Sitka.

The draft presents to the public a proposal by the Alaska Department of Fish and Game to develop a hatchery at Baranof Lake on the east coast of Baranof Island, as proposed in the Comprehensive Salmon Plan for Southeast Alaska, Phase I, developed by the Joint Southeast Alaska Regional Planning Teams in April 1981.

Any comments on this proposal will be accepted at the November 13 public hearing or may be submitted in writing up to 15 days after the hearing to:

Salmon Rehabilitation and Enhancement Coordinator
Alaska Department of Fish and Game
Division of FRED
P. O. Box 3-2000
Juneau, AK 99802
907-465-4160

If you have questions on the review or hearing, contact Jerry Madden at the above address.

Enclosure

PROPOSAL FOR HATCHERY DEVELOPMENT AT BARANOF LAKE

A Planning Report
Prepared by the Alaska Department of Fish and Game
for discussion at a public hearing to be held
in Sitka on November 13, 1986

Compiled by

Steve McGee, Fishery Biologist
Private Nonprofit Program
Alaska Department of Fish and Game

Prepared for
Office of the Commissioner
Alaska Department of Fish and Game

Don W. Collinsworth
Commissioner

October 1986

REVISED DRAFT
10/30/86

PROPOSAL FOR HATCHERY DEVELOPMENT AT BARANOF LAKE

I. The Site

Warm Spring Bay, located on the east side of Baranof Island, 20 miles east of Sitka, has been identified as the site for a major new salmon hatchery. The site has been under consideration since 1977, when its huge potential was identified. In 1978, the Fisheries Rehabilitation, Enhancement and Development (FRED) Division of the Alaska Department of Fish and Game (ADF&G) obtained a permit from the Department of Natural Resources (DNR) to appropriate water from the lake. In 1982, DNR refused to renew this permit because of in-house rules that require an applicant to use the water within five years. The department reapplied to DNR for a water appropriation of 110 cubic feet per second (cfs) for hatchery development, and that application is now under consideration. ADF&G is now working with DNR to make some modifications to the "five-year rule," since this is not sufficient time to develop a hatchery site of this magnitude.

Baranof Lake is capable of supplying water for a major freshwater smolt-rearing facility without appreciable drawdown of the lake. Only one of the hatcheries in southeast Alaska (Snettisham) has a water supply capable of providing as much high-quality fresh water as is available from Baranof Lake. It has been determined by the Commissioner of the ADF&G, in accordance with his statutory authority and as identified in the comprehensive salmon plans for the Northern Southeast Region, that the priority use of the site is fisheries enhancement for contribution to the common-property fisheries.

The Baranof Warm Spring project was listed as a "category A opportunity" in the comprehensive salmon plans for northern

southeast Alaska approved in 1981 (Phase I: p. 201), 1982 (Phase II: pp. 37, 68, 92), and 1985 (Phase II, Revised: pp. 26, 35, 55), and was recommended as one of the two best hatchery opportunities for production of chinook salmon in the Icy Strait/Chatham Strait area. The 1985 version of the plan recommended development of the site within the next five years (p. 79).

A 1985 evaluation of chinook salmon mitigation hatchery proposals, conducted by a multidisciplinary team charged with preparing a plan for the production of 100,000 harvestable chinook salmon to offset reductions in the Alaskan harvest required under the U.S./Canada Pacific Salmon Treaty, once again found that the Baranof Warm Spring site was ideally suited for the production of the needed salmon. The 1985 evaluation rated the site highest based on water-supply characteristics, flexibility in fish-culture strategies, construction potentials, and ability to maximize contributions to the fisheries while minimizing potential interception of other stocks, gear group conflict, and impact on natural stocks.

Based on these determinations, the Commissioner of the ADF&G determined that the department would develop a major salmon hatchery at the site and directed a departmental team to prepare a plan to optimize use of this prime hatchery site. The team included the following departmental staff: Bob DeJong, Commercial Fisheries Sitka Area Management Biologist; John McNair, FRED Division Assistant Sitka Area Biologist; Ben Pollard, FRED Division Regional Engineer; Art Schmidt, Sport Fisheries Sitka Area Management Biologist; and Brad Sele, FRED Division Regional Project Manager. Jim Cochran, hatchery manager for Hidden Falls Hatchery, assisted in plan development. Steve McGee, fishery biologist for the Private Nonprofit (PNP) Program, and Chrystal Smith, staff assistant for the PNP Program, prepared the plan documents.

Several options exist for funding hatchery development at Warm Spring Bay, including federal funds associated with mitigation of the impacts of the U.S./Canada Pacific Salmon Treaty on Alaskan fisheries, state general funds, and funds from private aquaculture organizations. The U.S./Canada Pacific Salmon Treaty, signed in 1985, established ceilings on some southeast Alaskan chinook and sockeye salmon fisheries and reallocated harvests from Alaskan fishermen to Canadian fishermen on transboundary rivers. Congressional hearing records support the use of federal funds to mitigate treaty impacts.

To date, the state has received $3.17 million in federal funds of a projected $20 million total which had been proposed to return the commercial harvest of chinook, sockeye, and chum salmon by southeast Alaska fishermen to pre-treaty levels. So far $2.02 million has been spent on enhancement projects in the region. Congress has appropriated $4.0 million for FY 87 as the second installment of mitigation funding.

The department has entered into a planning process with Southeastern gear groups, the aquaculture associations, and U.S./Canada fisheries delegates which will be reviewed with the Board of Fisheries to assess mitigation projects that may qualify for federal funding. Baranof Warm Spring is one of the projects being considered in this process, but no funding has been committed to any specific projects at this time.

II. The Development Plan

The site development plan outlined below was prepared in response to a request from the Commissioner to plan a project that would maximize use of the Baranof Lake water resource, minimize the impact on wild stocks, offer the least social disruption, offer the opportunity to distribute the benefits as equally as possible

to the fishing fleet, and insure sufficient returns for brood collection.

The hatchery development project proposed for Baranof Lake has a long-term goal of producing 100,000 harvestable chinook salmon and 1 million harvestable chum salmon annually. A standard yearling smolt facility with production from land-based, freshwater raceways in combination with a central incubation facility for chum salmon is planned at the site. Construction will begin when adequate funds are secured from federal appropriations under terms of the U.S./Canada Pacific Salmon Treaty, from state or other funding sources, or from a combination of sources.

The proposal involves two main features:

1. Chinook salmon eggs would be incubated and juveniles reared and released at the hatchery site on Warm Spring Bay. At full capacity, 5.5 million chinook salmon eggs would be incubated annually, resulting in the release of approximately 3.4 million smolt. The total return from a release of this magnitude would be about 102,000 adults annually, of which approximately 2,000 would be needed for broodstock.

   It may be a number of years before adequate funds for total completion of the hatchery facility will be available. However, it is proposed that initial activities to establish a chinook salmon broodstock for Warm Spring Bay and to establish the use of the site for ADF&G hatchery activities begin in the spring of 1987, with the release of chinook salmon smolt in Warm Spring Bay. These fish will return to the area as harvestable adults beginning in 1990, at which time the hatchery could be ready to take eggs for incubation and

rearing at the site. It is proposed that stock from Crystal Lake Hatchery (Andrew Creek origin) be used for initial releases, with the development of a brood based on the Tahini River stock to proceed as eggs become available. Performance of the Andrew Creek stock in other hatcheries has demonstrated its ability to contribute effectively to common-property fisheries.

2. Chum salmon eggs would be incubated at either the Baranof Lake Hatchery or an expanded Hidden Falls facility, but all resultant fry would be transported to remote locations for rearing and release. All returning adults would be available for harvest. Chum salmon broodstock for the Baranof Lake Hatchery could be taken from returns to Hidden Falls Hatchery.

No expansion of existing egg-take facilities at Hidden Falls would be needed; however, expansion of chum salmon incubation capacity at Hidden Falls would be necessary to provide incubation of an additional 60 million chum salmon eggs for transport to Baranof Lake Hatchery or directly to remote release sites. This number of eggs would result in approximately 47 million chum salmon fingerlings for release at one or several remote sites depending on where the Board of Fisheries determines the fish should be harvested. Approximately 1 million adult chum salmon would be available for harvest annually from a release of this magnitude.

Takatz Bay has been identified as a release site for chum salmon fingerlings from Baranof Lake Hatchery. Segregation of returning chum from returning chinook salmon will ensure that sufficient chinook salmon adults escape harvest in the terminal area at Warm Spring Bay to provide the necessary broodstock for the

hatchery. Release of chum salmon at Takatz Bay would expand the existing harvest area available for chum salmon returning to Hidden Falls from Kasnyku Bay south to and including Takatz Bay.

The Baranof Lake Hatchery will have the capability to move chum salmon fry wherever logistically and biologically possible to deliver adult returns to specific user groups as determined by the Board of Fisheries.

The component parts of this project are divided into facilities at Baranof Lake producing 100,000 adult chinook salmon and other facilities at Hidden Falls, and Takatz Bay producing 1,000,000 adult chum salmon in addition to current production levels.

Baranof Lake would be tapped with deep and shallow intakes, and process water would flow through a pair of pipelines under an access road along the south side of the river to a hydropower plant near the entrance to the lagoon (Fig. 1). These pipelines could be tapped to supply water to current water users on the north side of the river. From the hydro, water would flow by gravity to the incubation building and raceways to be constructed on a landfill in the lagoon. Effluent water from the raceways would pass through a fish ladder to attract returning broodstock. All returning adult chinook salmon not needed for egg takes would be stopped at a weir in the lagoon entrance and made available for harvest. Broodstock would be held in raceways for ripening, and 5,500,000 chinook salmon eggs would be taken for incubation. Sufficient rearing space would be provided in 24 raceways requiring up to 110 CFS. Smolts would be released as 15-gram yearlings.

In addition to the main production facilities, year-round housing for six permanent employees, a bunkhouse for ten seasonal

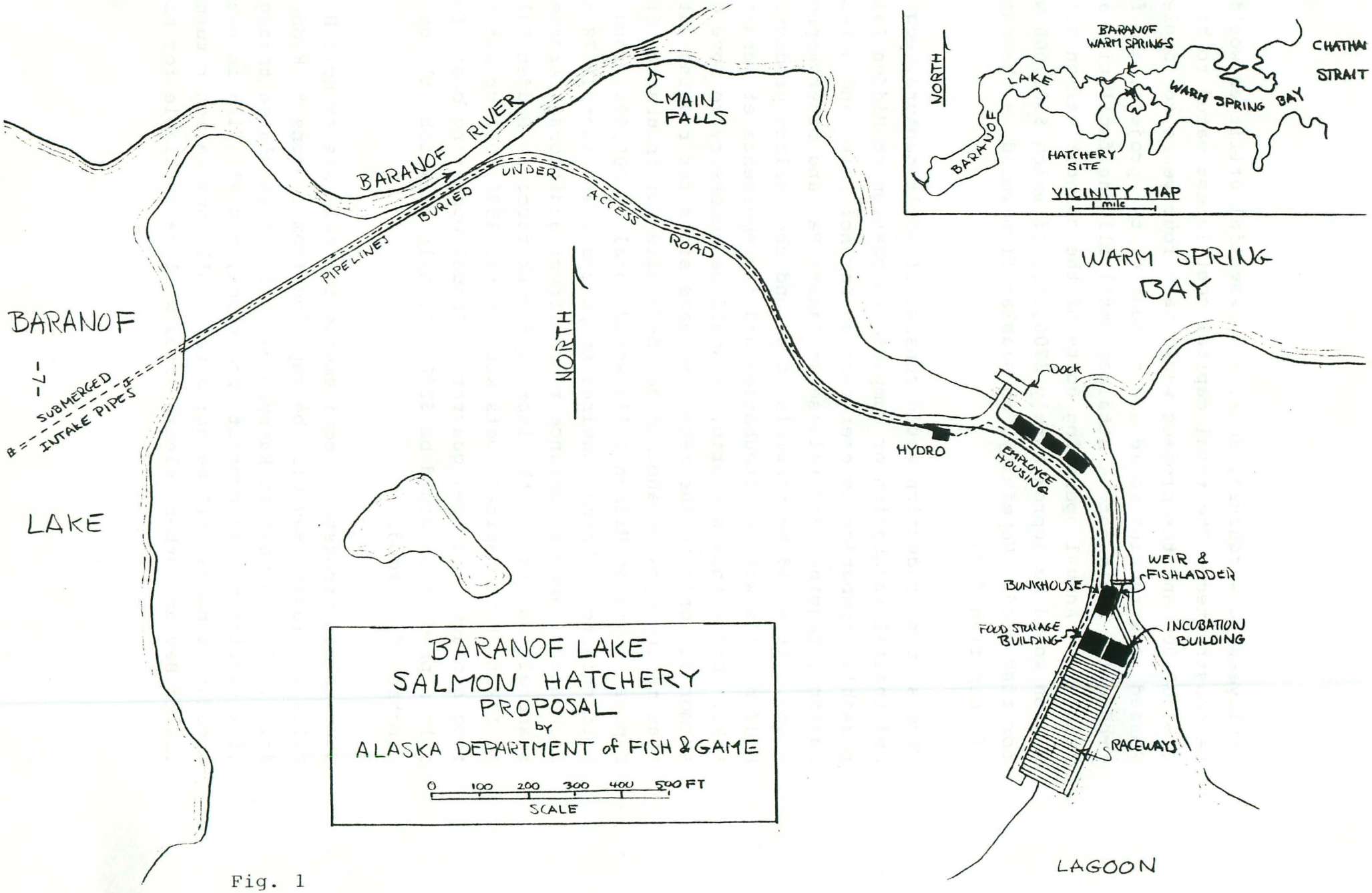
BARANOF RIVER
MAIN FALLS
BARANOF
LAKE
SUBMERGED INTAKE PIPES
PIPELINE
BURIED UNDER
ACCESS ROAD
NORTH
HYDRO
Dock
EMPLOYEE HOUSING
WARM SPRING BAY
WEIR & FISHLADDER
BUNKHOUSE
FOOD STORAGE BUILDING
INCUBATION BUILDING
RACEWAYS
LAGOON
NORTH
BARANOF WARM SPRINGS
CHATHAM STRAIT
LAKE
WARM SPRING BAY
BARANOF
HATCHERY SITE
VICINITY MAP
1 mile
BARANOF LAKE
SALMON HATCHERY
PROPOSAL
by
ALASKA DEPARTMENT of FISH & GAME
0 100 200 300 400 500 FT
SCALE

Fig. 1

employees, a warehouse, dock, and essential utilities would also be constructed. The total capital cost is estimated to be $18,500,000 and the project would take four years to complete. Phased construction would add to cost of the project, and full production could not be attained until all the facilities are complete. Annual operating costs of the chinook salmon production would be approximately $700,000, of which $300,000 will be for fish food. Hopefully, an Alaskan firm would be the supplier of this fish food.

Chum salmon production would consist of adult capture, egg take, and initial incubation or complete incubation at Hidden Falls, possible incubation to emergence at Baranof Lake, and net-pen rearing, tagging, and release at Takatz Bay and other appropriate sites. It would be possible to expand chum salmon production at Hidden Falls without incubation and fry emergence at Baranof Lake. Under this scenario, it would be necessary to move chum salmon fry only to the remote release sites for rearing rather than moving eggs to another hatchery site for incubation first. Capital costs at Hidden Falls would total $1,000,000, roughly half this total being required to purchase and install 78 new incubators, and the balance to construct additional permanent and seasonal housing for the increased work force at Hidden Falls. At Takatz Bay, capital costs would total $500,000 for net pens, food storage, and crew quarters. Annual operating costs for chum salmon production would be $250,000, half of which will go to purchase fish food.

Chum salmon broodstock requirements for releases at both Hidden Falls and Takatz Bay will be supplied from returns to Hidden Falls. The harvest in Kasnyku Bay will be regulated through use of a barrier net to protect broodstock, and all fish in excess of broodstock needs will be harvested. All chum salmon returning to Takatz Bay and other release sites will be available for harvest.

III. Fisheries Management Implications

Chinook Salmon

Chinook salmon produced at the Baranof Lake Hatchery are expected to contribute to traditional troll fisheries in much the same way as do chinook salmon from other hatcheries in the area. The extent of such contributions will depend primarily on the timing and duration of the summer troll season, although some stock-specific differences in the patterns of contribution may develop. In addition, immature chinook salmon from the Baranof Lake Hatchery are expected to rear in inside areas of northern southeast Alaska and, thus, will contribute to the traditional winter as well as to the summer troll fishery and the recreational fishery.

The area within three miles of the western shore of Chatham Strait, approximately five miles north and twenty-five miles south of Warm Spring Bay, has been suggested as a near-terminal harvest area for chinook salmon returning to the Baranof Lake Hatchery. Although it is not yet known how effective troll gear will be for harvest of returning adults in this near-terminal area, an excellent opportunity exists in lower Chatham Strait for such a harvest without a significant impact on Alaskan chinook salmon wild stocks.

Some opportunity may exist for troll harvest of returning chinook salmon inside Warm Spring Bay. However, it is anticipated that a short-net fishery will be necessary to harvest fish as they accumulate in the bay and before they deteriorate to the point of losing value. Opportunities for sport harvest of returning chinook salmon in the bay will be increased many fold.

Chum Salmon

Since all chum salmon fry produced at the Baranof Lake Hatchery will be released at remote sites, there will be no terminal harvest of returning chum salmon in Warm Spring Bay. Remote releases of chum salmon are necessary because a large-scale harvest of early summer chum salmon in Warm Spring Bay would intercept the chinook salmon adults needed for broodstock at the hatchery and conflict with other uses of the bay.

Since Hidden Falls Hatchery will provide chum salmon broodstock for the Baranof Lake Hatchery, the release of chum salmon at Takatz Bay will effectively extend the existing harvest area for returning adults from Kasnyku Bay south to and including Takatz Bay. Run timing and timing of the existing fishery are expected to be maintained. The magnitude of chum salmon returns to Kasnyku and Takatz Bays could approach 1.6 million fish annually, with the potential of doubling to tripling the number if marine net-pen facilities are completed at Hidden Falls to rear all chum salmon fry released there now.

Other locations for marine rearing and release of chum salmon fingerlings could be identified with the intention of further spreading the harvest by area and gear-type following a plan approved by the Board of Fisheries.

MEMORANDUM

State of Alaska

DEPARTMENT OF FISH AND GAME

TO: Recipients of Baranof Lake Hatchery Proposal

DATE: November 3, 1986

FILE NO.:

TELEPHONE NO.: 465-4100

SUBJECT: Revisions to Proposal

FROM: Don W. Collinsworth DWC
Commissioner
Alaska Department of Fish and Game

Some editorial revisions have been made to the introductory material on pages 3 and 4 of the draft "Proposal for Hatchery Development at Baranof Lake" you received last week. A copy of the revised draft, dated October 30, is enclosed.

These revisions were made to clarify the relationship between the U.S./Canada Pacific Salmon Treaty and the federal government's responsibility for funding mitigation of treaty impacts. In addition, the department's process for assessing potential mitigation projects is more clearly described in the revised section of the proposal.

The remainder of the plan for hatchery development at Baranof Lake is identical to the previous draft proposal, dated October 23.

Thank you.

Enclosure

PRELIMINARY COST/BENEFIT ANALYSIS

For A Proposed Hatchery at Baranof Warm Springs

A preliminary cost/benefit analysis has been prepared for the proposed enhancement project at Baranof Warm Springs. The purpose of the analysis is to estimate the potential value of using the site for a full scale chum and chinook hatchery. Results show that the present value of the Net Benefits are between $ 26 Million and $73.8 Million and a B:C ratio of respectively 1.8:1 and 3.3:1. Alternate use strategies which prevent the use of this site for a chinook/chum hatchery will require Net Benefits of approximately $26 to $74 million to be competitive.

ASSUMPTIONS USED IN THE ANALYSIS:

Optimistic price for Chums $0.49/lb
Pessimistic price for chums $0.34/lb.

Optimistic price for Chinook $2.47/lb
Pessimistic price for Chinook $1.73/lb.

Optimistic prices are averages for southeast region from 1981 to 1984.
Pessimistic prices are 0.7 (optimistic price).

Optimistic Fishing costs for the chum salmon are estimated to be "0".

Optimistic fishing costs for the chinook salmon are estimated to be "0".

Pessimistic fishing costs for the chum salmon are estimated to be 15% of gross exvessel revenue.

Pessimistic Fishing costs for the chinook salmon are estimated to be 30% of gross exvessel revenue. The majority of the chinook salmon production are assumed to be harvested in the troll fleet.

Real interest rate for analysis is at 3.0%.

SUMMARY OF COMMERCIAL HARVEST, BENEFITS, AND COSTS FOR A PROPOSED CHINOOK AND CHUM HATCHERY AT BARANOF WARM SPRINGS

YEAR	CALENDR YEAR	PRESENT VALUE FACTORS	KING COMM HARV HATCHERY SALMON 1000'S	KING GROSS REVENUE $1000'S	KING PRESENT VALUE GROSS REVENUE $1000'S	KING PV OF NET BENEFITS COMM FISHERY KING $1,000	CHUM COMM HARV HATCHERY SALMON 1000'S	CHUM GROSS REVENUE $1000'S	CHUM PRESENT VALUE GROSS REVENUE $1000'S	CHUM PV OF NET BENEFITS COMM FISHERY CHUM $1,000	(1986$'S) HATCHRY OPERATING COST $1,000'S	(1986$'S) HATCHERY CAPITAL COST $1,000'S	(1986$'S) TOTAL HATCHERY COST $1,000'S	PRESEN VALUE TOTAL COST $1,000'S
0	1986	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1100.00	1100.00	1100.00
1	1987	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	1800.00	1850.00	1796.12
2	1988	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	250.00	8500.00	8750.00	8247.71
3	1989	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	450.00	8600.00	9050.00	8282.03
4	1990	0.89	0.00	0.00	0.00	0.00	50.00	153.00	135.94	115.55	950.00	0.00	950.00	844.06
5	1991	0.86	0.00	0.00	0.00	0.00	800.00	2448.00	2111.67	1794.92	950.00	0.00	950.00	819.48
6	1992	0.84	0.00	0.00	0.00	0.00	1000.00	3060.00	2562.70	2178.30	950.00	0.00	950.00	795.61
7	1993	0.81	0.00	0.00	441.12	308.79	1000.00	3060.00	2488.06	2114.85	950.00	0.00	950.00	772.44
8	1994	0.79	19.60	542.53	1966.58	1376.60	1000.00	3060.00	2415.59	2053.25	950.00	0.00	950.00	749.94
9	1995	0.77	90.00	2491.20	2121.44	1485.01	1000.00	3060.00	2345.24	1993.45	950.00	0.00	950.00	728.10
10	1996	0.74	100.00	2768.00	2059.65	1441.76	1000.00	3060.00	2276.93	1935.39	950.00	0.00	950.00	706.89
11	1997	0.72	100.00	2768.00	1999.66	1399.76	1000.00	3060.00	2210.61	1879.02	950.00	0.00	950.00	686.30
12	1998	0.70	100.00	2768.00	1941.42	1358.99	1000.00	3060.00	2146.22	1824.29	950.00	0.00	950.00	666.31
13	1999	0.68	100.00	2768.00	1884.87	1319.41	1000.00	3060.00	2083.71	1771.15	950.00	0.00	950.00	646.90
14	2000	0.66	100.00	2768.00	1829.97	1280.98	1000.00	3060.00	2023.02	1719.57	950.00	0.00	950.00	628.06
15	2001	0.64	100.00	2768.00	1776.67	1243.67	1000.00	3060.00	1964.10	1669.48	950.00	0.00	950.00	609.77
16	2002	0.62	100.00	2768.00	1724.93	1207.45	1000.00	3060.00	1906.89	1620.86	950.00	0.00	950.00	592.01
17	2003	0.61	100.00	2768.00	1674.69	1172.28	1000.00	3060.00	1851.35	1573.65	950.00	0.00	950.00	574.77
18	2004	0.59	100.00	2768.00	1625.91	1138.14	1000.00	3060.00	1797.43	1527.81	950.00	0.00	950.00	558.02
19	2005	0.57	100.00	2768.00	1578.55	1104.99	1000.00	3060.00	1745.08	1483.31	950.00	0.00	950.00	541.77
20	2006	0.55	100.00	2768.00	1532.57	1072.80	1000.00	3060.00	1694.25	1440.11	950.00	0.00	950.00	525.99
21	2007	0.54	100.00	2768.00	1487.94	1041.56	1000.00	3060.00	1644.90	1398.17	950.00	0.00	950.00	510.66
22	2008	0.52	100.00	2768.00	1444.60	1011.22	1000.00	3060.00	1596.99	1357.44	950.00	0.00	950.00	495.80
23	2009	0.51	100.00	2768.00	1402.52	981.77	1000.00	3060.00	1550.48	1317.91	700.00	0.00	700.00	354.66
24	2010	0.49	100.00	2768.00	1361.67	953.17	1000.00	3060.00	1505.32	1279.52	0.00	0.00	0.00	0.00
25	2011	0.48	100.00	2768.00	1322.01	925.41	1000.00	3060.00	1461.47	1242.25	0.00	0.00	0.00	0.00
26	2012	0.46	80.00	2214.40	1026.81	718.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	2013	0.45	10.00	276.80	124.61	87.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		19.33	1799.60		32328.20	22629.74			41517.93	35290.24				32233.4

Present Value of Net Benefits
with fish harvesting costs

B private-Cprivate-Cpub	25686.54
(B private-Cprivate)/Cpub	1.80

Present Value of Net Benefits
assuming no fish harvesting costs

B private-Cprivate-Cpub	41612.69
(B private-Cprivate)/Cpub	2.29

SUMMARY OF COMMERCIAL HARVEST, BENEFITS, AND COSTS FOR A PROPOSED CHINOOK AND CHUM HATCHERY AT BARANOF WARM SPRINGS

YEAR	CALENDR YEAR	PRESENT VALUE FACTORS	KING COMM HARV HATCHERY SALMON 1000'S	KING GROSS REVENUE $1000'S	KING PRESENT VALUE GROSS REVENUE $1000'S	KING PV OF NET BENEFITS COMM FISHERY KING $1,000	CHUM COMM HARV HATCHERY SALMON 1000'S	CHUM GROSS REVENUE $1000'S	CHUM PRESENT VALUE GROSS REVENUE $1000'S	CHUM PV OF NET BENEFITS COMM FISHERY CHUM $1,000	(1986$'S) HATCHRY OPERATING COST $1,000'S	(1986$'S) HATCHERY CAPITAL COST $1,000'S	(1986$'S) TOTAL HATCHERY COST $1,000'S	PRESEN VALUE TOTAL COST $1,000'
0	1986	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1100.00	1100.00	1100.0
1	1987	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	1800.00	1850.00	1796.1
2	1988	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	250.00	8500.00	8750.00	8247.7
3	1989	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	450.00	8600.00	9050.00	8282.0
4	1990	0.89	0.00	0.00	0.00	0.00	50.00	220.50	195.91	166.52	950.00	0.00	950.00	844.0
5	1991	0.86	0.00	0.00	0.00	0.00	800.00	3528.00	3043.28	2586.79	950.00	0.00	950.00	819.4
6	1992	0.84	0.00	0.00	0.00	0.00	1000.00	4410.00	3693.31	3139.31	950.00	0.00	950.00	795.6
7	1993	0.81	0.00	0.00	629.81	440.87	1000.00	4410.00	3585.73	3047.87	950.00	0.00	950.00	772.4
8	1994	0.79	19.60	774.59	2807.77	1965.44	1000.00	4410.00	3481.29	2959.10	950.00	0.00	950.00	749.9
9	1995	0.77	90.00	3556.80	3028.88	2120.22	1000.00	4410.00	3379.90	2872.91	950.00	0.00	950.00	728.1
10	1996	0.74	100.00	3952.00	2940.66	2058.46	1000.00	4410.00	3281.45	2789.24	950.00	0.00	950.00	706.8
11	1997	0.72	100.00	3952.00	2855.01	1998.51	1000.00	4410.00	3185.88	2708.00	950.00	0.00	950.00	686.3
12	1998	0.70	100.00	3952.00	2771.85	1940.30	1000.00	4410.00	3093.09	2629.12	950.00	0.00	950.00	666.3
13	1999	0.68	100.00	3952.00	2691.12	1883.78	1000.00	4410.00	3003.00	2552.55	950.00	0.00	950.00	646.9
14	2000	0.66	100.00	3952.00	2612.74	1828.92	1000.00	4410.00	2915.53	2478.20	950.00	0.00	950.00	628.0
15	2001	0.64	100.00	3952.00	2536.64	1775.65	1000.00	4410.00	2830.61	2406.02	950.00	0.00	950.00	609.7
16	2002	0.62	100.00	3952.00	2462.76	1723.93	1000.00	4410.00	2748.17	2335.94	950.00	0.00	950.00	592.0
17	2003	0.61	100.00	3952.00	2391.02	1673.72	1000.00	4410.00	2668.12	2267.90	950.00	0.00	950.00	574.7
18	2004	0.59	100.00	3952.00	2321.38	1624.97	1000.00	4410.00	2590.41	2201.85	950.00	0.00	950.00	558.0
19	2005	0.57	100.00	3952.00	2253.77	1577.64	1000.00	4410.00	2514.96	2137.72	950.00	0.00	950.00	541.7
20	2006	0.55	100.00	3952.00	2188.13	1531.69	1000.00	4410.00	2441.71	2075.45	950.00	0.00	950.00	525.9
21	2007	0.54	100.00	3952.00	2124.39	1487.08	1000.00	4410.00	2370.59	2015.00	950.00	0.00	950.00	510.6
22	2008	0.52	100.00	3952.00	2062.52	1443.76	1000.00	4410.00	2301.55	1956.31	950.00	0.00	950.00	495.8
23	2009	0.51	100.00	3952.00	2002.45	1401.71	1000.00	4410.00	2234.51	1899.33	700.00	0.00	700.00	354.6
24	2010	0.49	100.00	3952.00	1944.12	1360.89	1000.00	4410.00	2169.43	1844.01	0.00	0.00	0.00	0.0
25	2011	0.48	100.00	3952.00	1887.50	1321.25	1000.00	4410.00	2106.24	1790.30	0.00	0.00	0.00	0.0
26	2012	0.46	80.00	3161.60	1466.02	1026.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
27	2013	0.45	10.00	395.20	177.91	124.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		19.33	1799.60		46156.45	32309.52			59834.67	50859.47				32233.4

Present Value of Net Benefits
with fish harvesting costs

B private-Cprivate-Cpub	50935.54
(B private-Cprivate)/Cpub	2.58

Present Value of Net Benefits
assuming no fish harvesting costs

B private-Cprivate-Cpub	73757.68
(B private-Cprivate)/Cpub	3.29