Columbia Basin System Planning

SALMON and STEELHEAD PRODUCTION PLAN

SALMON RIVER SUBBASIN

September 1, 1990

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Lead Agency: Idaho Department of Fish and Game
P.O. Box 25
Boise, Idaho 83707

Co-writers: Nez Perce Tribe of Idaho
P.O. Box 365
Lapwai, Idaho 83540

Shoshone-Bannock Tribes of Fort Hall
P.O. Box 306
Fort Hall, Idaho 83203

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<u>Table of Contents</u>

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Special recognition also goes to the individual writers from the various fish and wildlife agencies and Indian tribes who have spent countless hours writing and rewriting the plans.

The System Planning Group also wants to acknowledge Duane Anderson of the Northwest Power Planning Council's staff for his assistance and expertise in computer modeling. Eric Lowrance and Leroy Sanchez from the Bonneville Power Administration also deserve recognition for developing the useful salmon and steelhead distribution maps, which appear in many of the subbasin plans.

Last, but not least, the System Planning Group recognizes the members of the System Planning Oversight Committee and the Columbia Basin Fish and Wildlife Authority's Liaison Group for their guidance and assistance over the past several months.

INTRODUCTION

The Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program calls for long-term planning for salmon and steelhead production. In 1987, the council directed the region's fish and wildlife agencies, and Indian tribes to develop a systemwide plan consisting of 31 integrated subbasin plans for major river drainages in the Columbia Basin. The main goal of this planning process was to develop options or strategies for doubling salmon and steelhead production in the Columbia River. The strategies in the subbasin plans were to follow seven policies listed in the council's Columbia River Basin Fish and Wildlife Program (Appendix A), as well as several guidelines or policies developed by the basin's fisheries agencies and tribes.

This plan is one of the 31 subbasin plans that comprise the system planning effort. All 31 subbasin plans have been developed under the auspices of the Columbia Basin Fish and Wildlife Authority, with formal public input, and involvement from technical groups representative of the various management entities in each subbasin. The basin's agencies and tribes have used these subbasin plans to develop the Integrated System Plan, submitted to the Power Planning Council in late 1990. The system plan will guide the adoption of future salmon and steelhead enhancement projects under the Northwest Power Planning Council's Columbia Basin Fish and Wildlife Program.

In addition to providing the basis for salmon and steelhead production strategies in the system plan, the subbasin plans attempt to document current and potential production. The plans also summarize the agencies' and tribes' management goals and objectives; document current management efforts; identify problems and opportunities associated with increasing salmon and steelhead numbers; and present preferred and alternative management strategies.

The subbasin plans are dynamic plans. The agencies and tribes have designed the management strategies to produce information that will allow managers to adapt strategies in the future, ensuring that basic resource and management objectives are best addressed. Furthermore, the Northwest Power Planning Council has called for a long-term monitoring and evaluation program to ensure projects or strategies implemented through the system planning process are methodically reviewed and updated.

It is important to note that nothing in this plan shall be construed as altering, limiting, or affecting the jurisdiction, authority, rights or responsibilities of the United States, individual states, or Indian tribes with respect to fish, wildlife, land and water management.

The Salmon River Subbasin Plan was a cooperative effort among the Idaho Department of Fish and Game (IDFG), the Nez Perce Tribe and the Shoshone-Bannock Tribes. This plan is a consensus document among these three participants.

The Technical Work Team met during the planning process to generate background information, review and critique drafts, and offer ideas and suggestions concerning anadromous production. strategies. In addition to members of the IDFG, Nez Perce Tribe and Shoshone-Bannock Tribes, the Technical Work Team included the following representatives.

U.S. Forest Service
John Andrews
Bruce Smith
John Lloyd
Rick Stowell
Dave Burns

U.S. Fish and Wildlife Service
Dan Herrig
Bill Miller
Walt Ray

Bureau of Land Management
Craig Johnson
Lyle Lewis

Idaho Power Company
Larry Wimer

University of Idaho
Ted Bjornn

Environmental Protection Agency
Don Martin

Idaho Department of Water Resources
Bill Graham

Idaho Department of Health and Welfare
Steve Bauer

System planners in Idaho held public meetings in the fall of 1988 to ascertain issues to be addressed by subbasin and system planning. The Nez Perce Tribe held tribal meetings at Lapwai, Kamiah and Orofino, while the Shoshone-Bannock Tribes conducted meetings at Fort Hall. The Idaho Department of Fish and Game conducted general public meetings in Lewiston, Grangeville, McCall, Boise, Salmon, Pocatello and Twin Falls. Public advisory committees were also formed to help develop utilization objectives and strategies. The advisory committees met through the spring of 1989 in Lewiston, Grangeville, Pocatello, Boise, Salmon and Twin Falls. Public Advisory Committee members are listed below. An informational newsletter, sponsored by the Idaho Department of Fish and Game, informed a wide range of publics and agencies about the planning progress.

Public input from all of these sources was a major consideration in the development of objectives and strategies for increased fish production.

Members of the Public Advisory Committee were:

Herb Meyr	Dan Magers
Steve Settles	Gary Willis
Steve Pierson	Dennis Creek
Louis Strahler	Rusty Gore
Mickey Turnbow	Janet Toliver
Warren Hostetler	Mitch Sanchotena
Bill Russell	Jerry Myers
Ed Link	Bruce McFarland
Ron Bloxham	Doug Leaton
Hadley Roberts	Ed Hall
Mick Gerhardt	Andy Hibbs
John Kelly	Larry Coonts
Ron Grant	Virgil Cromer
Mike Satterwaite	Lee Neer
John Patterson	Bill Chetwood
Frank Dammarell	Con Gilmore
Gary Busch	Tim Crist
Bruce Lium	Robert Hendricks
Gary Shepherd	Eddie Lewis
Allen Eng	Lane Hansen
Robert Butler	Thayne Huntsman

PART I. DESCRIPTION OF SUBBASIN

Location and General Environment

The Salmon River (EPA Reach 170602) flows 410 miles north and west through central Idaho to join the Snake River at River Mile (RM) 188. The Salmon River is the largest subbasin in the Columbia River drainage, excluding the Snake River, and has the most stream miles of habitat available to anadromous fish. The total watershed is just over 14,000 square miles. Major tributaries include the Little Salmon River, South Fork Salmon River, Middle Fork Salmon River, Panther Creek, Lemhi River, Pahsimeroi River and East Fork Salmon River (Table 1).

Table 1. Major tributaries of the Salmon River.

Tributary	River Mile*	Drainage (sq. mi.)
Little Salmon River	87	584
South Fork	134	1311
Middle Fork	199	2886
Panther Creek	210	532
Lemhi River	259	1269
Pahsimeroi River	304	835
East Fork	343	545

* Above mouth of Salmon River.

The subbasin straddles two physiographic provinces. The Northern Rocky Mountain Province encompasses 90 percent of the subbasin and is characterized by high, mature mountains and deep, intermontane valleys. The western tenth of the drainage lies within the Columbia Intermontane Province, which includes an mountainous mass cut by deep canyons, and a gently undulating plateau 3,000 feet to 5,000 feet in elevation and underlain by Columbia River basalt flows. Elevation ranges from 900 feet mean sea level (msl) at the mouth of the Salmon to 12,662 feet msl at Mount Borah.

Climate in the subbasin is strongly affected by both Pacific Maritime and Western Desert weather. The prevailing westerly winds from the coast make for cool, moist winters. In the summer, continental climate predominates and hot dry conditions result. Mean temperatures in January range from 19 degrees Fahrenheit to 35 F and in July from 64 F to 76 F. Precipitation varies from an annual mean of 7 inches at Challis in Custer County to 31 inches at Dixie in south central Idaho County (NWS 1982). Over half the precipitation in the subbasin falls in the form of snow.

The dominant geologic feature in the subbasin is the Idaho Batholith. The batholith is comprised of granitic bedrock materials that have high natural rates of erosion. Major soil orders within the drainage are mollisols, inceptisols and aridisols.

Riparian conditions range from poor, such as in areas of the Lemhi drainage, to excellent in much of the Middle Fork drainage. Major impacts on riparian areas in the subbasin are livestock grazing, road construction, logging and mining.

The dominant vegetation in the Salmon River Subbasin is coniferous forest of grand fir (Abies srandis), subalpine fir (Abies lasiocarpa), western red cedar (Thuja plicata), Engelmann spruce (Picea enselmannii), Douglas fir (Pseudotsuaa menziesii), ponderosa pine (Pinus aonderosa), limber pine (Pinus flexilis) and lodgepole pine (Pinus contorta). The western part of the subbasin, from Riggins downstream, is an open grassland of bunchgrass. In the Lemhi and Pahsimeroi areas, including the mainstem Salmon River, sagebrush (Artemisia sp.) predominates.

No major barriers exist on the Salmon River and its tributaries. Partial barriers to anadromous fish exist on Panther Creek in the form of acid mine drainage, and on the Lemhi, Pahsimeroi and upper mainstem Salmon rivers as water diversions for irrigation. Twenty minor tributaries contain dams that are used for numerous purposes such as irrigation, recreation and fish propagation.

Water Resources

On the whole, water quality and substrate quality, as it relates to spawning and rearing habitat, is good to excellent (Table 2). Problems do exist in Panther Creek as acid mine drainage affects anadromous stocks. Sediment deposition degrades portions of the South Fork Salmon River and Bear Valley Creek in the Middle Fork Salmon River.

Table 2. Water quality information from various stations in the Salmon River subbasin. Values are median values. Measurements for minerals, nutrients, and trace elements are available for all stations (Fall - September, October, November; Uinter - December, January, February; Spring - March, April, May; Summer - - June, July, August).

Stream (reach number)	Location Near	Season	pH	Temp. F	DO(mg/l)	Specific Conductance (micromhos)	Turbidity	Years of Sample
Salmon River	Uhite Bird	F	8.2	46.4	11.4	177	1.7 NTU	77-86
(13317000) (1) *		W	8.1	34.7	13.8	174	2.0 JTU	77-86
		SP	8.0	48.2	11.2	92	5.9 NTU	77-86
		su	8.1	65.8	8.9	122	1.5 NTU	77-86
Salmon River	Challis	F	7.7**	57.7	---	159**	6 JTU	71,72
(13-2985.00) (3)		SP	7.6**	46.0	---	96**	36 JTU	71,72
		su	7.5**	50.5	---	87**	43 JTU	71,72
Little Salmon R.	New Meadows	F	8.0	47.3	10.5	85	5.0 FTU	76,80-83
(2040083) (2)		U	7.5	39.2	12.0	60	5.0 FTU	81-83
		SP	7.9	47.3	10.1	48	7.3 FTU	81-83
		su	7.3	64.4	7.2	130	3.5 FTU	81-83
South Fork	Krassel	F	7.6	46.6	---	56	---	77-81
(13310700) (1)	Ranger	W	---	32.9	---	59	---	78-81
	Station	SP	7.6	42.8	---	32	---	77-81
		su	7.1	59.0	---	39	---	77-79,81
Middle Fork	Yellow	F	8.0	38.3	---	100	---	77,79-81
(13309220) (1)	Pine	W	6.2	32.9	---	97	---	77,79-81
		SP	8.4	39.2	---	94	---	77,79,81
		su	7.6	55.4	---	82	---	77,79,81
Lemhi River	Lemhi	F	8.5	51.8	---	477	---	77-81
(13305000) (1)		W	---	32.9	---	375	---	77-81
		SP	8.7	45.5	---	359	---	77-81
		su	7.9	53.6	---	373	---	77-81
East Fork	mouth	F	7.7**	44.6	---	197**	6 JTU	71,72
(13-2980.00) (3)		SP	7.1**	43.7	---	135**	40 JTU	72
		su	7.5**	45.5	---	125**	47 JTU	71,72

* Turbidity measured 1977-1981 only.

** Lab measurements.

(1) U.S. Geological Survey (1977-1986)

(2) IDHW (personal communication)

(3) Emmett (1975)

Flows are adequate for anadromous fish throughout most of the subbasin (Table 3). Typical flow patterns in the Salmon River Subbasin are low flows of about half the average annual flow from August to March. Peak flows are in May and June at three to four times the average annual flow (Heitz et al. 1980).

Major water withdrawal in the subbasin is for agricultural use, primarily irrigation (Table 4). Irrigation usage is most common in the Little Salmon, Lemhi, Pahsimeroi, upper Salmon, and headwater areas. Dewatering due to irrigation demands can be a significant problem in these drainages.

Land Use

The vast majority of land in the Salmon River Subbasin is in the public domain (Table 5). The U.S. Forest Service is by far the largest landholder with almost 80 percent of the area within six national forests. Private property amounts to only 8 percent of the total area, yet private ownership controls essential water rights.

Major land use within the subbasin is for forestry, recreation, wilderness, agriculture and grazing. Some mining and residential development also exist. Of the few towns within the anadromous portion of the subbasin, none has a population over 4,000 people. All of the mainstem Middle Fork, 125 miles of the mainstem Salmon River and 24 miles of Rapid River are part of the national Wild and Scenic Rivers System. Under study for inclusion into this system are the South Fork Salmon River, Secesh River, French Creek, Big Creek, Monumental Creek, East Fork Salmon River, and an additional portion of the mainstem Salmon.

Much of the Salmon River is still undeveloped. The largest tract of wilderness in the lower 48 states, the 3,690-square-mile Frank Church-River of No Return Wilderness, lies within the subbasin. The majority of the Sawtooth National Recreation Area and Sawtooth Wilderness are located in the subbasin. Most all of these areas are anadromous fish habitat.

A great potential for hydropower exists on the Salmon River. Less than 15 small hydropower facilities are currently operating within the area. A total of 43 other projects are at various stages in the licensing process.

Table 3. Mean flows in the Salmon River subbasin.

Stream	Location	Per. of rec. (1)	River miles (2)	Mean monthly discharge (CFS) (3)												Mean annual flow (CFS) (4)
				J	F	M	A	M	J	J	A	S	O	N	D	
Salmon River																11397
	Whitebird	1910-88	53.5	4207	4468	5470	11610	32268	39490	14006	5483	4520	4880	4979	4501	
	Salmon	1913-88	258.9	1081	1096	1133	1652	4054	5869	2806	1264	1117	1287	1316	1158	
Little Salmon River				---	---	---	---	---	---	---	---	---	---	---	---	508
South Fork				---	---	---	---	---	---	---	---	---	---	---	---	2027
Middle Fork				---	---	---	---	---	---	---	---	---	---	---	---	3284
Panther Creek	Shoup	1945-77	1.0	83	132	91	193	776	1003	317	139	111	109	99	90	234
Lemhi River				---	---	---	---	---	---	---	---	---	---	---	---	297
Pahsimeroi River	May	1930-72	0.3	244	246	255	215	133	182	159	156	189	247	281	264	215
East Fork				---	---	---	---	---	---	---	---	---	---	---	---	259

(1) period of record
(2) Above mouth of river
(3) U.S. Geological Survey (personal communication)
(4) Heitz et al. (1980)

Table 4. Water usage in the Salmon River Subbasin (IDWR, pers. commun.).

Stream	Usage in million gallons/day					
	Agricultural	Commercial	Industrial	Domestic	Mining	Total
Little Salmon River	72.83	0.00	0.00	0.00*	0.00	72.83
South Fork	0.00	0.00	0.00	0.02*	0.00	0.02
Middle Fork	0.00	0.00	0.00	0.00	0.00	0.00
Lemhi River	545.88	0.00*	0.00	0.00*	0.00	545.88
Pahsimeroi River	112.31	0.00	0.00	0.00	0.00	112.31
Salmon River mainstem & other tributaries	255.51	**	0.00	2.50*	0.98	258.99
Total	986.53	0.00	0.00	2.52	0.98	990.03

* Estimated.
** Data not available to estimate commercial use, but is included as a part of domestic usage.

Table 5. Land ownership within the Salmon River Subbasin.

Area	State (%)	BLM (%)	USFS (%)	Private (%)
Little Salmon River	3.9	5.3	67.8	23.0
South Fork	1.6	0.2	97.7	0.5
Middle Fork	0.4	0.0	99.1	0.5
Panther Creek	0.0	0.0	99.2	0.8
Lemhi River	3.1	34.9	46.2	15.8
Pahsimeroi River	2.9	42.7	46.0	8.4
East Fork	2.9	35.0	60.1	2.0
Salmon River mainstem & other tribs	1.5	9.5	77.1	11.9
Total for Subbasin	1.6	11.4	78.9	8.1

PART II. HABITAT PROTECTION NEEDS

History and Status of Habitat

Description of Habitat

The natural fish production potential of a subbasin primarily depends upon the watershed's characteristics. Each geomorphic process develops its own characteristic assemblage of landforms as it shapes the landscape and its streams. Ninety-five percent of all landforms are sculptured by streams; landform and stream development inevitably occur together. Streams are controlled by the watershed they help build, and the watershed exercises its control over the streams by dictating or influencing physical and chemical conditions that, in turn, help determine the character of the aquatic environment (Platts 1974).

As pointed out in the subbasin description, the Idaho Batholith is the dominant geologic feature of the Salmon. A batholith is an area of land comprised of granitic bedrock materials. This one covers about 16,000 square miles in central Idaho and western Montana (Fig. 1). Typical batholith topography consists of steep slopes separated by narrow ridges and valleys or high elevation basins. Soil cohesion is low because silt and clay comprise small percentages of the soil (Megahan 1975). Soils are thus composed largely of unstable granitic sand and are coarse and have high natural rates of erosion (USFS 1988). This is an important point because the combination of steep topography, extreme soil erodibility, and climatic stresses create significant erosion hazards (Megahan 1975).

Furthermore, the flatter areas, such as meadows, in the batholith are extremely vulnerable to sedimentation because the sediment transport power is low in low-gradient stream sections. Any activity that disturbs the soil or disrupts vegetative cover has the potential to increase the amounts of fine sediments being transported by runoff into streams. Fine sediment reduces production of anadromous fish by filling the interstices in gravels, which 1) smothers incubating eggs and fry; 2) reduces production of aquatic insects, which provide most of the food for juvenile anadromous fish; and 3) eliminates spaces between rocks, which juveniles use for rearing and overwintering. Sediments also fill pools that are important rearing habitats for juvenile salmon and steelhead (IDFG 1985). Waters draining from the batholith are generally low in minerals because of the dominant granitic bedrock in the watershed.

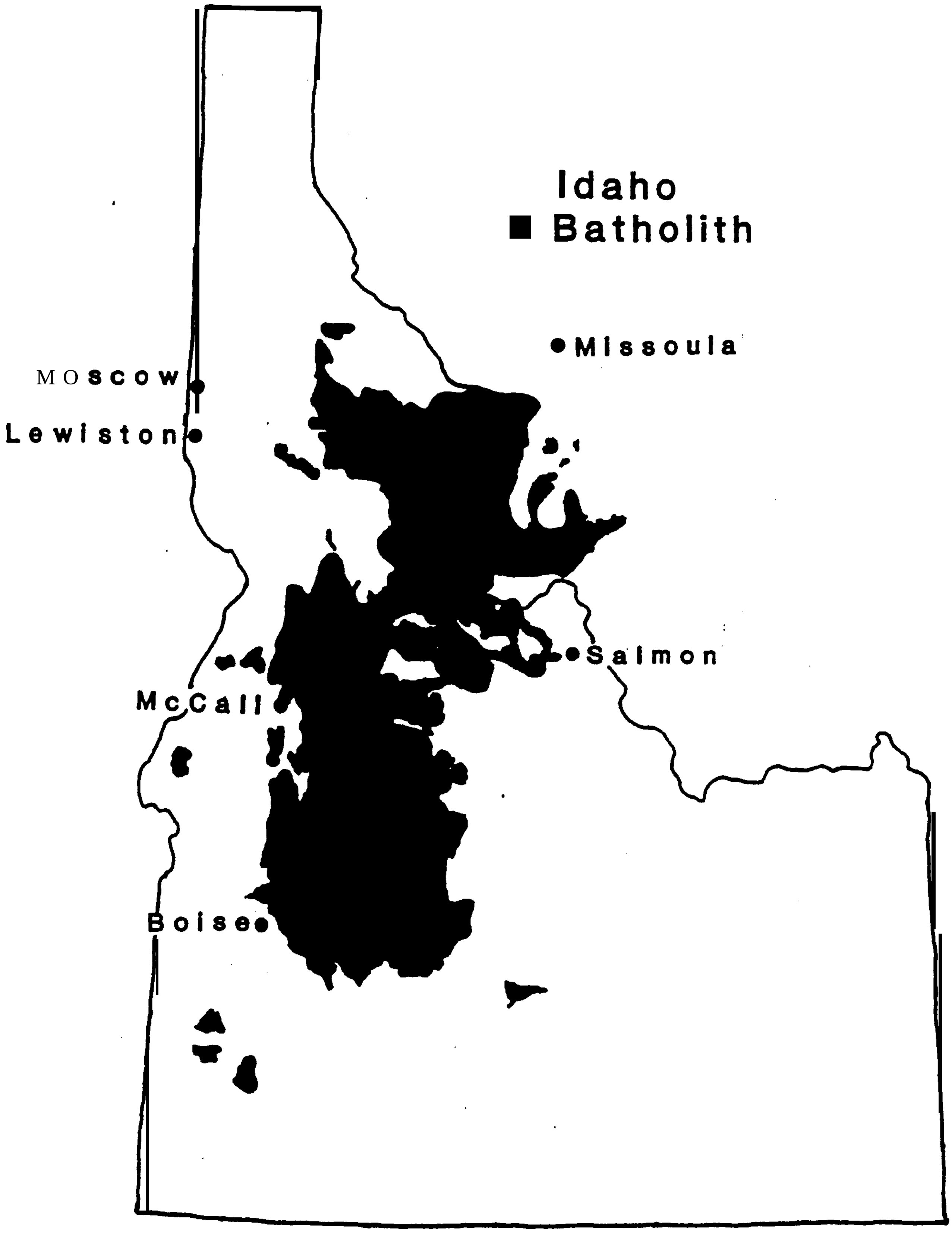


Figure 1. Location of the Idaho Batholith. From: Platts 1974.

Climate is another important feature of the Salmon River Subbasin. Large seasonal storm systems and local topography play major roles. A large low pressure system that dominates the weather from about November to April causes the area's cool, moist winters. A major high pressure system generally follows and results in a hot, relatively dry period from July through September. Mountain barriers to the west in Oregon claim most of the eastward moving summer precipitation before it reaches Idaho. Other local topographic features serve to shadow and channel the precipitation and other climatic conditions (USDA-FS 1988).

Occasionally, lengthy frontal rain storms can produce as much as 10 inches of precipitation and are a critical factor in flooding and landslides during winter and spring (Platts 1974). Some areas are snow covered for more than eight months of the year while other areas receive only minor amounts. Above 4,000 feet, most of the annual precipitation occurs as snow with maximum accumulation occurring around April 1. The annual precipitation of the Payette National Forest, for example, varies from 12 inches at lower elevations to over 60 inches in the high country. Fifty percent to 75 percent of the precipitation becomes streamflow, with the remainder either recharging groundwater, evaporating, or being used by plants.

Most of the precipitation occurs as snowpack. When snowpack is low, anadromous fish in irrigated portions of the subbasin are impacted by stream dewatering and elevated summer temperatures. However, the most severe impacts of low runoff occur with smolt migration mortalities in the Snake and Columbia rivers. Peak streamflows occur during the April to June snowmelt. At higher elevations, the frost-free period may last less than 30 days and winter temperatures can drop to minus 40 degrees Fahrenheit. At lower elevations, the frost-free period may last up to 180 days and summer temperatures can reach 120 F (USDA-FS 1988).

In pristine streams, potential smolt production of anadromous fish can be limited by natural stream characteristics such as channel morphology, gradient, substrate and temperature. Low-gradient, meandering streams in flat basins and valleys tend to aggrade or accumulate the naturally transported sand and gravel (Rosgen 1985). Much of the transported sand is deposited along the streamside and stabilized by riparian vegetation. In undisturbed drainages, these streams provide abundant, excellent spawning habitats for steelhead and chinook. Steeper stream channels in confined valleys tend to transport sand and gravel and characteristically have substrates dominated by larger materials such as rubble and boulders. Spawning habitats tend to be more scattered in these channels, although little evidence suggests the amount of spawning gravel limits anadromous fish in the Salmon Subbasin;

Steelhead and chinook show preferences for different types of habitat for summer rearing. Potential production of steelhead parr appears to be greater in the confined stream channels (Thurow 1983, Petrosky and Holubetz 1988), which characteristically have steeper gradients, higher velocities, and larger substrates. Conversely, chinook juveniles rear in greater densities in low-gradient, meandering streams. Most anadromous production areas in the Salmon Subbasin contain a mix of these two basic channel types. When rating a stream for its potential production of salmon and steelhead, system planners took into account the channel morphology and the degree of degradation from land management or other sources.

In undeveloped drainages of the Salmon River Subbasin, few problems exist with low streamflow or high summer temperatures. The granitic soils of the batholith release water gradually, moderating flow regimes and maximum temperatures. Water use, however, has created temperature and flow problems in several tributaries of the subbasin. The mainstem Salmon River below the Pahsimeroi River is too warm for anadromous fish spawning and rearing. Reingold (1970) believed that the mainstem probably reared anadromous fish for its entire length before modern man's use of the river and land. Water quality is good throughout most of the subbasin. In some isolated areas, turbidity exists due to natural factors or mining.

Past and Present Land Use

Timber resources are present in the subbasin and logging occurs throughout, except in the Middle Fork. Logging activities have impacted several areas and the severity of impact varies widely. Road construction, usage, and the associated logging activities have increased sedimentation, and riparian degradation and alteration. The South Fork drainage is testament to the magnitude of damage that can occur, particularly in areas with extremely unstable soils. Sedimentation from human activities is probably the single, most important factor contributing to degraded habitat in the Salmon Subbasin, particularly within the batholith (Stowell et al. 1983). Excessive sedimentation can reduce egg-to-fry survival rates substantially.

Grazing is another problem encountered throughout the subbasin. Platts and Nelson (1985) have studied the long-term effects of grazing on fish habitat in batholith streams of the Salmon Subbasin. Most of the current, popular grazing strategies were developed primarily to increase the production and vigor of upland grasses, not to improve riparian vegetation. Thus, land users have not achieved a balance between use of riparian areas and upland areas. Evaluation of range conditions in upland vegetation may show a positive result due to moderate grazing over most of the allotment, whereas conditions in the streamside corridors may be precisely the opposite due to heavy to severe grazing pressure (Platts and Nelson 1985). Several studies have documented damage to the riparian area and the stream channel because of livestock use. OEA (1987) documented reductions in streambank stability and increased levels of **instream** sediment with the type and intensity of grazing in the upper Middle Fork and headwaters of the Salmon River. Grazing can affect the riparian environment by'changing, reducing, or eliminating vegetation and by actually eliminating riparian areas by widening the channel, aggrading the channel, or lowering the water table (Platts 1981). These, in turn, alter streamflow, water temperature, sediment transport, and water quality. Of the various effects, Platts (1981) feels that the sloughing-off and collapse of streambanks may be the most detrimental to the health and survival of fish. He indicates that a commonly used grazing strategy compatible with the requirements of all stream-dwelling fish has not been identified. However, it does appear that degrees of protection can be gained from a combination of strategies, careful management, and monitoring.

Mining, though no longer as major a land use as it was historically, is still very prevalent in parts of the Salmon River Subbasin. Impacts from mining can be severe due to alterations in substrate composition, channel displacement, bank and riparian destruction, and loss of **instream** cover and **pool-**forming structures. All of these impacts are typical of large scale dredging and occur with other types of mining. Often natural stream channels, which are necessary for spawning and rearing, are destroyed by dredge mining, as documented in the Yankee Fork, East Fork of the South Fork, and Bear Valley Creek. Furthermore, heavy metal pollution from mine wastes and drainage can eliminate all aquatic life and even block access to valuable habitat, as is the case in Panther Creek. The transport of toxic materials associated with mining along river roads, particularly in the South Fork drainage, risks killing fish, even though stringent precautions may be in place.

With increased energy costs and laws that encourage the development of small hydropower projects, the number of proposed hydropower projects are increasing, particularly in the Lower Salmon and the Salmon canyon areas. As with large-scale hydropower projects, these can impact fisheries through turbine injuries and migration blockage. The cumulative impacts of construction and operation of many small projects could substantially limit the production of a drainage.

In its Anadromous Fisheries Management Plan, the Idaho Department of Fish and Game proposed a number of streams that should not be considered for future hydroelectric or water development (Table 6). All of these streams, as well as several others, including the **mainstem** Salmon River and much of the **mainstem** Lemhi River, have been addressed in the "protected **areas"** amendment to the Northwest Power Planning Council's

Columbia River Basin Fish and Wildlife Program, The amendment designates stream reaches throughout the Columbia River Basin that should be protected from future hydroelectric development because of their importance as critical fish and wildlife habitat. While the council does not license hydroelectric projects, the Northwest Power Act of 1980 requires the Federal Energy Regulatory Commission (FERC) to take the council's fish and wildlife program into account during its licensing decisions on projects within the Columbia River Basin. The protected areas policy does not apply to existing hydropower dams, the relicensing of existing dams, modifications to existing dams, or addition of generation facilities to dams that currently do not have hydropower (NPPC 1988). Protected areas designation is to be taken into account to the fullest extent, but FERC may be obligated to complete the licensing process on these applications.

Table 6. Idaho's Salmon River Subbasin streams that should not be considered for future hydroelectric or water development (IDFG 1985).

SALMON RIVER TRIBUTARIES
1. Whitebird Creek
2. Slate Creek
3. Little Salmon River
Rapid River
4. Wind River
5. Sheep Creek
6. South Fork Salmon River and Tributaries
7. Johnson Creek
8. Five Mile Creek
9. Bargamin Creek
10. Sabe Creek
11. Chamberlain Creek
12. Horse Creek
13. Middle Fork and Salmon River and Tributaries
14. Panther Creek and Tributaries
15. East Fork Salmon River and Tributaries
16. Warm Springs Creek
17. Yankee Fork
18. Valley Creek
19. Red Fish Lake Creek
20. Alturas Lake Creek
21. Pole Creek

The diversion of water,' primarily for agricultural use, also has a major impact in developed portions of the subbasin, most notably in the Lemhi and Pahsimeroi drainages and in the mainstem and several tributaries of the Salmon River. Although many diversions are screened, several need repair and upgrading. A major problem is localized stream dewatering. Diversions dewater spawning and rearing areas, block the upstream migration of adults, and strand juveniles migrating downstream. According to Murphy (1988), stream alteration permits are issued for non-agricultural diversions or temporary dams, but no process is in place for regulating diversions for agricultural uses. In addition to water diversions, numerous small pumping operations for private use are spread throughout the subbasin. Impacts of water withdrawals on fish production are greatest during the summer when streamflows are critically low.

The effect of residential and commercial land and water use is relatively small in the Salmon Subbasin. Problems develop from encroachment into riparian areas and stream alterations to protect private property from flooding without regard to fisheries resources. This has been a major factor in the Lemhi drainage. Recreational activities also have the potential for impacting fish production, particularly through degradation of riparian areas in localized areas where use is heavy, such as in the Middle Fork and the Sawtooth National Recreation Area. This potential, however, is relatively minor compared to grazing impacts. Currently, permit systems limit use of some areas. An increased emphasis on the education of river users and more comprehensive enforcement by regulatory agencies will help alleviate local problems.

Because of the enormity (just over 14,000 square miles) of the Salmon River Subbasin, planners have divided it into sections for the following description of habitat, land use and problems related to fish production.

1) Lower Salmon River (Mouth to French Creek, including Little Salmon River)

The lower mainstem of the Salmon River flows through a deep, rocky canyon. The river is characterized by a series of deep pools separated by rocky rapids. It serves as a migration corridor and a wintering area to anadromous fish because of warm summer temperatures. The tributary drainages are mostly high gradient in deep canyons with very unstable soils. The area's geology is mostly decomposed granite with many slides and faults.

Production areas for this section lie within both "managed" and pristine watersheds. Logging and road building on unstable lands has caused severe siltation and instability in important tributaries, notably in the Slate Creek and Little Salmon River areas. U.S. Forest Service land management plans include intense logging and road construction in French Creek, which currently has excellent'steelhead habitat. Ranching and livestock use has degraded riparian areas and water quality in the Little Salmon River and has contributed to siltation throughout this drainage. The high gradient of tributary streams creates attractive sites for small hydropower projects and in recent years, prior to the Columbia River Basin Fish and Wildlife Program's protected areas amendment, development of small hydroelectric generating facilities threatened to reduce or eliminate production in virtually every tributary (IDFG 1985). Dredge and placer mining has also impacted the area and continues to cause turbidity and siltation.

Whitebird Creek, a major tributary in this section, enters the Salmon River at RM 53.8. The drainage contains about 27 miles of available and potential anadromous fish spawning waters (Mallet 1974). Most of this drainage is located in the border zone of the Columbia River basalt flow: extrusive flows of the batholith are present in portions of headwaters. The lower portion of drainage is too low to support forest, however, the upper watershed contains large stands of ponderosa pine interspersed with spruce along streambanks. Whitebird Creek has a moderate channel gradient. Tributaries are steep-gradient in the lower portions and moderate at the meadow-like sources. Lands in lower reaches are used for hay and grain production, and cattle production. A valuable resource is the large stands of timber in the headwaters. Logging has disturbed some sections of the streambed and has accelerated gravel and sediment flows. Cottonwood trees and various brush species such as ha&berry, willow, and alder, which border streambanks, help stabilize the stream channel.

Slate Creek enters the Salmon River at RM 66. This watershed ranges from 1,560 feet at the mouth to over 6,000 feet. The lower terrain is semiarid; the annual precipitation is light and irrigation is necessary. The sides of the main canyons are very steep. South facing slopes in the lower drainage are usually barren except for scant herbaceous growth. Northern slopes are heavily brushed or covered with scattered stands of timber that are denser in the headwaters. Hillside erosion is acute in the Slate Creek drainage. The drainage also has several diversion ditches.

The Little Salmon River, 43 miles long, enters the main Salmon at RM 82. Its lower 24 miles follow a steep gradient. Much of its lower 34 miles has been altered by erosive floods and channel changes made by the state Highway Department. The Little Salmon River above Hazard Creek is currently blocked to anadromous fish migration due to a series of rock falls. The removal of barriers to allow passage to the upper Little Salmon River and upper Hard Creek is an amendment to the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife

Program, but is on hold pending the completion of subbasin planning. The removal of the Little Salmon River barrier would make available 89 miles of habitat. Passage improvement at Hard Creek Falls would open four miles of stream. Anadromous fish habitat in Hard Creek and tributaries to the Little Salmon River above the barriers is in good to excellent condition, whereas habitat in the mainstem Little Salmon River above the falls has been degraded by livestock grazing and irrigation withdrawals between the falls and the town of New Meadows. These impacts have increased sedimentation, removed riparian vegetation, and destabilized streambanks.

Rapid River, the major tributary of the Little Salmon River, runs for 21 miles. Mostly a pristine drainage, natural occurrences such as mass failure of hillsides, stream channel scouring, and localized flash flooding continue to shape its land features. Rapid River is part of the national Wild and Scenic Rivers System. Only the lower two miles is accessible by road. The upper end of Rapid River is roadless, but has not received wilderness recommendations in the forest plan. Most of the West Fork of Rapid River is blocked by a natural falls.

Another important tributary in the Little Salmon drainage is Boulder Creek. It is currently undergoing road construction and heavy logging in previously unaccessed sites (C. Petrosky, IDFG, pers. commun.).

2) Salmon River Canyon (French Creek to Middle Fork)

Here the main Salmon River flows through a deep canyon, forming a series of deep pools separated by rapids and runs. In this reach, which is primarily roadless and wilderness, the mainstem Salmon is a migration corridor and wintering area for anadromous fish due to high summer temperatures. Activities such as ranching, logging, and mining in steep, unstable drainages have caused some siltation, streambank degradation, and riparian alteration in some of the lower tributaries. Many of the smaller tributaries have steep gradients with migration blocks at their mouths. Reingold (1970) reported that over 90 percent of the 108 named tributaries in the Salmon River Canyon between Corn Creek and Vinegar Creek are small, steep, intermittent streams with little fishery value. Wilderness classification has protected most of the area from the South Fork to the Middle Fork, thus it has remained in pristine condition. However, the high gradient of tributary streams in this area creates attractive sites for small hydropower projects, which could threaten the natural production potential.

Chamberlain Creek enters the Salmon River at RM 168. This drainage is one of the largest between the South Fork and the Middle Fork. Ball (1985) reported it to be a major steelhead spawning stream in the canyon area, followed by Bargamin, Horse, Crooked, Sabe and Sheep creeks. The habitat in this drainage has been unchanged since the 1950s and has been managed as wilderness since the 1930s. Free of major diversions, roads or man-caused pollution, the drainage is composed of steep canyon lands that drain directly into the main Salmon. Soils are primarily granitic in and near the batholith. Substantial low-gradient areas are present in a high-elevation basin. Allthough inventories conducted in the early 1980s in this drainage and others in the canyon area indicated extremely low chinook densities, biologists believe the low densities were the result of off-site mortalities, not adverse environmental conditions. Currently, figures indicate that chinook densities are moderate (10 to 40 fish per 100 square meters) in this area (C. Petrosky, IDFG, pers. commun.).

3) South Fork Salmon River

The South Fork Salmon River flows through densely forested mountains of yellow pine and Douglas fir, and enters the Salmon River at RM 133. The lower 65 miles follow a moderate to steep gradient through a narrow, rocky valley. Upper headwaters are of low gradient with extensive meanders and many deep pools above the Secesh River confluence.

The South Fork drainage lies entirely within the Idaho Batholith. In the headwaters of the Secesh River, the stream valleys are open and floored with glacial till and glacial-fluvio stream gravel. All of the area is complexly mountainous; about half the area ranges from 5,000 feet to 8,000 feet. Most slopes are steeper than 40 percent and slopes more than 65 percent are common. Characteristic of the Idaho Batholith, waters draining the watershed are low in mineral content (Platts and Partridge 1978). The watershed contains many natural resource values including fish, mineral, timber, hydropower, recreation and wildlife.

The South Fork Salmon River watershed produces approximately 20,000 tons of sediment each year, of which 4,500 tons per year is thought to result from management activities (USFS 1988). The extremely unstable soils are the overriding habitat factor in this drainage. In the 1940s, a large open-pit mine at Stibnite began producing antimony oxide and tungsten for use in the war. Large amounts of sediment and chemicals from the mine entered the East Fork during this period (USFS 1988). Commercial logging also began during the 1940s. Loggers harvested progressively steeper lands, often using logging systems that required extremely high road densities to access the steep slopes. Since the 1940s, road construction and logging have caused erosion and damage to aquatic habitat in the South Fork. Between 1945 and 1965, loggers harvested approximately 320 million board feet of timber from the South Fork Salmon River Planning Unit and constructed approximately 800 miles of road (USFS 1988). By

1965, 15 percent of the watershed area had been logged. Seventy--eight percent of the logging and 69 percent of the road construction occurred on steep, unstable stream-cut lands (Thurow 1987).

During the mid-1960s, unusual precipitation combined with logging and road construction resulted in massive silt loads flowing into the South Fork. Spawning and rearing areas were buried under several feet of sand, eliminating a major portion of the anadromous fish production. The Forest Service suspended logging in 1965 for a period and initiated a rehabilitation program. During the late 1960s and early 1970s, land managers closed over 500 miles of road and revegetated to stabilize accelerated erosion. However, a large quantity of interstitial fine sediment still remains and most of the recovery has yet to occur. Managers estimate that about 60 percent of the South Fork Salmon River drainage is damaged due to sediment. Recovery from past degradation has been slow and may be negated by new activities. Land management activities tend to accelerate the natural rates of erosion and sedimentation, especially when these activities are conducted without proper levels of erosion mitigation and without careful planning to assure adequate dispersion of impacts over time.

As mentioned previously, logging has been a major activity in the drainage and timber is one of the prime resources. The average annual volume for a 20-year period prior to the logging moratorium in 1965 was 16 million board feet. Since the end of the moratorium, the average volume has been about 5 million board feet and emphasis has been on minimizing new road construction. Nearly 100,000 acres in the drainage are currently developed for timber management or mining. New logging techniques, however, are more protective of habitat. The techniques require less roads so less sediment enters the river. Erosion mitigation measures are now more effective and management of riparian areas has also improved (USFS 1988). Yet, any land-disturbing activity such as logging, road building, or mining has the potential for additional serious impacts in the South Fork drainage.

Fisheries managers are also concerned about impacts of mining and hydropower development on habitat quality. National forests in the South Fork drainage are administering about 104 active mining claims. Mining of precious metals has significantly altered sections of the East Fork of the South Fork and its headwater tributaries (Thurow 1987). Grazing on U.S. Forest Service lands on upper Johnson Creek is currently degrading the riparian habitat and increasing sediment deposition. In 1980, the private sector became interested in the hydroelectric potential of tributary streams within the drainage. Today, developers have several permit applications filed with the Federal Energy Regulatory Commission for proposed projects.

4) Middle Fork Salmon River

The Middle Fork enters the Salmon River at RM 191 and all 106 miles are included in the national Wild and Scenic Rivers System. The Middle Fork flows through a remote area of central Idaho, which for the most part lies within the Frank Church-River of No Return Wilderness. The sizes of the major tributaries are listed in Table 7. The tributary streams in the Middle Fork drainage were subjected to glacial action that formed numerous alpine lakes, hanging valleys, glacial till, and moraines. The Middle Fork flows through the Idaho Batholith where the region's rock consists primarily of granites and volcanics. The topography is rugged and steep. The lower part of the drainage is moderate to steep, while headwater streams become nearly flat and meandering.

The seasonal pattern of water temperatures is typical of Rocky Mountain streams. According to Sekulich (1980), approximately 39 inches of precipitation falls primarily as snow. Stream discharges peak during a two- to six-week: period in May and June as snows melt. The magnitude and timing of spring runoff likely affects steelhead spawning activity (Thurow 1982). As in other batholith streams, hydrochemical analysis indicates that the Middle Fork and tributaries contain relatively low concentrations of various ions.

Vegetation varies by elevation. Ponderosa and lodgepole pine, Douglas fir, Engelmann spruce, and aspen provide the main tree cover on ridge tops and side slopes. Sagebrush, shrubs, and grasses are common in lower areas, especially on south-facing slopes. Tributaries support riparian growth of alder, water birch, cottonwood, and willows (Thurow 1982).

Recreational use is an extremely important consideration for this drainage. The lower 97 miles of the Middle Fork is only accessible by air, raft or trail. This river has attained national prominence as a recreational area since it offers outdoor enthusiasts opportunities in whitewater experiences, angling, hunting, or passive enjoyment of scenery. In 1981, 7,906 people floated the Middle Fork, compared to 625 in 1962 (Thurow 1982).

Most of the Middle Fork drainage and aquatic habitat lies in a pristine wilderness state and habitat quality is good to excellent. However, some notable exceptions exist. Important as salmon and steelhead habitat, portions of headwater streams Bear Valley, Marsh, Camas, Big, and Loon creeks lie outside the wilderness area and have been degraded to various degrees by mining, grazing and logging.

Table 7. Stream miles of the major Middle Fork Salmon River tributaries and mainstem. Tributaries beyond second order are not included (S. Allen, IDFG, Northwest Environmental Data Base, pers. commun.) .

Stream	Stream Miles	Percent of Drainage in Stream Miles
Bear Valley Cr.	93.3	8.6
Marsh Cr.	59.3	5.4
Loon Cr.	104.7	9.6
Camas Cr.	118.5	10.8
Big Cr.	245.5	22.5
Remainder of Middle Fork	471.1	43.1
Total Middle Fork	1092.4	100.0

Bear Valley Creek is 37 miles long with a watershed of about 180 square miles. Sedimentation from dredge mining and heavy livestock use have severely degraded the creek. Cattle have severely impacted the riparian area. In the 1950s, dredge mining for placer deposits in upper Bear Valley induced catastrophic sedimentation of important spawning and rearing areas. Miners dug canals into depositional bottom lands and diverted the stream, causing breaching and scouring. In 19691, managers filled in the canal system and allowed the stream to find its own channel. Today, sediment from the dredge mining area continues to enter and degrade the drainage, however, under a Bonneville Power Administration (BPA) project, managers are trying to rectify the problem. Biologists also estimate that extensive heavy livestock use of meadow areas could be as large or a larger source of sediment transport into the stream (Petrosky and Holubetz 1985).

Logging, livestock grazing, and mass erosion in the Bearskin Creek watershed have increased sedimentation above natural levels in Elk Creek, a 22-mile-long tributary to Bear Valley Creek. Biologists consider degradation in this area severe (C. Petrosky, IDFG, pers. commun.). Streambanks have collapsed and native riparian vegetation, such as willows, has disappeared in many reaches where livestock graze. Ongoing BPA projects are trying to reduce the sediment.

Habitat in both Marsh and Camas creeks is better than Bear Valley, but livestock grazing has degraded riparian areas in these creeks as well. Streambanks in Marsh Creek have become unstable and sediment loads have increased. Although portions of Marsh Creek are moderately degraded, other tributaries such as Beaver, Capehorn and Knapp creeks are still pristine. Most of the Camas Creek drainage is also pristine, however, past agricultural practices at Meyers Cove have destabilized streambanks and degraded aquatic habitat for about three miles (C. Petrosky, IDFG, pers. commun.). Another Bonneville Power Administration project is trying to restore streambanks in Camas Creek.

Precious metal mining has caused extensive sediment transport in some Middle Fork tributaries. Activities at a mine have dumped substantial amounts of silt into Mule and Monumental creeks, affecting small portions of the Big Creek drainage, which is still primarily pristine habitat. Extensive placer mining continues along portions of upper Loon Creek (Thurow 1982), a primarily pristine drainage also.

5) Panther Creek

Panther Creek enters the Salmon River at RM 203. The region's basic geology consists of volcanic rocks. Several ice fields were present during the glacial epoch on Napias Creek and the head of Panther Creek. Lateral and terminal moraines, glaciated boulders, and swampy areas are found throughout the area. This area is characterized by steep and rocky slopes with elevation ranging from 3,000 feet to 9,000 feet., The lower end of the drainage is semiarid with sagebrush dominating the vegetation. Lodgepole pine and Douglas fir are intermixed with spruce in the upper drainage. Stream gradients vary widely, from 1.2 percent in lower reaches to over 5 percent in some of the headwaters. Other headwaters in the basin, however, have low gradients of less than 0.5 percent. Overall, tributary gradients are steep.

Much of the Panther Creek drainage suffers from varying degrees of chemical pollution from mining. About 20 miles of mainstem Panther Creek are polluted by toxic heavy metal effluent from the Blackbird Mine. Active mining in the 13lackbird area began in the 1890s for cobalt and copper. Mine tailings originally flowed directly into Blackbird Creek. Settling ponds and tailing pipelines were subsequently constructed in the 1940s and 1950s, however, these measures were often ineffective. Mining also began in Big Deer Creek, which contaminated Panther Creek via Bucktail Creek (Bechtel National, Inc. 1986). Because of poor water quality, the spring chinook run declined and managers discontinued redd counts after 1968. By about 1970, the mine effluent eliminated anadromous fish runs. Except for the water quality problems, however, most of the habitat in this drainage is in good to excellent condition.

Currently, the highest concentrations of effluent and lowest fish populations in Panther Creek's mainstem exist from Big Deer Creek down to the mouth of Clear Creek (three miles above the mouth of Panther Creek). Toxic conditions also exist from Blackbird Creek downstream to the mouth of Big Deer Creek. Big Deer Creek and Blackbird Creek are essentially devoid of any fish and macroinvertebrates.

Migration mortality for smolts and adults also appears to be a problem that constrains production throughout the drainage except, perhaps, for Clear Creek. In 1986, managers released excess adult chinook from Pahsimeroi Hatchery into lower Panther Creek, primarily to provide a fishery. A few adults passed through the toxic effluent and spawned successfully (C. Petrosky, IDFG, pers. commun.). Live box studies in 1977, using juvenile steelhead, indicated a 90 percent to 100 percent mortality rate occurring 0.6 miles below Blackbird Creek, and 5 percent mortality at the mouth of Panther Creek. Similar tests with juvenile chinook conducted in 1984 showed a 40 percent mortality 0.6 miles below Blackbird and no mortality at the mouth of Panther Creek. This information indicates, but does not prove, that the toxicity of the water to fish has declined somewhat during this period (Gard and Reingold 1984). Studies have also shown that there appears to be an increase in the concentration of heavy metals in mine drainage water during high flows.

The Idaho Department of Fish and Game has conducted rehabilitation studies and has proposed remedial measures as a BPA project. Restoration work in Panther Creek is currently under consideration.

6) Lemhi River

The Lemhi enters the Salmon River at RM 251. Along the north edge of the Lemhi Valley lie the Bitterroot and Beaverhead mountain ranges, which form the Continental Divide. To the south is the Lemhi Range. The lower 28 miles of river has a moderate gradient whereas the upper river is flatter and meandering. Tributaries contain steep gradients. The Lemhi Valley is a broad glacial-cut valley. The river wanders through a flood plain up to 1 mile wide. The valley floor includes alluvial and glacial deposits, which are sequences of successive alternating layers of sand, gravel, and clay (Ott Water Engineers, Inc. 1986). Unlike the batholith streams, the Lemhi River is a productive stream with total dissolved solids of nearly 300 parts per million (ppm) in contrast to about 60 ppm for streams such as the Middle Fork and South Fork. The annual precipitation is under 10 inches at the valley floor, but it is higher in the surrounding mountains.

Upper Lemhi vegetation consists primarily of Wyoming big sagebrush with an understory of various grasses and forbs. The lower Lemhi is a wet or semi-wet meadow complex consisting of sedges, rushes, willows; dogwood and other species that tolerate a high water table through much of the growing season.

Channel alterations and extensive irrigation diversions impact the lower Lemhi drainage. Approximately 21 percent of the streambed has been channelized and straightened by the state Highway Department and local ranchers. This has resulted in steeper gradients, scouring, and redeposition of gravel in the lower river, subsequently raising the river bed and increasing flood hazards as well as destroying fish habitat.

The main land uses are agriculture and livestock grazing. A major source of pollution is irrigation water return, which increases sedimentation and water temperatures. Furthermore, cattle grazing along the river degrades the riparian vegetation and streambank stability.

The unique hydrology of the Lemhi is characterized by a complex interaction among surface water runoff, irrigation diversions, and ground water recharge. At the present time, the Lemhi's flow is totally appropriated for irrigation: the use of water from the watershed for irrigation influences discharge patterns more than any other factor. The discharge of snowmelt normally peaks in late May and early June, the same time farmers begin withdrawing water from streams and tributaries. Typically, flow in the tributaries exceeds the needs for irrigation and enters the river in large quantities during years when snowpack is average or better. Large amounts of precipitation also fall in the valley during May and June. Irrigation water, spread on the alluvial fans in the valley, enters the stream as groundwater two months to six months later, increasing flows during the late summer and fall (Bjornn 1978).

Depending upon the amount and distribution of snow, dewatering of the lower river can delay anadromous smolt and adult migration. The large number of irrigation diversions may also be a mortality factor because they delay smolts, affecting migration timing. Except for Big Springs Creek,, tributaries of the upper Lemhi above Hayden Creek are no longer available to anadromous production because of low flows and diversions. However, juvenile densities indicate that fish numbers are rebuilding in the upper Lemhi, itself, where the best habitat in this system exists.

7) Pahsimeroi River

The Pahsimeroi River enters the Salmon River at RM 295. Many tributaries in this drainage are also blocked due to diversions and dewatering; anadromous fish can no longer use the entire upper drainage above RM 20. The Pahsimeroi watershed is similar in climate, topography, geology, and hydrology to the Lemhi (Gebhards 1959).

8) Upper Salmon River (Middle Fork to Yankee Fork, including East Fork)

Various land uses increase water temperatures and degrade habitat quality in the upper Salmon River. Several tributaries such as Indian and Colson creeks suffer from siltation due to road construction and logging, as well as improperly placed culverts. Grazing and irrigation withdrawals have impacted other streams. Most of the mainstem Salmon downstream from Challis is a migration corridor or wintering area and does not rear juvenile salmonids, mainly because of high summer temperatures. The Challis area marks the first major area where Salmon River water is used for irrigation. The diversion of water for irrigation and its subsequent return is a major factor contributing to decreased water quality and clarity, and increased temperatures in the mainstem Salmon downstream from Challis. All water in Iron, Challis and Squaw creeks is appropriated. Reingold (1970) identified 66 diversion ditches on the main Salmon alone, many of which are included in this section of river.

The North Fork is a major tributary in this; section and enters the Salmon River 229 miles above the mouth. Although a major tributary in this river section, the North, Fork is actually smaller than Big Creek on the Middle Fork. The North Fork flows for 23 miles through a narrow, mountainous valley. The geology of the North Fork is similar to the Lemhi and Pahsimeroi. Rocks of the region include guartzites, slate, and Challis volcanics. Glaciation is evident only at high elevations. Throughout its entire course, the stream is rather steep and meanders little. Gebhards (1959) reported that the predominant gravel size was in excess of 4 inches in diameter. The principal industry at one time was mining, but most of the operations have been abandoned for a number of years. Dredge and placer mining, logging, and agricultural activities, as well as poorly constructed road crossings, have impacted the drainage. Pollution sources are silt washings of deserted mine tailings and irrigation return flows. The current land uses are ranching and logging, while several irrigation diversions appear throughout the drainage.

The East Fork, 32 miles long, enters the Salmon River at RM 336 and is another major tributary. Rocks are primarily volcanic, but some sedimentaries exist. Most of this drainage lies within the rugged ranges of the White Cloud Peaks and

Boulder Mountains. The gradient varies from steep to moderate. The current land use is mainly ranching. Sedimentation and loss of riparian vegetation due to livestock, channel alterations, and irrigation diversions have reduced the productivity of the lower East Fork and the tributaries Herd and Road creeks. Most of the upper drainage is in pristine condition.

The Yankee Fork, 25 miles long, enters the Salmon River at RM 360. The drainage is extremely mountainous and the stream follows a steep to moderate gradient. The stream flows through narrow canyons, moderately wide valleys of lodgepole pine forests, and wide meadow-like valleys. Most of the system is roaded and lies in a Challis-volcanic area, which is characterized by highly erosive sandy and clay-loam soils. (Konopacky et al. 1985). Headwaters of the Yankee Fork are at 8,500 feet. While the upper portion of the drainage provides excellent habitat, dredge mining has severely degraded approximately six miles of the lower Yankee Fork.

Historically, the chief industry in the Yankee Fork drainage was mining and over 50 percent of the streambed was subjected to gold dredging in the 1930s and 1950s. Mining activities have completely rechanneled the lower portions of the Yankee Fork and deposited extensive, unconsolidated dredge piles. Over 30 dredge ponds remain as remnants of dredging operations. These are isolated from the streamflow except during high water periods. During heavy runoff, the Yankee Fork becomes quite turbid, muddying the mainstem Salmon. Under way is a BPA project to connect off-channel ponds to partially compensate for lost chinook production potential in the dredged reach. Overall, dredged portions of the Yankee Fork are sparsely vegetated with long sections containing no riparian area (Reiser and Ramey 1987). Currently, smaller dredge, placer, deep rock, and open pit mines continue to operate in this drainage. Permits are for both commercial and recreational operations (Konopacky et al. 1985).

9) Headwaters (from Yankee Fork upstream)

The headwaters of the Salmon River rise in the rugged Sawtooth Mountains. The river then flows through the Sawtooth Valley, an elongate intermontane valley flanked by the Sawtooth Mountains to the west and the White Clouds to the east. Elevations of streams studied by OEA Research Company (1987) ranged from 6,168 feet to 7,710 feet. Granitic rock of the Idaho Batholith underlies much of the area. An assortment of igneous rocks belonging to or associated with the Challis volcanics comprise the remaining important bedrock component. Sedimentary rocks form outcrops in the southern headwaters. Climate in this region is characterized by a short summer and a long severe winter. Emmett (1975) indicated that precipitation for this area ranges from less than 10 inches to more than 60 inches, depending on altitude and location: the major part of the basin receives about 30 inches. Most streams are perennial and hydrology is dominated by high spring runoff from snowmelt in the mountains.

The flora is representative of montane and subalpine Rocky Mountain flora. Forests are interspersed with and border the willow and sedge areas of the narrow valley. Broad valleys support willows and sedges as well as drier grassland and shrub areas (OEA Research 1987).

Land uses, especially in the Stanley Basin, are recreation, irrigation, livestock grazing and limited mining. The upper river, primarily above Stanley, lies in the Sawtooth National Recreation Area.

Although the aquatic habitat in the headwaters of the Salmon in general is relatively high quality, several problems exist. Some of the major tributaries such as Valley and Basin creeks have sediment problems and streambank degradation due to grazing. Several of the streams are currently undergoing studies that focus on sediment, degraded streambanks, and damaged riparian areas resulting from livestock grazing and irrigation.

Flow diversions in this section are a substantial constraint on fish production because irrigation restricts anadromous fish from parts of the basin. Irrigation diversions have severely impacted several streams in this area. Diversions on Alturas Lake Creek and the upper Salmon River dewater these streams and create migration barriers in many years. Not only do they restrict passage for adults, but they also reduce rearing habitat for juveniles. The annual dewatering of Alturas Lake Creek has been a major impediment for sockeye production in Alturas Lake. The Sawtooth National Recreation Area is attempting to solve passage problems through either the Columbia River Basin Fish and Wildlife Program or its own funding authority (C. Petrosky, IDFG, pers. commun.). Other tributaries such as lower Beaver Creek and Fourth of July Creek are typically dewatered during the summer.

Constraints and Opportunities for Protection

Institutional Considerations

Approximately 78.9 percent of the anadromous fish habitat in the Salmon River Subbasin is administered by the U.S. Forest Service, 11.4 percent by the Bureau of Land Management, 1.6 percent by the Idaho Department of Lands, and 8.1 percent by the private sector. These three agencies manage fish habitat on their respective lands in cooperation with such agencies as the Federal Environmental Protection Agency, Idaho Department of Health and Welfare, Idaho Department of Water Resources, and the U.S. Soil Conservation Service. These agencies have important responsibilities for protection of water quality and stream habitat.

The Sawtooth, Challis, Salmon, Bitterroot, Payette, Boise, and Nez Perce national forests each manages lands according to its own forest plan. With district offices in Salmon and Cottonwood, the Bureau of Land Management manages streams in its jurisdiction through aquatic zone habitat management plans. -To date, the BLM has completed habitat management plans for the mainstem Salmon from the Snake River confluence to White Bird Creek, and from the Little Salmon River to French Creek (C. Johnson, BLM, pers. commun.). In addition, the national Wild and Scenic Rivers System, the Frank Church-River of No Return Wilderness, the Gospel Hump Wilderness, and the Sawtooth National Recreation Area, all administered by the Forest Service, afford protection to anadromous fish habitat in the Salmon River Subbasin. Wilderness-and wild and scenic river designations protect the integrity of naturally functioning ecosystems to the greatest extent possible and are considered optimal from a fish habitat protection standpoint (USFS 1988).

Over the past several years, the public has increased its awareness of fisheries and watershed values. Since the mid-1970s, streams have received considerably more protection due to state and federal water quality laws. In many cases, law makers have revised land use allocations and forest management guidelines to give more consideration and protection to anadromous fish habitat. Both the Forest Service and the Bureau of Land Management have proposed goals for future fish habitat protection and enhancement in recent land management plans and programs such as the Forest Service's "Rise to the Future" and the BLM's "Strategy for the Future." However, it should be pointed out that land management agencies generally operate under a multi-use concept and have multiple goals and constituencies. A wide range of user groups, including anadromous fishery managers, are currently appealing these forest plans, pressing for modifications to various management directives. Conflicts over the degree of protection for anadromous fish habitat have occurred in the past and will undoubtedly continue.

Fishery management agencies and Indian tribes often have specific goals for habitat protection, although they lack direct jurisdiction in most cases. For example, the National Marine Fisheries Service policy is to accept no further habitat degradation. The Idaho Department of Fish and Game's policy is to protect and enhance natural production habitat in the state, consistent with a stream classification system illustrated in Table 8. Although the goal for natural production is full production from all available habitat, some degradation of quality as a consequence of other resource uses has occurred or is anticipated in portions of the subbasin. Idaho Fish and Game indicates that important and highly productive habitat should receive high levels of protection, while lesser habitat may be subject to lesser protection; However, it does caution that agencies should strive for a standard of zero degradation (IDFG 1985).

The nature of habitat protection is complex. Interdisciplinary teams'involving fisheries biologists, range conservationists, foresters, surface protection specialists, and managers are often needed to ensure that anadromous fish resources are considered in riparian management strategies for administration of grazing, timber harvest, and mining operations (Vetterick et al. 1987). Rarely does one agency possess these resources or even the complete authority to manage habitat and fish, so cooperative efforts are needed for anadromous fish habitat protection to occur.

The public is also an important consideration in habitat protection. Although a minor amount of anadromous habitat is in private holdings, private landowners can have a major impact on fish habitat. It is crucial that the public be educated and informed about the impacts of land uses on private and public lands.

Table 8. Classification of streams in the Salnnon River Subbasin for production of anadromous fish (Idaho Departnnent of Fish and Game 1985).

Subarea	EPA Reach #	Streams	Class*
Lower Salmon River	17060209	mainstem & tribs	2
Little Salmon River	17060210	mainstem	3
		Rapid River	
		Boulder Creek	
		Hazard Creek	
		Hard Creek	
		all other tribs	2
Salmon River Canyon	17060207	mainstem	2
		Wind River	
		Sheep Creek	
		Crooked Creek	
		all other tribs	2
South Fork	17060208	mainstem & tribs	2
Middle Fork	17060205/206	mainstem & tribs	1
Upper Salmon River	17060203	mainstem & tribs	2
Lemhi River	17060204	mainstem & tribs	2
Pahsimeroi River	17060202	mainstem & tribs	3
Salmon River Headwaters	17060201	mainstem	2
		Morgan Creek	3
		East Fork	2
		Yankee Fork	3
		all other tribs	2

* Class l-no man caused reduction from full natural production capacity.

Class 2-up to 10 percent reduction from nat. prod. capacity.

Class 3-up to 20 percent reduction from nat. prod. capacity

Class 4-up to 30 percent reduction from nat. prod. capacity. (Allowable short-term impacts due to sediment occurring no more than three years out of 10, with expectation of full recovery.)

A further consideration of habitat protection is the use of monitoring to advise managers of the -effectiveness of their land management practices in protecting or improving habitat. Monitoring also identifies where changes are needed. What agencies and the public must also consider is the social, biological and economic'losses resulting from degraded anadromous fish habitat. Preventing or minimizing this degradation will reduce the cost and possibly the need for future habitat improvements, as well as litigation costs related to habitat loss (Vetterick et al. 1987). Although it is possible to improve production capacities of anadromous fish habitat, once habitat has been damaged, it is difficult to completely restore or replace. Even with the best available technology, altered streams are rarely as productive as pristine streams. Artificial habitat enhancement or restoration should not be regarded as an adequate substitute for protecting existing habitat (IDFG 1985).

Critical Data Gaps

Habitat protection is a necessary component in land management to maintain and increase natural fish production. To assure adequate protection for all species throughout the subbasin, more information is needed on the physical and biological aspects of the habitats and the direct and indirect effects of land-use practices (Murphy 1988). Research on many of these topics is occurring. The critical information or data gaps include the following.

A) The relationship among sediment yield, sediment deposition, and fish habitat capability, including relationships between productivity of a system and fish production.

B) The effects of various grazing systems for domestic livestock on fish habitat.

C) The relationship among flows, temperature variation, and fish habitat.

D) The relationships between fire suppression and fish habitat condition.

E) The effectiveness of current land management monitoring programs and "best management practices" and mitigation measures.

F) A standardized methodology to evaluate habitat to assure that necessary variables are measured and a consistent approach is used to rate the quality of habitat.

G) Optimum flow and timing for outmigrating juveniles, and minimum instream flows required to maintain or optimize fish production in all anadromous waters.

H) Quantification and qualification of winter use and activity in relation to flow diversions.

I) Land management strategies given key limiting factors. .

Habitat Protection Objectives and Strategies

Objectives

1. Protect and/or enhance habitat in streams used or potentially used by anadromous fish to enable optimum production.

2. Provide adequate streamflows for the spawning,. incubating, rearing and migrating life stages of anadromous fish.

Strategies

A) Conduct or support research needed to improve management of anadromous fish habitats and to determine effectiveness of habitat improvements.

B) Maintain close liaison with the U.S. Forest Service, Bureau of Land Management and other state and federal agencies involved in land and water use programs, and encourage, advocate and support implementation and enforcement of programs that will reduce stream degradation. Support state and federal water quality standards and enforcement of pollution control.

C) Support "protected areas" designations.

D) Establish common fish production objectives with appropriate land management agencies.

E) Develop partnership memorandum of understandings with special interest groups interested in fisheries habitat management on public and private lands to assist management agencies in project proposal, development and implementation.

F) Promote and advocate education in sound land use practices and develop an understanding in landowners and managers of the positive effects improvement in land use practices can have on habitat and subsequently on fish populations.

G) Advocate management of state waters to meet instream flow needs for spawning, rearing, and migrating salmon and steelhead.

H) Emphasize the importance and value of fisheries habitat resources on public lands to ensure commensurate value and program comparisons with other resources during planning and decision making processes. Include benefits to fish habitat considered at the project level for land management activities occurring in riparian areas such as timber management.

I) Advocate and support implementation of grazing strategies that regulated animal distribution and forage use to protect riparian areas and stream channels.

PART III. CQNSTRAINTS AND OPPORTUNITIES FOR ESTABLISHING PRODUCTION OBJECTIVES

Institutional Considerations

A number of entities are involved in the Salmon River Subbasin anadromous resources. As mentioned earlier, federal agencies include the U.S. Forest Service, Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, Northwest Power Planning Council, Bonneville Power Administration, Federal Energy Regulatory Commission and U.S. Army Corps of Engineers. Among the state agencies involved are the departments of Fish and Game, Water Resources, Health and Welfare, and Lands. Non-federal or state governmental entities include Nez Perce Tribe and Shoshone-Bannock Tribes. Idaho Power Company is also involved through its dam mitigation requirements.

Federal agencies owning land within the subbasin are presently or will soon be working under their respective management plans. The Forest Service has finalized forest management plans for the Bitterroot, Salmon, Sawtooth, Payette, Challis, and Nez Perce forests. All these plans are currently being appealed. The Boise National Forest Management Plan is pending finalization. The Bureau of Land Management is currently operating under its Lemhi, Ellis, Pahsimeroi, and Chief Joseph land management plans.

The Idaho Department of Fish and Game is presently working under or in conjunction with three plans concerned with anadromous fish. The department's five-year anadromous fisheries management plan will end in 1990. Earlier mitigation efforts resulted in two other plans, the Lower Snake River Fish and Wildlife Compensation Plan and the settlement agreement with Idaho Power Company.

Currently the various agencies, tribes and private entities are cooperating on a number of projects, including stream enhancement work on Yankee Fork, Bear Valley Creek and Camas Creek. Still in the preliminary stages are projects on South Fork Salmon River, Panther Creek, Lemhi River, Alturas Lake Creek, East Fork Salmon River and the upper Middle Fork Salmon River and upper mainstem Salmon areas. Cooperative efforts that include agencies outside the subbasin are the Fish Passage Center, and the Fish Transportation and Oversight Team.

Additional opportunities for cooperation among fish, water and land managers exist throughout the subbasin. Managers are currently discussing potential cooperative management efforts, including actions to improve stream conditions. Future projects may include Thompson Creek, Squaw Creek and Morgan Creek. Monitoring activities and data dissemination will require further cooperation and coordination among land, water and fish management agencies.

The Idaho Habitat Enhancement Coordinating Committee is responsible for the review and evaluation of ongoing and proposed enhancement projects throughout the state. Representatives from the Forest Service, Bureau of Land Management, Idaho Fish and Game, Nez Perce Tribe, Shoshone-Bannock Tribes, U.S. Fish and Wildlife Service and National Marine Fisheries Service serve on this committee. The Boise and Payette forests are working with the Idaho Fish and Game, the Nez Perce Tribe and other interested parties on the South Fork Salmon River. This monitoring team has carefully planned and developed management techniques to aid restoration of the South Fork's fisheries habitat.

Lesal Considerations

Management of anadromous salmonids in the Salmon River has been and will be greatly influenced by the outcome of several court cases and negotiations. The adjudication of water rights in the Snake River adjudication will determine private, tribal, state and federal reserve water rights within the Snake River and its tributaries. The federal government is presently considering consolidating selected federal lands, including Bureau of Land Management land in the subbasin. The protected areas amendment to the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program included a large number of stream reaches in the Salmon River drainage that would essentially be protected from further hydropower development. Still unresolved is the proposed wilderness areas for Idaho, which involve large tracts within the subbasin.

The Pacific Salmon Treaty Act of 1985 provides for coastal management of salmon by the United States and Canada to rebuild natural stocks of chinook and other species and considers steelhead compensation needs in salmon fisheries. This treaty and United States vs. Washinaton determined harvest allocation principles and processes for anadromous fish in coastal areas of the United States and Canada. United States vs. Oregon, which involves the Columbia River Fish Management Plan, is intended to deal with similar issues in the Columbia River, but is currently under appeal by various parties. The Fishery Conservation and Management Act of 1976, also known as the Magnuson Act, provides for domestic U.S. harvest management processes in national waters of the Pacific Ocean through the Pacific Fishery Management Council. One of the biggest problems in the subbasin is when negotiations break down and participants take the problem to litigation. As the resolution of the issue is prolonged, the resource often suffers as corrective actions are delayed.

The pristine condition of the Salmon River has been recognized by several federal acts. All or portions of the Middle Fork, Rapid River and the Salmon River mainstem are part of the national Wild and Scenic Rivers System. In 1972, Public Law 92-400 established the Sawtooth National Recreation Area and the Sawtooth Wilderness. The Central Idaho Wilderness Act of 1980 combined the Idaho'and Salmon River Breaks Primitive Areas and adjacent roadless areas into the Frank Church-River of No Return Wilderness.

No anadromous fish species in the Salmon River Subbasin is currently listed as endangered by the Environmental Protection Agency. Although carrying no legal ramifications, the Idaho Department of Fish and Game classifies sockeye (Oncorhynchus nerka) as endangered, summer and fall chinook (Oncorhynchus tshawvtscha) as threatened, and spring chinook and steelhead (Oncorhynchus mvkiss) as species of special concern. The Bureau of Land Management lists chinook, sockeye, and steelhead as sensitive species. The Northern Region of the.Forest Service has officially classified as sensitive all anadromous species.

Various other legal considerations affect Idaho anadromous salmonids. Important federal legislation includes the Water Resources Development ACt of 1976, Pacific Northwest Electric Power Planning and Conservation Act of 1980, and Salmon and Steelhead Conservation and Enhancement Act of 1980.

Several major state laws affect anadromous fish in the Salmon River Subbasin. Title 36 of the Idaho Code commissions the Idaho Department of Fish and Game to manage the fish and wildlife of the state. The Stream Channel Protection Act of 1971, administered by the Idaho Department of Water Resources, regulates proposed stream channel alterations. The Idaho Legislature passed a bill in 1988 that mandated the development of a comprehensive state water plan and authorized a state protected rivers system. Under this authority, a plan for the conservation, development, management, and optimum use of all the unappropriated water resources of Idaho will be developed and implemented by the Water Resource Board. The Legislature further provided the Water Resource Board with the authority to designate highly valued waterways as protected rivers, and to prohibit or restrict activities within stream channels of waterways so designated.

Title 39 of the state Environmental Health Protection Act sets the basis for water quality standards in state waters and is administered by the Idaho Department of Health and Welfare. Until recently, non-point sources of pollution have not been effectively regulated. However, Section 319 of the federal Water Quality Act of 1987 (Clean Water Act) requires states to implement management programs for controlling non-point source pollution. In response to this directive, the 1989 Idaho

Legislature adopted an antidegradation policy to be implemented by a newly created water quality advisory working committee led by the Department of Health and Welfare. This legislated policy sets out an approach to achieve coordination and enhancement of water quality monitoring in the process of water quality planning, regulation, and management. It represents a major step in acknowledging non-point source pollution and establishing comprehensive water quality planning.

Several tribes have traditionally fished within the subbasin. By virtue of the Treaty of 1855, the Nez Perce Tribe has the right to fish in usual and accustomed sites throughout the subbasin. The Shoshone-Bannock Tribes through the 1868 Fort Bridger Treaty have the right to fish on any unoccupied federal lands. The extent of the Shoshone-Paiute Tribes fishing right remains unresolved pending anthropological and legal research and evaluation. Several court cases have established the scope and extent of these treaties and the subsequent rights possessed by tribal members.

A number of easements that include riparian clauses have been negotiated within the subbasin. The Forest Service has three easements with private ranches in the upper Salmon River area on Valley Creek, Pole Creek, and the mainstem Salmon. The Shoshone-Bannock Tribes have easements for stream enhancement projects on Yankee Fork and Bear Valley Creek with the respective mining companies.

Little has been finalized in terms of water rights and instream flows in the Salmon Subbasin. Minimum instream flows have been legislated for the Pahsimeroi River and water rights have been adjudicated for the Lemhi River. Status of the rest of the Salmon River Subbasin's water rights and usage is dependent upon the outcome of the Snake River adjudication and the preparation of the Salmon River Basin component of the comprehensive state water plan.

Critical Data Gaps

Fisheries managers have identified a number of data gaps for salmon and steelhead in the Salmon River Basin:

A) Seasonal habitat utilization, juvenile rearing potential, and smolt yield for mainstem Salmon and major tributary mainstems.

B) Wild and natural escapement into mainstem and major tributaries.

C) Mixed harvest methods and structure, determination of mortality rates of catch and release chinook.

D) **Baseline evaluation** of genetic differences of stocks, races and populations in major tributaries for future genetic monitoring.

E) Seasonal mortality rates as related to habitat.

F) Age structure, sex ratio and fecundity and age of runs. .

G) Effects of sedimentation on seasonal habitat capacities and survival rates.

H) Migration timing and survival for smolts in **mainstem** and tributaries. Determination of where and why major losses of smolts occur prior to Lower Granite Dam.

I) Definition of most effective life stages for supplementation according to habitat.

J) Influence of hatchery supplementation on ecology and genetics of wild and natural stocks.

K) Better definition of migration timing of adults into **subbasin** and tributaries.

L) Effect and extent of hatchery fish straying into wild fish management areas.

PART IV. ANADROMOUS FISH PRODUCTION PLANS

SPRING AND SUMMER CHINOOK SALMON

Fisheries Resources

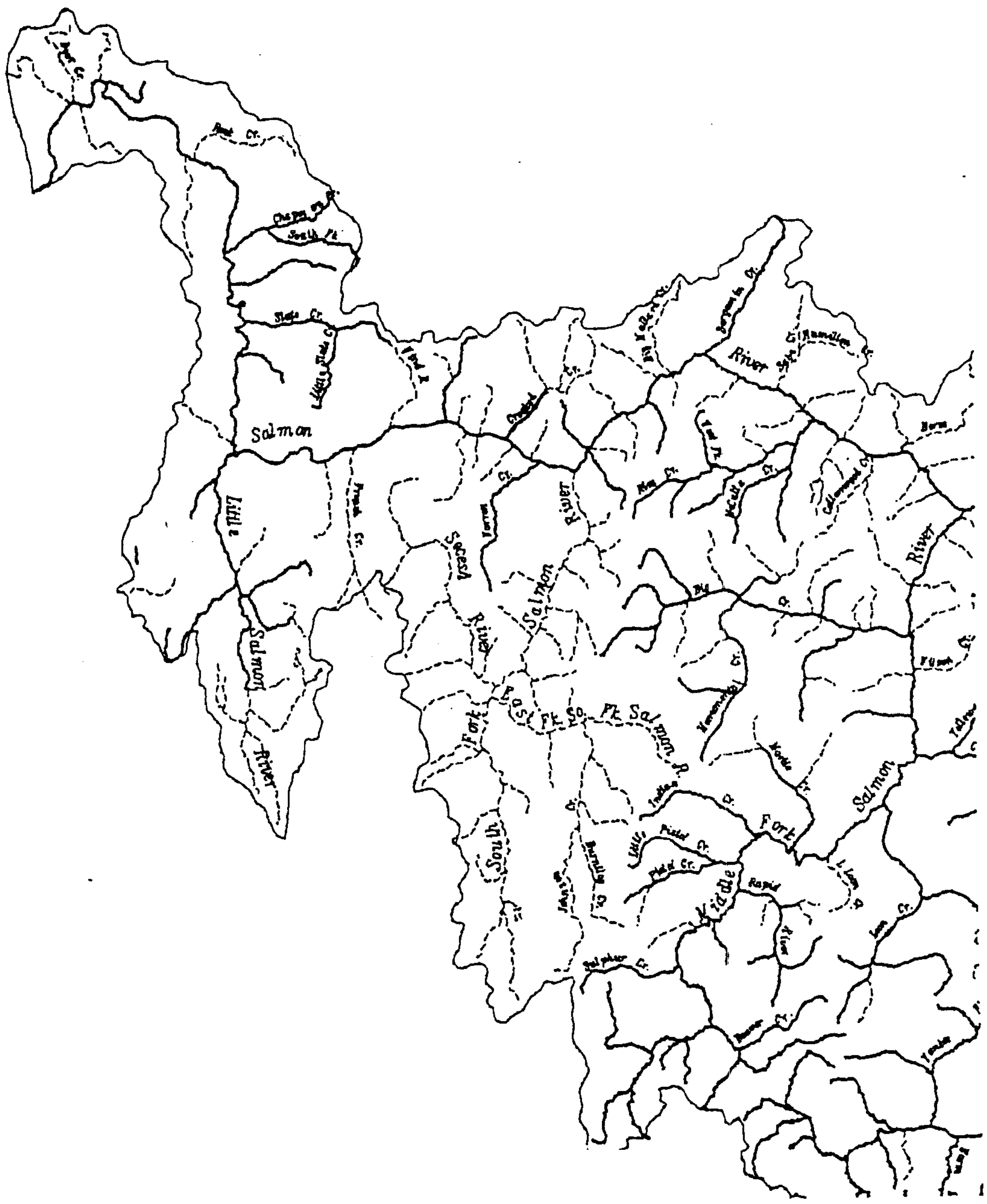
Natural Production

Two "races" of chinook salmon enter the Salmon River Subbasin, based on the time they pass over Bonneville Dam on the Columbia River. Spring chinook cross Bonneville Dam from March 1 to May 31 and summer chinook cross from June 1 to July 31. The upriver run is composed of stocks from the Snake River drainage, the upper Columbia River drainage above McNary Dam, and the mid-Columbia tributaries between Bonneville and McNary dams including the Wind, Klickitat, Deschutes, John Day and Little White Salmon rivers. Idaho's chinook are truly unique. Few other, if any, chinook salmon have the ability to make the 700-mile to 950-mile spawning migration.

Natural production includes wild, indigenous fish and fish of hatchery ancestry that have returned to reproduce and rear naturally. Naturally produced spring and summer chinook are present throughout most of the Salmon River drainage while several populations of spring and summer chinook are indigenous to a particular drainage, such as the Middle Fork spring chinook.

Populations have declined drastically and steadily since 1960. Many wild populations are at a remnant status and the complete loss of some spawning populations appears a possibility. Horner and Bjornn (1981) estimated that prior to construction of McNary Dam in 1953, production rates averaged better than three returning adults for every spawner for upriver Columbia Basin spring chinook. When ocean harvest was taken into account, rates averaged better than 5-to-l. After the lower Snake River dams were completed in the 1970s, production rates were estimated to be close to one returning adult per spawner, indicating the population was just maintaining itself. Production rates for the wild Snake River segment of the upriver run also showed a decrease, but at a faster rate. Also, present stock recruitment relationships showed there was no longer a large surplus of fish and, in some cases, nearly all returning fish were needed to maintain the run.

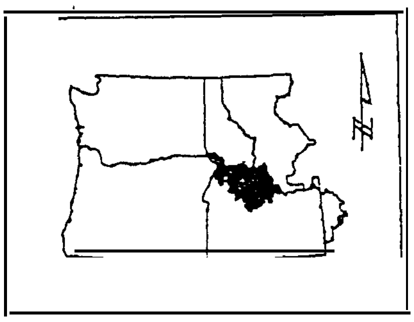
SALMON SUBBASIN-WEST HALF



SPRING CHINOOK DISTRIBUTION*

PRESENT/POTENTIAL

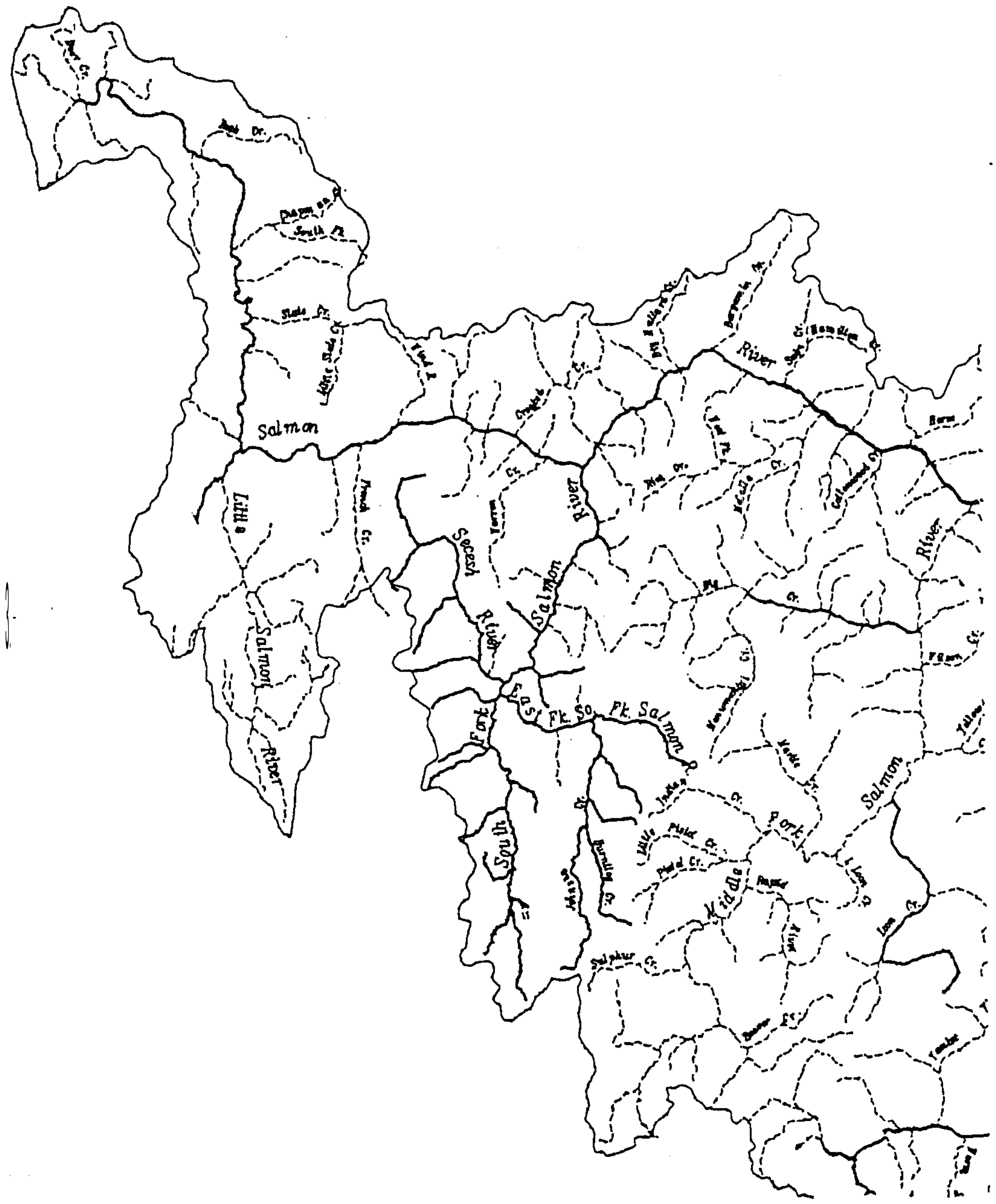
ABSENT



GEOGRAPHIC INFORMATION SYSTEM
BONNEVILLE POWER ADMINISTRATION

* Due to the limitotions of scale, all streams which support onodromous fish ore not shown on this mop.

SALMON SUBBASIN-WEST HALF



SUMMER CHINOOK DISTRIBUTION*

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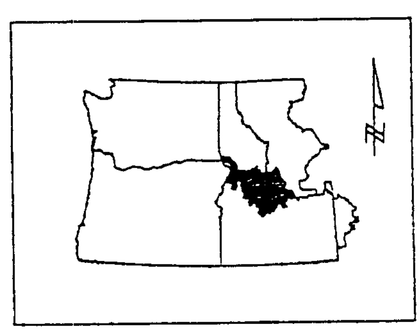

GEOGRAPHIC INFORMATION SYSTEM
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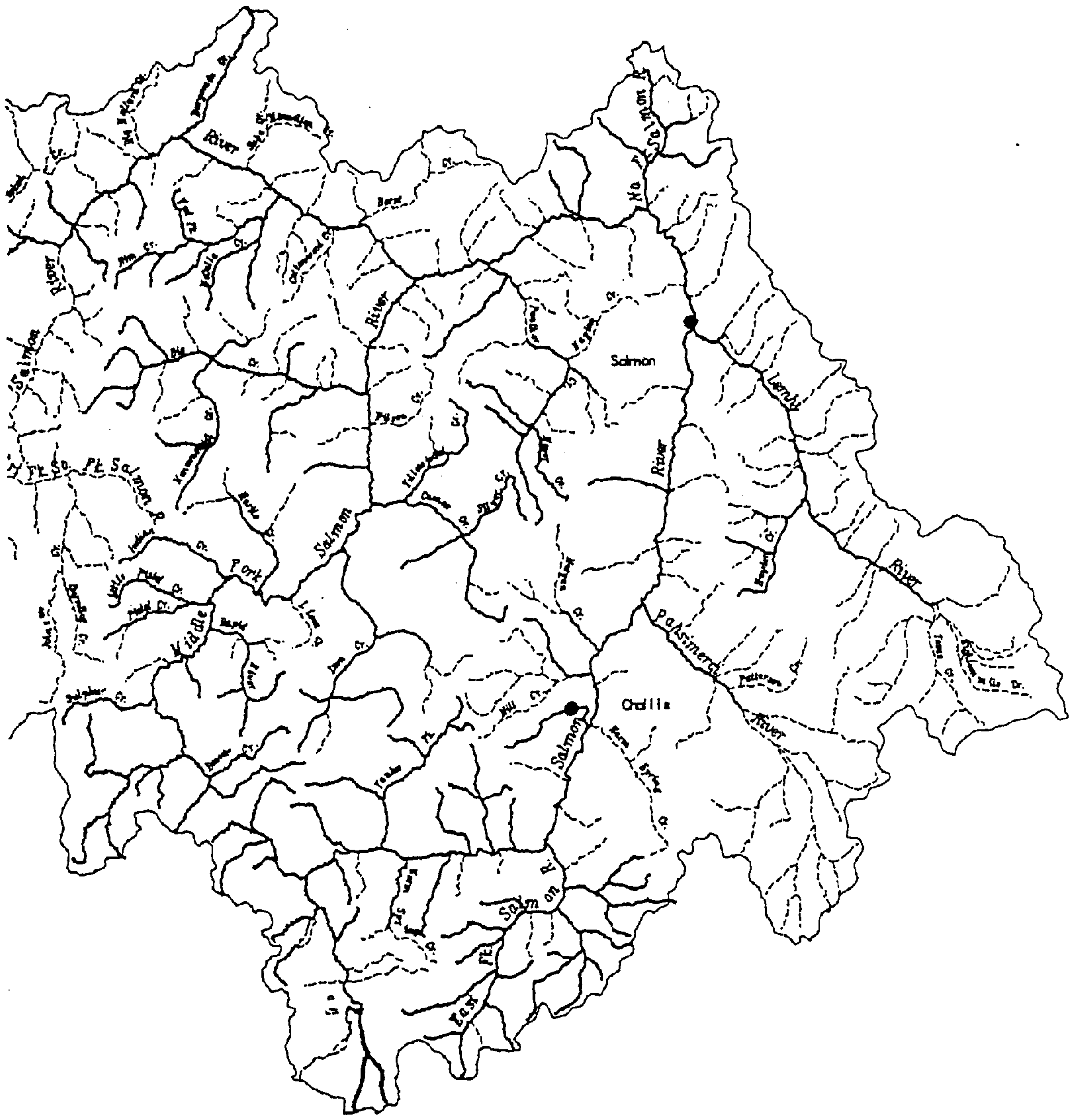
BONNEVILLE POWER ADMINISTRATION

* Due to the limitations of scale, all streoms which support onadromous fish are not shown on this map.

SALMON SUBBASIN-EAST HALF



SPRING CHINOOK DISTRIBUTION*

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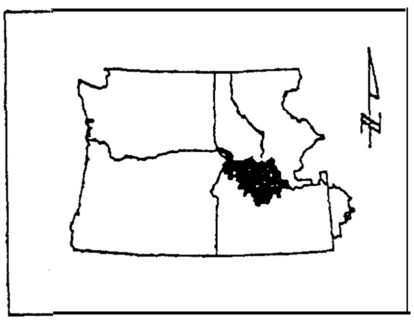
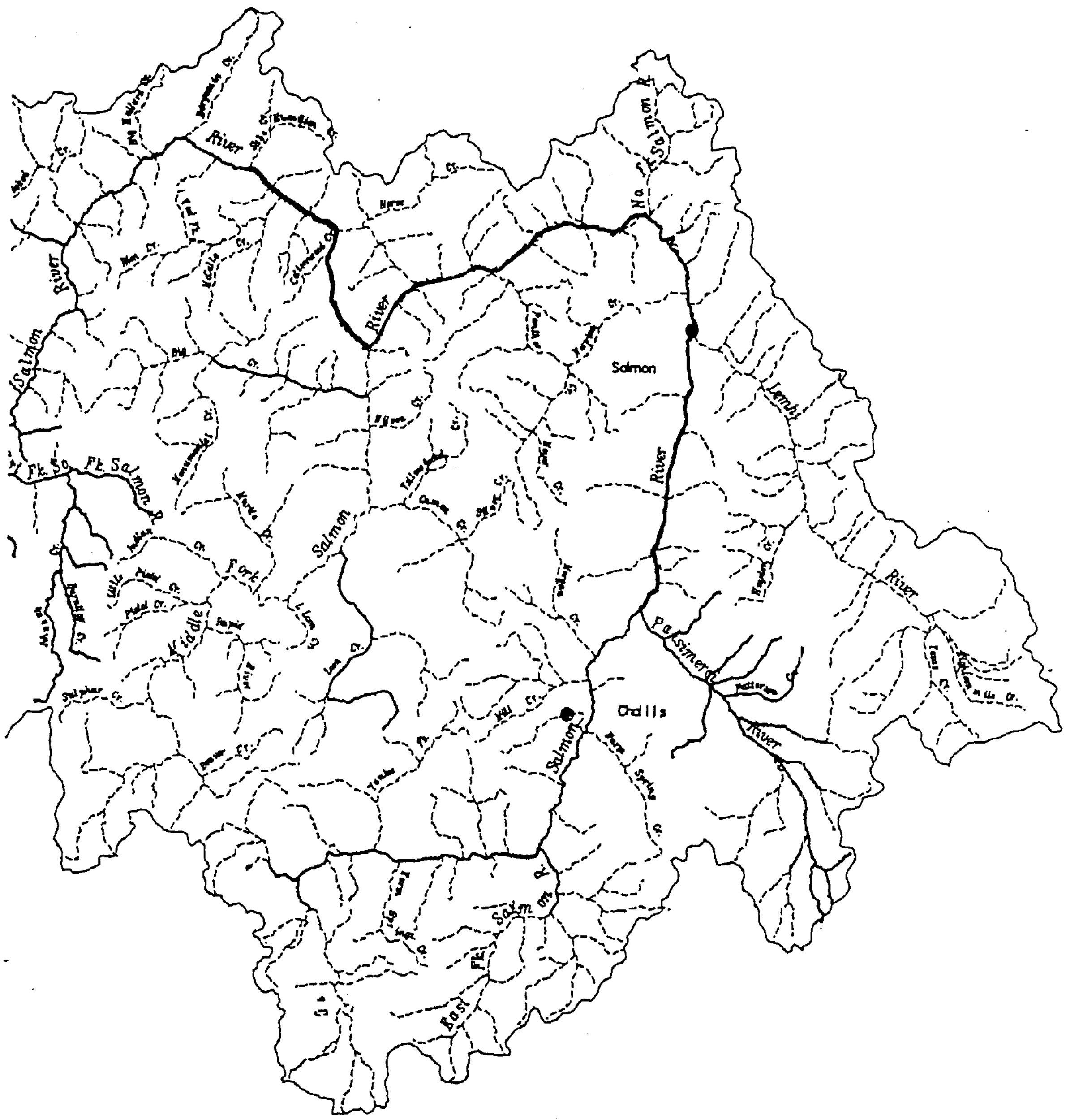


GEOGRAPHIC INFORMATION SYSTEM

BONNEVILLE POWER ADMINISTRATION

* Due to the limitations of scale, all streams which support onadromous fish are not shown on this mup.

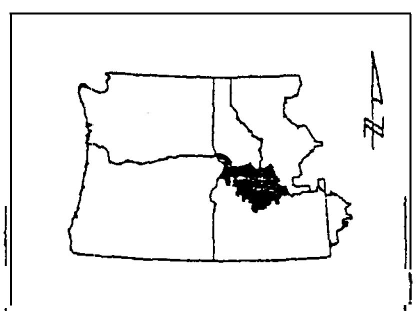
SALMON SUBBASIN-EAST HALF



SUMMER CHINOOK DISTRIBUTION*

——— PRESENT/POTENTIAL

------- ABSENT



GEOGRAPHIC INFORMATION SYSTEM

BONNEVILLE POWER ADMINISTRATION

* Due to the limitations of scale, all streams which support onodromous fish are not shown on this mop.

The Salmon River Subbasin historically produced an estimated 39 percent of the spring and.45 percent of the summer chinook salmon that entered the Columbia River. Annual escapement to this drainage averaged 29,300 spring chinook and 20,000 summer chinook between 1962 and 1970 (Tables 9 and 10). However, natural escapement approached 100,000 total chinook from 1955 to 1960. The estimated total chinook smolt production from the Salmon River ranged from 1.5 million to 3.4 million fish between 1964 and 1970 (IDFG 1985). The 1987 Lower Granite Dam count of spring chinook was almost 29,000 fish, which includes hatchery as well as naturally produced adults. The 1987 summer chinook escapement over Lower Granite Dam was 6,551 fish, the majority destined for the Salmon River Subbasin.

Table 9. Adult spring chinook returns to major Idaho streams, 1962-1974 (Mallet 1974).

Year	Snake River at Ice Harbor	Idaho* Spring Chinook	Clearwater River	Salmon River
1962	33,613	27,731	13	27,718
1963	26,778	22,092	5	22,087
1964	23,116	19,071	66	19,005
1965	12,178	10,047	318	9,729
1966	43,881	36,202	355	35,847
1967	35,495	29,283	428	28,855
1968	44,773	36,938	990	35,948
1969	51,895	42,813	2,529	40,284
1970	47,931	39,543	1,700	37,843
1971	32,638	26,926	2,187	24,739
1972	50,350	41,539	3,467	38,072
1973	60,617	50,090	**	NA
1974	19,205	15,844	**	NA
Average	37,113	30,625	1,096	29,102

* Idaho total approximates 82.5 percent of Ice Harbor count.
** Lewiston Dam removed - no Clearwater River count available.
NA - Count not available

Table 10. Adult summer chinook returns to Idaho, 1962-1974 (Mallet 1974).

Year	Snake R.*	Idaho Summer Chinook**
1962	30,639	25,277
1963	20,875	17,222
1964	24,696	20,374
1965	14,701	12,128
1966	16,983	14,011
1967	30,315	25,010
1968	29,531	24,363
1969	30,917	25,506,
1970	19,382	15,990
1971	26,606	21,950
1972	22,820	18,827
1973	12,795	10,556
1974	10,242	8,450
Average	22,346	18,436

* Snake River count at Ice Harbor Dam.
** Idaho summer chinook total approximates 82.5 percent of the Ice Harbor count. A small number of summer chinook enter the Clearwater River system.

Redd counts are another method biologists use to indicate spawning escapement trends. A comparison of historical and current redd counts for several major chinook production streams also shows the decline in chinook numbers over the last 30 years (Table 11). An indication of natural production potential is smolt capacity. System planners estimated chinook smolt capacities for all the Columbia River subbasins by using a "standard density method" developed for the Preliminary Information Report, July 8, 1988. The spring and summer chinook smolt capacity for the Salmon Subbasin totals about 11 million (Table 12).

Several major events within the Salmon River Subbasin have affected natural production. Sunbeam Dam, built in 1913 on the upper mainstem Salmon River near the mouth of the Yankee Fork, practically eliminated major sockeye, chinook, and steelhead populations upstream. The dam was removed in 19134. A fishway was constructed at Dagger Falls, 96 miles above the mouth of the Middle Fork Salmon River. Managers considered Dagger Falls a migrational delay at high flows and a complete block to anadromous fish at low flows. Consequently, they installed a vertical slot fishway in 1960. The fishway made the entire upper reaches of the Middle Fork and its tributaries more accessible to anadromous fish. The construction was funded through the Columbia River Fisheries Development Program (CRFDP). Today, about 95 percent of the spawning and rearing habitat in the Salmon River is still available to chinook.

Although a majority of the habitat still available to chinook is high quality, man's activity in the Salmon drainage has degraded many streams. Sedimentation has increased with widespread logging and road building. Intensive! livestock grazing near streams has removed riparian vegetation, changed stream morphology, and accelerated soil erosion. Mining has had profound effects in parts of the drainages through stream channel alterations, discharge of toxic effluents, and increased stream withdrawals (Petrosky and Holubetz 1986). Examples of mining damage include Panther Creek, where chinook have been severely depressed due to toxic mine pollution, and Yankee Fork and Bear Valley Creek where channel alteration has been severe. However, a significant amount of restoration and enhancement of natural spawning and rearing habitat has occurred in the latter two streams.

Table 11. Comparison* of redd count averages for 1958-1962 and 1983-1987 for selected Salmon River streams.

Stream	1958-1962	1983-1987	Percent of 1958-1962
Spring Chinook Wild/Natural Redd Counts			
Middle Fork			
Bear Valley	444	84	18.9
Elk Creek	416	59	14.2
Marsh Creek	315	90	28.6
Summer Chinook Wild/Natural Redd Counts			
Middle Fork			
Loon Creek	188	83	44.1
South Fork			
Secesh/Lake Creek	355	92	25.9
Johnson Creek	316	56	17.7
Spring Chinook Currently Hatchery-Influenced Redd Counts			
Lemhi River	1192	98	8.2
Upper Salmon River	642	136	21.2
Upper East Fork	385	90	23.3
Summer Chinook Currently Hatchery-Influenced Redd Counts			
South Fork	1499	353	22.9
Lower Salmon River	468	102	21.8
Lower Valley Creek	107	24	22.0

* Some difference attributable to changes in survey methods.

Table 12. Natural chinook smolt capacity for Salmon **Subbasin** as determined by the Northwest Power Planning Council's standard density method.

Drainage	Run	Capacity
Lower Salmon (Mouth-French Cr)	Spring	239,214
Little Salmon	Spring	291,103
Little Salmon	Summer	144,985
Mid-Main&em Salmon (French Cr-Middle Fork)	Spring	505,456
South Fork Salmon	Summer	1,399,175
Secesh	Summer	692,838
Middle Fork Salmon	Spring	3,256,409
Middle Fork Salmon	Summer	481,351
Bear Valley	Spring	530,347
Panther Cr	Spring	42,769
Lemhi	Spring	715,499
Pahsimeroi	Summer	257,620
Upper Salmon (Middle Fork-Weirs)	Spring	1,586,454
Upper Salmon (Middle Fork-Weirs)	Summer	976,459
Headwaters Salmon	Spring	596,398
Total **Subbasin**		11,716,077

In addition to the above events, **irrigation diversions** were impacting anadromous fish production in the Lemhi and the headwaters of the Salmon River as early as the 3.850s. Irrigation withdrawals have reduced flows, limiting juvenile and adult passage and increasing water temperatures, often to critical levels for anadromous fish during summer months. Unquantified losses of juvenile outmigrants to irrigations diversions in the drainage continued unabated into the mid-1950s. Finally, studies by Gebhards in 1957 and 1958 documented anadromous fish losses in 60 Salmon River diversions in the upper part of the drainage. One of the objectives of these studies was to identify the most damaging diversions and prioritize the placement of screens under the auspices of the Columbia River Fisheries Development Program, which had been expanded in 1956 to include that portion of the Columbia River Basin above **McNary** Dam. As a result of these studies, Gebhards, as reported by Schill (1984), estimated a loss of 422,000 outmigrants in the Lemhi River in 1958 and suggested that a screening program could save over 1 million juvenile chinook during years of heavy outmigration.

Construction of screens on irrigation canals through the Columbia River Fisheries Development Program began in 1958 and ended in the late 1960s. The Bureau of Commercial Fisheries,+ now the National Marine Fisheries Service, administered funds for the project and the Idaho Department of Fish and Game constructed and maintained the screens. By 1969, 222 fish screens had been constructed on diversion ditches and canals within the drainage (Richards 1969); some 215 are currently active. These have about a 25-year life span and must be continually maintained. Nearly half of the active screens are located in the Lemhi River system. By the late 1960s, Columbia River Fisheries Development Program funds for new screen construction had run out before all major diversions were screened. Funding was then limited primarily to the operation, maintenance and replacement of existing screens. In the late 1970s, the Idaho Fish and Game used U.S. Forest Service funds to screen additional diversions in the Stanley Basin and Bureau of Land Management funds to screen diversions in the East Fork. Schill investigated benefits of the screening program in 1984. He estimated benefits from screening fry amounted to $0.33 per chinook and $0.14 per steelhead. He estimated net monetary values of salmon and steelhead smolts to be $3.30 and $2.87 per fish, respectively. He also concluded that a substantial amount of information needed to be acquired before the relationship between screen operation and maintenance costs and benefits could be more adequately evaluated. Information needs included flow data, trapping information, costs , and migration delay information. Managers are developing a five-year plan and have begun some limited evaluation.

Events outside the Salmon River Subbasin have constrained natural production the most. These include the development of hydroelectric dams and mixed-stock harvests. Upstream migrants suffer delays in finding the ladder entrances and ascending the ladders. Downstream migrants are killed outright or stunned while passing through turbines, making them more susceptible to predation. Impoundments behind the Snake and Columbia river dams slow river currents and delay migration. Upstream storage projects reduce or eliminate the spring freshet, compounding downstream migration delays. The advent of smolt transportation and the "water budget" has made some gains in survival, but not of the magnitude needed to restore runs to productive levels. Low flows in the upper Snake River are documented to have significant impacts on juvenile migrants. Although the water budget was created to alleviate this problem, it has become apparent that the water budget, as it is currently enacted, is inadequate. A major problem is the fact that the water budget fails to provide adequate flows for fish passage during low and even average water years.

Runoff forecasting errors emphasize other problems associated with conservative and rigid operating rule curves that give priority to reservoir refill and power generation over fish passage, when they are supposed to have equal weight. The Fish Passage Center (FPC) has concluded that "the Snake River presents a particular problem in that there are no minor modifications that would solve the problem [of water budget inadequacy]. A major program amendment that generates substantial increases in flow commitments for fish is the only solution," (FPC memo, June 21, 1988). Although a small amount of progress was made with the beginning of the Idaho Power Company's water budget participation in 1987, more water is needed. This could come, in part, from increased water releases from Brownlee and Dworshak reservoirs as well as new storage. However, the management of these reservoirs falls under the jurisdiction of the U.S. Army Corps of Engineers and Idaho Power. The Corps has not always complied with water budget measures in the Columbia River Basin Fislh and Wildlife Program and a September 30, 1988, memo issued by the Fish Passage Center reiterates this by stating "the lack of compliance with the Program by the Corps accentuated the inability of present Program measures to provide adequate protection."

Some changes in the management of the hydroelectric system may occur as a result of the Snake River adjudication. A joint agreement currently exists among the National Marine Fisheries Service, the U.S. Department of Interior, and Idaho Power, negotiating joint studies of fish and wildlife resources within the Snake River. The Federal Energy Regulatory Commission issued this order as a measure of the adjudication. Included in the agreement is a study plan for anadromous fish, outlined in Table 13. It addresses some of the flow problems discussed above.

Fishing has also substantially impacted chinook, as well as steelhead. Idaho stocks are mixed with coastal and lower river stocks in both ocean and Columbia River sport, commercial, and treaty fisheries. Mixed-stock steelhead fisheries also exist in the mainstem Snake and Salmon rivers, although currently, consumptive harvest is only allowed on hatchery fish. Many stocks of fish have harvestable surpluses. However, it is difficult to harvest surplus fish without overharvesting depressed stocks in a mixed-stock fishery. Besides smolt transportation and the water budget, encouraging developments include reduction in ocean harvest and increased survival through improved passage facilities.

Table 13. Outline of study plan for anadromous fish. (Joint agreement regarding fish and wildlife studies, FERC Docket No. EL83-38-000).

A. Water Studies to Promote Juvenile Anadromous Fish Migration.
Identify sources of additional water within the Snake River Basin to provide for migrating juvenile anadromous fish by evaluating several alternatives.

1. Existing storage and marketing.

 a. Compile information on existing Federal storage capacities and constraints. Review and evaluate the Snake River Optimization Study (Bureau of Reclamation).

 b. Evaluate possible effects on existing values and uses of providing flows for anadromous fish smolt migration using existing storage at Federal projects in the Snake River drainage.

2. Energy storage. Assess issues regarding energy and capacity exchanges and storage agreements and feasibility of modification to improve flows for juvenile anadromous fish.

3. New storage opportunities. Review literature and studies for development of additional storage capacity.

4. Changes in project operations. On basis of review and analysis of available rule curve literature, summarize feasibility of modifying project operations to improve flows for juvenile anadromous fish migration.

5. Water conservation opportunities and trends. Identify conservation strategies that may result in net gain of water supplies available to improve flows for juvenile anadromous fish migration.

B. Alternative Flow Regime Studies.

C. Instream Flows for Anadromous Fish Downstream From Hells Canyon Dam.

1. Conduct a preliminary study to determine need for evaluating habitat/discharge relationships for fall chinook and steelhead trout below Hells Canyon Dam.

2. Evaluate anadromous fish spawning and rearing habitat/discharge! relationships between Hell's Canyon Dam and Lower Granite Dam using lnstream Flow Incremental Methodology. Conduct a literature search to identify anadromous fish habitat suitability index curves. Identify appropriate instream flow regimes below Hell's Canyon Dam to protect and enhance anadromous fish resources.

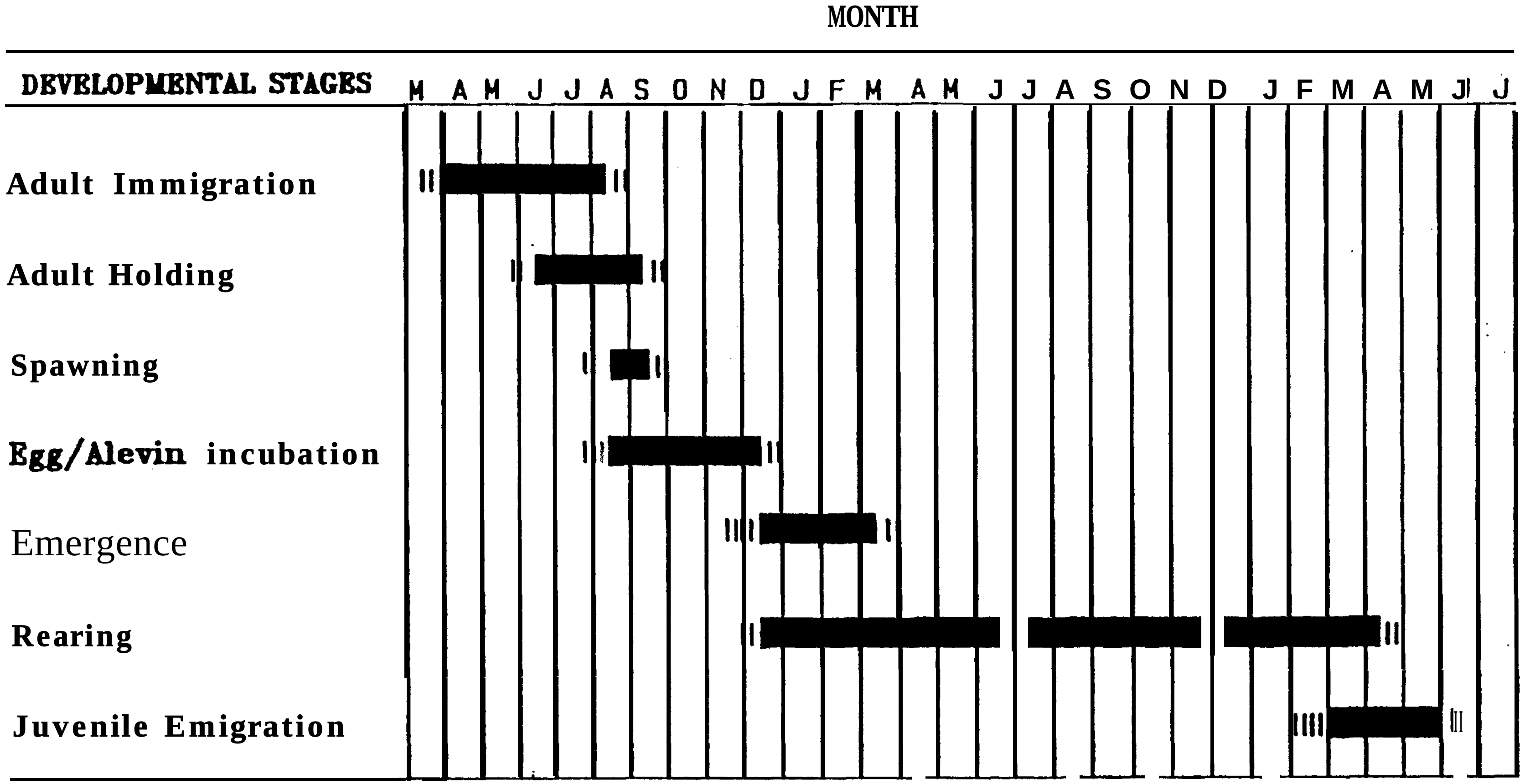
Several populations of spring and summer chinook reproduce naturally in the Salmon River drainage. Adult time of entry into the subbasin is April through September. Specific population characteristics are difficult to identify and for some tributaries little is known about the characteristics of the chinook inhabiting it. Biologists obtain most data from carcass surveys and at weirs. It is difficult to differentiate between spring and summer chinook where their ranges overlap; there . appears to be some differences in timing and spawning areas. Hatchery and wild/natural groups are inseparable because managers do not differentially mark all hatchery chinook, as they do hatchery steelhead.

In general, Salmon River spring and summer chinook display similar life history timing, as shown in Tables 14 and 15. Smolt size at migration for both spring and summer chinook is about 4 inches to 5 inches. Information from the mid-1950s indicates that 3-year-old fish (l-ocean or jacks) less than 25 inches made up a sizeable portion of the chinook run each year. During 1954 to 1956, approximately 15 percent of the spring and summer chinook salmon runs were less than 21 inches long and only 1 percent were females (Bjornn 1960). Gebhards (1959) used sex ratios ranging from 1.38-to-1 to 1.44-to-1 males to females, to estimate escapement for 1955 to 1958, respectively. However, this high percentage of jacks has not been reflected in recent carcass surveys or in spring chinook hatchery weir counts. Generally, 4-year-old chinook (a-ocean) are 27 inches to 30 inches long and average 8 pounds to 10 pounds, while 5-year-old fish (3-ocean) are 34 inches to 37 inches and 15 pounds to 18 pounds (Mallet 1974). Some specific information concerning life history and characteristics of individual populations is discussed below.

Spring Chinook

The Middle Fork Spring chinook is a wild population that managers are not supplementing with hatchery fish; the Idaho Fish and Game is managing this drainage for natural production of the native fish. The mainstem itself is 106 miles long, most of which is used by chinook for some phase of its life cycle. As many as 28 tributaries also contain chinook. Fish trapped at Bear Valley and Elk creeks during the 1950s and 1960s for the Clearwater River Reintroduction Program provided some data on average fecundity (Table 16). This group has a strong 3-ocean component and appears to have some sex ratio differences by age class.

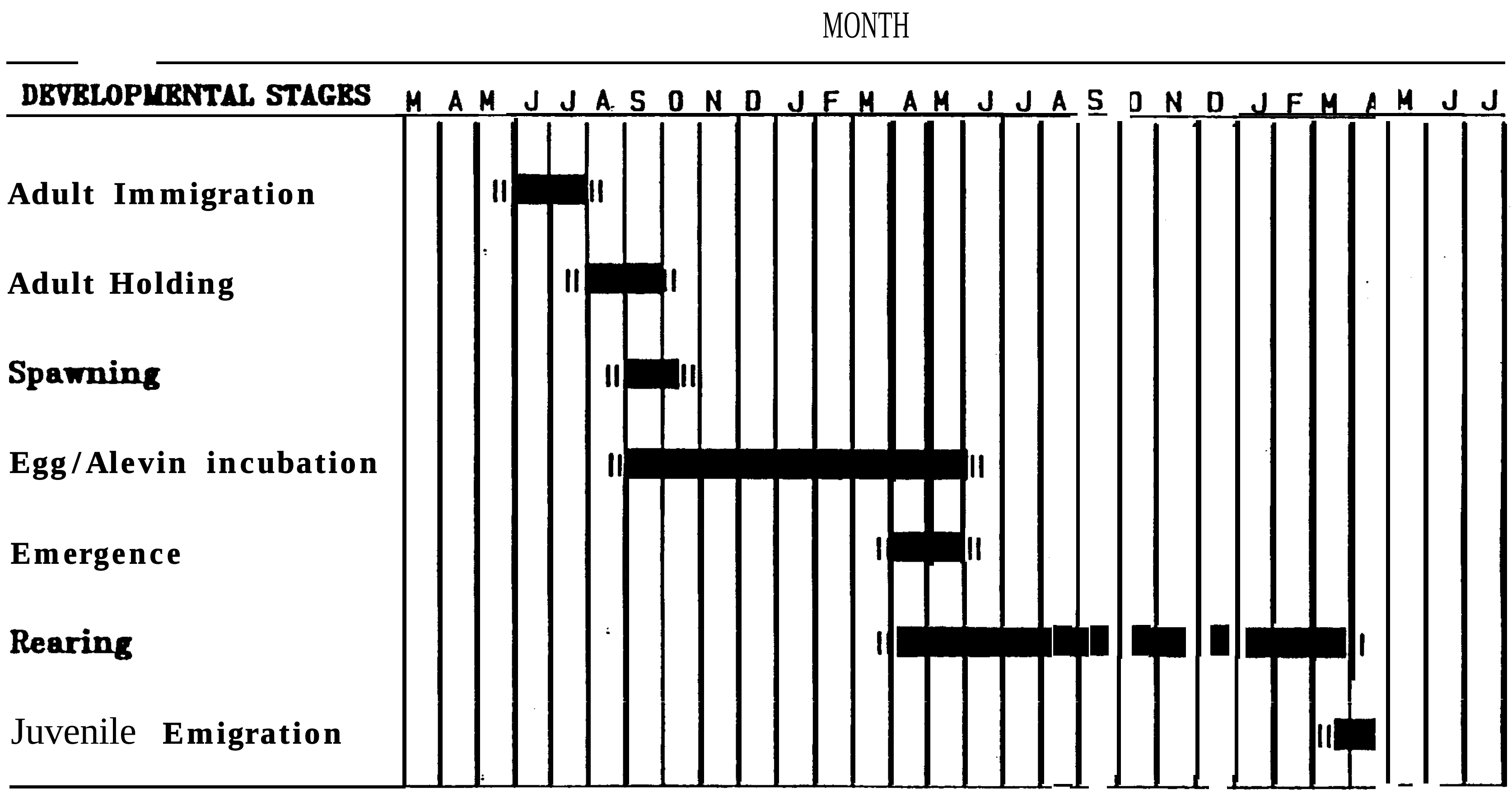
Table 14. **Freshwater** life history **for** natural/wild spring chinook in the **Salmon** River subbasin.



Notes:

1. **The** developmental stage timing **represents** basin-wide **averages,** local conditions may **cause some** variability.
2. Solid **bars** indicate **periods of** heaviest adult immigration, spawning **and** juvenile emigration.

Table 15. Freshwater life history for natural/wild summer chinook salmon in the Salmon River subbasin.



Notes:

1. The developmental stage timing represents basin-wide averages, local Conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration. spanning and juvenile emigration.

Table 16. Wild and natural chinook salmon average fecundities, Salmon River drainage.

Stock	Year	Stream	Average Fecundity
Spring Chinook			
Upper Salmon	1961-69	Salmon River (Decker Flat)	5,292
Middle Fork	1952-53	Elk Creek	4,914
Middle Fork	1962-69	Bear Valley Creek	5,712
Lemhi	1962-68	Lemhi River	4,787
Summer Chinook			
South Fork	1961-69	South Fork (Stolle Meadows)	3,590
Pahsimeroi	1969-77	Pahsimeroi River	5,255

During carcass surveys in the early 1960s, researchers noted that 2-ocean females were less prevalent than 2-ocean males; the reverse was true in the 3-ocean age class (Bjornn et al. 1964). Carcass surveys from 1960 to 1979 revealed an ocean age composition of 2 percent jacks, 31 percent 2-ocean, and 67 percent 3-ocean fish based on length frequencies. Egg-to-smolt survival values are not available. Researchers have recently estimated survival of early life stages in relation to habitat quality. They estimate egg-to-parr survival for Marsh Creek, a high quality habitat, at 32.5 percent, and for Elk Creek and Bear Valley Creek, where sedimentation has degraded habitat, at 2.8 percent and 3.4 percent, respectively (C. Petrosky, IDFG, pers. commun. and M. Rowe, Shoshone-Bannock Tribes, pers. commun.). This research is continuing in conjunction with fry and parr density monitoring. Smolt-to-adult survival estimates are not available at this time. Spawning escapement appears to be about 20 percent of historical escapement, however, some tributaries appear to be experiencing an upward trend.

The upper Salmon River, from the East Fork upstream, is managed as a natural population supplemented with hatchery production of the same population. Naturally produced chinook are throughout this area. Carcass surveys in the 1960s showed 3-

ocean fish predominating, especially among females. Sex ratio samples for carcasses in 1961 to 1964 were nearly equal (Howell et al. 1985). No carcass surveys have been reported in recent years. Average fecundity, measured when biologists trapped fish at Decker Flat during the 1960s for the Clearwater River Reintroduction Program, was 5,292 eggs per female (Table 16). Data collected from upper Salmon River check stations from 1970 to 1974 indicated that of 3,009 adult chinook checked, size . ranged from 20 inches to 49 inches (fork length), the average male length being 31.2 inches and the average female length, 35.8 inches. These fish would have been mainly from the Middle Fork Salmon River and the Salmon River upstream from the East Fork.

Limited supplementation occurred with Rapid River fish in the late 1970s; spring chinook in upper areas were mainly native fish. Managers used Rapid River fish previously for experimental rearing in Decker Pond, but believed these fish did not survive very well (see Sawtooth Hatchery brood stock discussion). Currently, as part of the Sawtooth Hatchery and East Fork Trap program, managers release upstream at least one--third of the run to spawn naturally, thus, age and sex characteristics are probably similar to those measured at the weirs. No information exists for downstream tributaries where this group of fish occurs. However, biologists believe that characteristics are similar in supplementation areas.

Although an egg-to-smolt survival rate is not available, some natural survival estimates for other life stages are. Researchers have estimated an egg-to-parr survival of 25.5 percent for the upper Salmon River and 13.6 percent for Herd Creek, a tributary of the East Fork. Habitat quality probably accounts for the differences (C. Petrosky, IDFG, pers. commun.)

The other natural population of chinook for which managers have some documentation is in the Lemhi River. Managers have periodically supplemented spring chinook in this productive system since the 1920s. However, in the last 20 years, redd counts have declined dramatically (Table 11). Summer chinook may have possibly been present in this stream, but were probably eliminated due to low water conditions.

With the advent of Hayden Creek Research Station in the 1960s, managers planted spring chinook into the system from areas other than the Lemhi (see Hayden Creek Research Station summary). Researchers also suppose that the spring chinook: timing may have been altered by hydroelectric and irrigation diversion dams (Bjornn 1978). Life history is similar to a general Salmon Subbasin spring chinook. The Lemhi spring chinook evidently exhibit a stronger 2-ocean return, as determined by weir counts from 1965 to 1974 (Bjornn 1978). He reported a run composed of 3 percent jacks, 53.5 percent 2-ocean and 43.5 percent 3-ocean fish, as determined by length frequencies. In 1963, researchers reported that, based on carcass surveys, 2-ocean females consistently outnumbered 2-ocean males. However, 1965 and 1966 weir data indicated that the sex ratios were near equal with 45.5 percent females in the 2-ocean class and 57.5 percent in the 3-ocean class. Average fecundity of the native population, determined when managers trapped Lemhi River chinook in the 1960s for the Clearwater Reintroduction Program, was 4,787 eggs per female (Table 16).

Bjornn (1978) estimated an average egg-to-smolt survival rate of 9.7 percent for spring chinook in this system; this value represented a variety of seeding levels. He also estimated survival of smolts from the time smolts left the upper Lemhi until they returned as adults. Values ranged from 0.18 percent for the 1971 year class, to 1.22 percent for the 1963 year class.

Summer Chinook

Generally, summer chinook enter the Columbia River in June and July and the Salmon Subbasin in June through September. They appear to hit peak spawning later than spring chinook. As with the spring chinook, there appears to be several groups of summer chinook indigenous to their natal streams. While no longer as ubiquitous as spring chinook, apparently summer chinook historically were widespread throughout the drainage. Gebhards (1959) stated chinook that spawned much later than the rest of the drainage, peaking around mid-September, used the Morgan Creek to Stanley section of the Salmon River. He also noticed that Panther Creek had two separate runs of salmon. An early run spawned in the headwater area and peaked around August 15, while a later run spawned downstream and peaked around September 1. Gebhards also reported that two separate spawning runs entered the South Fork. One entered in June and moved into Stolle Meadows to spawn from mid-August to early September. The second run entered the river in August and began spawning around the first of September, mainly in the Poverty Flat area. However, Welsh et al. (1965) reported that tag returns and the arrival time of these fish indicated the run was entirely a summer chinook run. Following is more specific information, however, little information exists for the remaining wild runs.

Summer chinook are native to the South Fork Salmon River drainage. Currently, the Secesh River is managed for natural production of wild indigenous stocks of summer chinook, while other parts of the drainage are managed for a mixture of hatchery and natural production. Runs of wild summer chinook in the early 1960s ranged from about 5,600 fish to 10,200 fish. Sport harvest reached a maximum of nearly 4,000 fish and spawning escapement peaked at over 6,200 fish in 1960. Redd counts available since 1957 show that the run peaked in the late 1960s and reached a low in 1979 (Table 11). From 1964 to 1967, at a counting weir approximately halfway up the South Fork, the run's first fish arrived as early as June 29 and as late as July 19. Adult salmon tagged at Bonneville Dam from June 6, 1966 to July 7, 1966, were later recovered at the weir. Spawning in the Stolle Meadows area of the upper South Fork peaked the last few days of August, while spawning below Stolle Meadows peaked in mid-September during the early 1960s. Life history is illustrated in Table 15 and fecundity, derived when biologists trapped these fish in the 1960s for the Clearwater Reintroduction Program, was 3,590 eggs per female (Table 16).

The yearly age composition of the population has varied tremendously. Generally, this is a 2-ocean spawning race. A unique feature of this population of fish is a very strong jack return, thus sex ratios lean heavily toward males (Howell et al. 1985). Bjornn (1964) reported that the summer chinook runs that enter the South Fork Salmon River contain a larger percentage of l-ocean fish than spring populations. Consequently, males are more numerous than females. The 3-ocean fish are predominantly female as with spring run fish.

Since the late 1960s, biologists have attempted to trap a portion of the indigenous summer chinook run that returns to the Pahsimeroi River. This was done to enhance the run and produced small numbers of smolts from the native fish. Average fecundity during this period was 5,255 eggs per female (Table 16). During Pahsimeroi Hatchery's spring chinook program, in the early to mid-1980s, managers separated spring and summer chinook at the weir based on timing and appearance, and then released summer chinook upstream to spawn naturally. Now that 'the hatchery has converted to a summer chinook program, this run will consist of natural production supplemented with hatchery production from a combination of native Pahsimeroi and South Fork Salmon River brood stock. Managers release upstream at least one-third of the run for natural production. This run shows a predominance of 2-ocean fish, similar to the South Fork summer chinook that return to McCall Hatchery. It also has a higher percentage of jacks than spring chinook. Information collected at the weir shows that the run is 17 percent jacks, 68.5 percent 2-ocean and 14.5 percent 3-ocean fish, based on length frequencies. Currently, no egg-to-smolt or smolt-to-adult survival rates are available.

An indigenous run of summer chinook also returns to Rapid River, although very little information exists about this run. Welsh (1965) reported that the bulk of spawning took place in the lower five miles of Rapid River. In 1959, he observed chinook spawning from September 9 through September 14, and including the West Fork, saw 49 live fish and 81 redds. Since the advent of Rapid River Hatchery, managers segregate spring and summer chinook at the weir based on timing and appearance, releasing the summer chinook upstream to spawn naturally. Spawning escapements have ranged from 62 to 1,269 fish from 1965 to 1987. From what managers note at the hatchery weir, it appears that 2-ocean fish dominate the run.

Areas of the Salmon River upstream from the Pahsimeroi, such as the broad riffles near the mouth of Warm Spring Creek, lower Big Creek and Loon Creek in the Middle Fork drainage, lower East Fork and lower Valley Creek, are believed to be historical spawning areas for summer chinook. Because of the difficulty of obtaining carcasses in many of these areas, especially from mainstem Salmon River riffles, stock characteristic data is lacking. Managers believe, however, that these upriver fish exhibit characteristics similar to the spring chinook, with a predominant 3-ocean age class. These are reportedly extremely large fish.

The supplementation history of chinook and steelhead for the Salmon River Subbasin is combined with hatchery production in Appendix D. Major production constraints for salmon and steelhead within the subbasin are listed in Appendix E. Reference should also be made to Part II.

Hatchery Production

Hayden Creek Research Station

Hayden Creek Research Station was constructed in 1966 to initiate and investigate pond rearing techniques of summer steelhead. In 1970, the station also began annual fall releases of 5-month-old pond-reared spring chinook. Beginning with the spring release in 1979, researchers discontinued all steelhead smolt releases and gave priority to spring chinook smolt production (Beers 1979). In 1974, although operations were still experimental, a hatchery manager was assigned to the station. The station was later transferred from research to hatcheries, and then closed in 1982. Currently the station is used as a research facility for the University of Idaho.

The station is located on Hayden Creek about three miles upstream from the confluence of the Lemhi River. Water can be drawn from a 52-degree-Fahrenheit spring or directly from Hayden Creek. The spring water contains high levels of zinc and copper, which cause high mortality in green eggs.

Because this was a research station, researchers used a variety of chinook stocks. Chinook eggs came from the Lemhi, Hayden Creek returns, and Rapid River. Since the station's construction, adult bypassing was a problem. In 1979, a moropholine homing experiment was initiated, however, no results were published.

Decker Flat Rearing Ponds

Decker Flat was a gravel-pit pond developed for the experimental rearing of chinook salmon. Basic project operations changed from an overwintering program to a summer rearing and fall release program in the early 1970s. The pond was constructed in 1966 on the upper Salmon River near what is the present site of the Sawtooth Hatchery. The water supply came from ground seepage and a diversion on the Salmon River (Reingold 1970).

The original brood stock in 1966 was upper Salmon River chinook. In subsequent years, researchers used eggs from Hayden Creek, Lemhi River, and Rapid River. In 1967, brood stock came from the Marion Forks Hatchery in Oregon because of a loss of the Salmon River eggs. This was the only year that researchers used a downriver stock; survival was very poor.

In the fall of 1975, researchers noted a high incidence of clouded eye lenses in pond juveniles and discovered the presence of the eye fluke *Diplostomum snathaceum*. It was believed that this parasite had possibly gone undetected at lower levels in prior rearing cycles (Reingold 1976). Managers studied the pathology of the eye fluke and incorporated prophylactic measures into the Sawtooth Hatchery, at that time in the design stage. During a survey of the upper Salmon River, Heckmann (1983) found chinook to be relatively free of the fluke. With the decision to build Sawtooth Hatchery, managers discontinued the experimental program at Decker Flat in the late 1970s.

Rapid River Hatchery

The Idaho Power Company owns and funds the Rapid River Hatchery, constructed in 1964, as part of its mitigation for spring chinook lost to the construction and operation of Brownlee, Oxbow, and Hells Canyon dams on the Snake River. The Idaho Department of Fish and Game operates the facility under contract. As mitigation for these dams, the Federal Energy Regulatory Commission (FERC) mandated that the Idaho Power Company have fish facilities constructed prior to the filling of Brownlee Reservoir. Idaho Power's program, as it exists today, is a culmination of negotiations with the signatories of a settlement agreement (FERC Docket No. E9579) and has been approved by FERC (L. Wimer, Idaho Power Company, pers. commun.).

As part of its program, Idaho Power transplanted mid-Snake River chinook to the Salmon drainage and has provided funds for the production of 3 million smolts annually at Rapid River Hatchery. Mitigation requirements are for 2 million spring chinook smolts into the Salmon River and 1 million smolts into the Snake River at a targeted size of 15 fish to 25 fish per pound and an age of 19 to 20 months. Although not a specified mitigation objective, an added value of this program has been its ability to provide spring chinook, primarily eggs and fry, for other programs such as the Clearwater Spring Chinook Reintroduction Program. The 1987 release consisted of 2,929,400 smolts weighing 129,374 pounds and 649,000 fry weighing 1,577 pounds. Information on rack returns, ocean-age proportions, life history, and fecundity are presented in Appendix F.

The Rapid River Hatchery is seven miles southwest of Riggins in Idaho County. The adult trapping facility is on Rapid River, approximately one-half mile downstream from the hatchery. The water source for all functions of the hatchery is Rapid River itself, a tributary to the Little Salmon River. Included in the federal Wild and Scenic Rivers Act, the Rapid River drainage has not been subjected to perturbations such as logging and roading, and provides an excellent water source for rearing chinook. A diversion dam provides the necessary hydraulic head to supply the hatchery with approximately 30 cubic feet per second (cfs) of water (Levendofske et al. 1988). In addition, managers can supply the incubators with Rapid River water from a gravity-fed or pumped system. Idaho Power has also drilled wells at the hatchery to provide an emergency source of water (L. Wimer, Idaho Power Company, pers. commun.).

Managers transplanted the spring chinook brood stock for this program from Hells Canyon Dam during 1964 through 1968. These fish originally occupied waters above the dam such as the Powder River, Eagle Creek, and the Weiser River. Studies conducted at Brownlee and Oxbow dams showed that downstream migrant chinook and steelhead were not passing through the reservoirs to maintain the runs, thus the program to rear offspring in artificial propagation facilities began (Reingold 1966).

Although primary emphasis has been on spring chinook, managers have attempted to raise other anadromous species at Rapid River. Although attempts were made during the 1960s and 1970s to raise steelhead, including the indigenous Rapid River A-strain fish, temperature problems precluded a steelhead program. Flooding has also posed hazards. For example, in 1974, Rapid River Hatchery obtained almost 5.4 million Clearwater B-strain steelhead eggs from Dworshak Fish Hatchery. However, almost all fry were destroyed when flood waters washed out the water supply line. The few survivors died from related stress factors (Parrish et al. 1975). Although fall chinook were hauled to Rapid River and spawned in 1964, cooler water temperatures caused high adult mortality. Consequently, this program did not succeed. In contrast, the spring chinook program has been very successful and has provided the backbone of the hatchery spring chinook program in Idaho.

Because an indigenous summer chinook run was present prior to the spring chinook introduction, managers retain spring chinook and release summer chinook upstream to spawn naturally. In addition to rearing progeny of adults returning to Rapid River, this hatchery also rears the progeny of spring chinook returning to Idaho Power's Hells Canyon Trap, as part of the company's mitigation program.

At this facility, pre-smolts prematurely migrate naturally out of ponds in the fall and, consequently, a determination is needed whether these fish are responding to stress or an environmental factor, whether these fish survive, and if necessary, determine the best prevention of this early outmigration. If needed, outmigration could probably be prevented by removing the water driven drum screens for the pond outlets and replacing them with fixed screens.

Sawtooth Hatchery

Sawtooth Hatchery and the East Fork Trap are part of the Lower Snake River Compensation Plan (LSRCP) and were built to compensate for losses of anadromous fish caused by lower Snake River dams. The U.S. Army Corps of Engineers constructed the facilities, the Idaho Department of Fish and Game operates the facilities, and the U.S. Fish and Wildlife Service administers and funds the operations. The hatchery is located along the upper reaches of the Salmon River, five miles south of Stanley in Custer County and has been in full operation since February 1984. Fisheries managers at this facility trap, spawn, and rear spring chinook to smolts as well as collect steelhead eggs for Magic Valley Steelhead Hatchery and Hagerman National Fish Hatchery. The hatchery also raises some summer steelhead to fry. Water sources consist of the Salmon River and three production wells. The satellite station, 16 miles up the East Fork: Salmon River, consists of trapping, holding and spawning facilities for salmon and steelhead adults (Rogers 1988).

The hatchery is designed to rear on site 2.9 million spring chinook smolt at 20 fish per pound. The targeted release size for chinook smolts is 15 to 25 fish per pound. In 1987, this facility also produced sockeye, which is discussed in a separate section.

The mitigation goal for the facility is to return about 19,232 spring chinook adults to the Snake River Basin. This figure employs a smolt-to-adult return rate of 0.87 percent, and a smolt size of 15 fish per pound (D. Herrig, USFWS, pers. commun.). The 1987 spring chinook return to the Sawtooth

Hatchery and East Fork Weir was 1,616 fish. No estimate exists for other returns to the basin. To perpetuate the natural runs of spring chinook that exist in the upper Salmon River, managers release at least one-third of the run to the East Fork and Sawtooth weirs upstream for natural production.

The spring chinook'hatchery brood stock consists of the indigenous spring chinook in the upper Salmon River and returns from Rapid River Hatchery offspring that biologists released at the Sawtooth Hatchery site from 1977 to 1979. There were earlier plants of Rapid River fish during the early to mid-1970s, however, these were experimental during the operation of Decker Ponds; adult returns appeared to be negligible. Eye fluke infestation also played a part in poor survival. In general, the upper Salmon River stock of spring chinook exhibits predominantly 3-ocean return. Information on rack returns, ocean-age proportion, life history, and fecundity is presented in Appendix F.

Some constraints to fish production at the Sawtooth Hatchery are discussed below.

A) Steelhead fry must be outplanted prior to July to accommodate chinook production: this facility was built to rear chinook. Low water temperatures throughout most of the year do not allow sufficient growth for steelhead smolt production.

B) The upper Salmon River is positive for Mvxosoma cerebralis or whirling disease. Ozone treatment of rearing water can control this disease in the hatchery, however, a maximum of 55 cfs of river water would have to be treated. This treatment would also reduce or eliminate other pathogens in the hatchery water system.

C) Managers are currently using well water for egg incubation due to the incidence of whirling disease in the Salmon River. However, due to high water temperatures, hatchery eggs are developing much faster than naturals, producing much larger smolts, which causes density-related problems such as stress and fin erosion. A water chiller capable of chilling 350 gallons per minute 10 degrees (to 38 degrees or 40 degrees Fahrenheit) would be needed to obtain optimum fish size during rearing and release.

D) Spring chinook and steelhead eggs must be trucked from the East Fork, as must chinook smolts for the return trip.

E) Current adult escapement levels are low, especially for spring chinook.

McCall Hatchery

The McCall Summer Chinook Hatchery was the first facility built to enhance salmon runs under the auspices of the Water Resources Development Act, which Congress enacted in 1976. This act authorized the Lower Snake River Compensation Plan. McCall Hatchery serves as part'of this compensation for fish losses due to Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams (Frew 1988). The hatchery's purpose is to restore the depleted summer chinook salmon run in the South Fork Salmon River. Due to the high priority of restoring this important chinook run, funding was obtained from the U.S. Army Corps of Engineers for pilot rearing programs in the mid-1970s. In 1977, the Pacific Northwest Regional Commission provided funding to begin designing the new hatchery. With this early start, it was possible to complete enough construction so that hatchery managers could raise the 1979 brood year entirely at the hatchery (Partridge 1984). As with the Sawtooth Hatchery, the Corps of Engineers constructed McCall Hatchery, the Idaho Fish and Game operates it, and the U.S. Fish and Wildlife Service administers and funds the facility.

The hatchery is located within the city limits of McCall in Valley County on the North Fork Payette River, approximately one-fourth mile downstream from Payette Lake. A satellite trapping and spawning facility is located on the South Fork Salmon River near Cabin Creek, approximately 26 miles east of Cascade. Hatchery water is collected from two inlets in Payette Lake, one at the surface and one 50 feet deep, so that managers can regulate water temperatures and quality. The adult return goal to the South Fork Salmon River as a result of McCall Hatchery production is 8,000 adults. The hatchery is designed to produce 1 million summer chinook smolts at 16 to 18 fish per pound. The original compensation was to produce 1 million summer chinook smolts at 18 fish per pound. The 1984 brood year was the first year that managers almost met the production goad, releasing 970,300 smolts. Releases in 1987 consisted of 958,300 smolts weighing 47,450 pounds, and 118,424 fry weighing 255 pounds.

The brood stock history of McCall Hatchery is complex. In 1978, adults were trapped at Little Goose Dam, spawned at Rapid River Hatchery and smolts reared at Mackay Hatchery due to McCall's construction. In 1979 and 1980, adults were trapped at Lower Granite Dam, spawned at Dworshak National Fish Hatchery, and raised at McCall Hatchery. It should be noted that most of the upriver summer chinook run does return to the South Fork. Additionally, managers collected adults at the South Fork Salmon River Trap in 1980. The first year that managers collected all hatchery brood stock directly from the South Fork Salmon River Trap was 1981.

To perpetuate the natural run of summer chinook in the South Fork above the trap, at least one-third of the returning adults are released upstream to spawn naturally. Managers spawn adults at the trap site and transport fertilized eggs from the trap to the hatchery where they are incubated and raised to smolts. Smolts are then transported back to the South Fork and released above the trap. Information on rack returns, oc:ean-age proportion, life history, and fecundity is presented in Appendix F.

A major disease has been **"spring** thing," which was responsible for the loss of up to 27 percent of production during 1980 through 1983. Managers believed this disease was linked to a nutritional deficiency; the addition of pantothenic acid to the diet has greatly decreased mortalities. The rearing of fry in McCall's extremely soft water at 36 F to 39 F is also believed to be correlated with this disease (Hutchinson and Chacko 1985). Other impediments or constraints to production c:an be minimized by:

A) Increasing the spawning area at the trap and enclosing the southwest corner to give a larger work area and provide shade for water hardening eggs.

B) Installing a silt trap for the egg incubator line to improve water quality.

C) Installing a false bottom on the South Fork: Salmon River Trap to reduce stress on adults.

D) Including plumbing to allow for mixing of water temperatures at the hatchery rather than at Payette Dam, and to allow for differential water temperatures to be delivered to the incubators and the fry and smolt rearing areas.

Pahsimeroi Hatchery

Idaho Power Company owns and finances the Pahsimeroi Hatchery as part of its fish program under FERC License 1971 for the Hells Canyon Hydroelectric Complex. The facility is operated under contract by the Idaho Department of Fish and Game and has been in production since the mid-1960s. Idaho Power constructed Pahsimeroi Hatchery as part of a program to relocate a portion of the mid-Snake River steelhead run to the Salmon River drainage.

The hatchery is located one mile upstream of Ellis on the Pahsimeroi River in Lemhi county. It receives its water directly from the river or a series of nearby springs. River temperatures vary from 32 F to 64 F while spring temperatures vary from 52 degrees to 55 degrees. A set of chinook **rearing** ponds is located at a separate facility seven miles upstream on the Pahsimeroi

River. Design capacity of the entire facility is 5 million green eggs, 3,500 adults, and 1 million chinook smolts.

Managers have raised steelhead, spring chinook, and summer chinook to various stages at this facility and have implemented a variety of research programs. A primary goal of this station is to take steelhead eggs for rearing at Niagara Springs Hatchery to sustain the hatchery steelhead run in the Salmon River drainage. Although the Pahsimeroi Hatchery expanded during 1980 and 1981 to increase its rearing capacity to 1 million chinook smolts, production of summer chinook has been limited in recent years by insufficient number of eggs.

Hatchery managers reared and released spring chinook from 1983 through 1986 (brood years 1981 to 1984), meeting Idaho Power's mitigation requirement of 1 million chinook smolts into the Pahsimeroi River. The brood stock for the spring chinook were from adult returns to Hayden Creek Hatchery and Rapid River Hatchery. Spring chinook were last released into the Pahsimeroi River in 1986; progeny of subsequent returns have been used for other programs because Pahsimeroi Hatchery converted to rearing solely summer chinook in 1987. In 1987, managers produced 444,700 smolts weighing 18,300 pounds and released them into the Snake River. Information on rack returns, ocean-age proportion, life history, and fecundity is presented in Appendix F.

Biologists first collected summer chinook eggs for the Pahsimeroi program in 1968. The brood stock consisted of an indigenous run of summer chinook in the Pahsimeroi River. Early reports indicate that, generally, chinook arriving prior to July 15 were allowed to spawn naturally upstream, and those arriving afterward were held in the hatchery. During these early years, eggs were reared to fry at Mackay Hatchery and then shipped back to Pahsimeroi and released as fingerlings. This evolved into a smolt program. With hatchery expansion in 1980 to 1981, managers initiated a spring chinook program, however, they continued to spawn and rear summer chinook returning to the hatchery.

In 1987, the chinook program at Pahsimeroi Hatchery converted solely to a summer chinook program and managers no longer release spring chinook into the Pahsimeroi River as part of Idaho Power's mitigation goal of 1 million chinook smolts. Due to the low number of summer chinook returning to the Pahsimeroi River, the 1985-brood-year egg lot was a combination of the Pahsimeroi River summer chinook and eggs collected from South Fork Salmon River summer chinook (Moore 1988). The 1987 production consisted of 258,600 smolts weighing 16,163 pounds. Information on rack returns, ocean-age proportion, life history, and fecundity is presented in Appendix F.

Some of the production constraints at this facility are as follows.

A) Fish have been exposed to whirling disease, and to reduce exposure, the use of spring or well water would be desireable during the early rearing segment of egg and fry development.

B) The spawning area could be covered to protect spawning operations.

C) Previously during low flow periods, only 3 cfs of water reached the rearing ponds. Idaho Power, however, is working to alleviate this problem and anticipates having it remedied by the time fingerlings are ponded in 1989.

D) Adults are stressed due to changing water flows in the trap. An improved trap pen would allow the trapping and counting of fish into the holding pen without lowering the water level.

Harvest

Spring Chinook

The Nez Perce and Shoshone-Bannock tribes historically fished the Salmon River drainage. In the mid-1960s a substantial Indian fishery was present on the East Fork and on the Yankee Fork, although the extent of that fishery is unknown. Chinook are a priority harvest species for tribal members, who have harvested chinook in tributaries of the Middle Fork, the South Fork, the Little Salmon and the mainstem Salmon rivers. Currently, due to depressed spring chinook runs, the Nez Perce Tribe harvests spring chinook from the Rapid River Hatchery supported run in the Little Salmon River and Rapid River. Tribal catch of spring chinook has ranged from 1,855 to 2,800 fish from 1985 through 1987 (Statler 1986, P. Cowley, Nez Perce Tribe, pers. commun.). The preliminary estimation for Nez Perce harvest of spring chinook in 1988 was 3,524 fish (P. Cowley, Nez Perce Tribe, pers. commun.).

Through severe restrictions on harvest locations and limits, the Shoshone-Bannock Tribes have also limited their subsistence and ceremonial fishing over the last 10 years because of depressed fish numbers. In 1984 and 1985, the Shoshone-Bannocks voluntarily closed the season for salmon. They too have restricted their harvest efforts to a hatchery run. In 1986 and 1987, the Shoshone-Bannock Business Council limited tribal members to fishing the South Fork Salmon River (discussed under summer chinook) and selected waters above the Middle Fork. Due to these self-imposed regulations, harvest of hatchery spring chinook in Yankee Fork, the principal fishery for the Shoshone-Bannocks, was held to 1,000 and 414 fish in 1986 and 1987, respectively, (M. Rowe, Shoshone-Bannock Tribe, pers. commun.). These are hatchery adults outplanted into Yankee Fork for the purpose of a tribal fishery.

Horner and Bjornn (1981) reported that statewide, Idaho anglers harvested an average of 23,000 spring and summer chinook annually, prior to construction of Ice Harbor Dam in 1961. Chinook harvest has steadily decreased and the first chinook closure was in 1965 because of small upriver escapement. Chinook seasons were also closed to non-treaty harvest in 1975 and 1976. From 1979 through 1984, the spring chinook runs returning to Idaho were too low to allow a non-treaty harvest and still meet hatchery and natural escapement needs, thus non-treaty harvest was curtailed. Since 1985, spring chinook harvest for non-treaty fishermen has primarily been restricted to the Little Salmon River below the mouth of Rapid River. This fishery harvests fish from the Rapid River Hatchery spring chinook run. Because of the critical nature of other stocks, no other harvest by non-treaty fishermen is currently allowed.

In 1985, anglers harvested fish in Panther Creek, however these fish were Rapid River Hatchery fish that had been reared at Pahsimeroi Hatchery and were trucked to Panther Creek from Pahsimeroi Hatchery. Harvest of spring chinook from 1977 through 1987 is listed in Table 17. The preliminary estimate for the non-tribal harvest for 1988 is 725 fish. A comparison of chinook harvest for 1960, 1974, 1977 and 1986 clearly shows a trend of declining runs and tributary closures (Table 18). For further comparison, in 1959, approximately 37,667 spring and summer chinook were harvested from the Salmon River drainage whereas in 1986, about 380 spring chinook were harvested, the lowest chinook harvest on record for a salmon season.

Table 17. Salmon River non-treaty chinook harvest. Harvest was composed primarily of spring chinook. Harvest since 1978 has been restricted to the Little Salmon River.

Section	1977	1978	Closed Seasons	1985	1986	1987
Lower Salmon (includes Little Salmon River)	1,702	1,553		2,313	2,976	380
Salmon Canyon (French Cr. to Middle Fork)	104	293		CS*	CS	CS
Middle Fork	404	1,724		CS	CS	CS
South Fork	CS	CS		CS	CS	CS
Lemhi	ND**	106		CS	CS	CS
Upper Salmon (Middle Fork to East Fork)	396	804		CS	834	CS
Headwaters (East Fork upstream)	525	1,782		CS	CS	CS
Total	3,131	6,262		2,313	3,810	380

* CS = Closed Season
** ND = No Data

Table 18. Comparison of Salmon Subbasin chinook harvest for selected years.

Drainage	1960	1974	1977	1986
South Fork	10,168	4	CS*	CS
Middle Fork	5,955	429	404	CS
East Fork	2,256	90	ND**	CS
Lemhi	2,850	35	CS	CS
Little Salmon	ND	322	1,430	2,976
Salmon River below Middle Fork	3,141	64	376	CS
Salmon River above Middle Fork	15,866	576	921	834

* CS = Closed Season
** ND = No Data

Historically, the Middle Fork and its tributaries, as well as the upper Salmon River to its headwaters, have produced the largest numbers of chinook in the sport harvest. This harvest, however, also included some summer chinook. Hauck (1960) reported that the Salmon River drainage above the Middle Fork accounted for over 50 percent of the statewide chinook harvest in 1959. Harvest of spring chinook from these two sections from 1969 through 1978 is listed in Table 19. Mallet (1974) reported that the mainstem Salmon produced 52.4 percent of the chinook harvest, the Middle Fork 26.7 percent, the Lemhi 7.1 percent, the Little Salmon 4.1 percent, and other tributaries 2 percent. However, this is not an accurate indicator of distribution due to differential access. Another important tributary for salmon harvest beginning in the late 1970s was the Little Salmon River, due to the Rapid River Hatchery program. In 1988, 100 percent of the non-treaty spring chinook harvest came from the Little Salmon River.

The Idaho Anadromous Fisheries Management Plan (IDFG 1985) identifies a number of long-term goals that play a part in the agency's current salmon and steelhead management program. Four key principles guide harvest management. Meeting and maintaining natural and hatchery spawning escapement objectives is a primary criterion. Also, preserving the genetic integrity of anadromous stocks has priority overmaximizing harvest potential. The third principle states that the productive capability of all available natural habitat will be utilized, and the fourth states that the maximum amount of fishing opportunities for anadromous fish resources consistent with the above principles will be provided. A major goal of harvest management is to manage the fishery for both treaty and non-treaty harvest, although a specific allocation formula for dividing catch has not been adopted. Other goals include providing diversity of fishing opportunities to salmon and steelhead anglers, encouraging nonconsumptive use of the resource, and selectively outplanting smolts.

Table 19. Middle Fork and Headwater Salmon chinook harvests, 1969-1978. Headwater refers to the Salmon River upstream from the East Fork.

Year	Middle Fork	Headwater
1969	1,906	ND*
1970	802	1,963
1971	687	1,013
1972	937	1,175
1973	1,216	2,263
1974	349	431
1975	CS**	CS
1976	cs	CS
1977	404	525
1978	1,724	1,782

* ND = No Data
** cs = Closed Season

Yearly coordination activities include annual meetings among the Idaho Fish and Game, and the Nez Perce Tribe and the Shoshone-Bannock Tribes. During 1988, biologists exchanged weekly harvest estimates to facilitate harvest management. Also regularly scheduled are biannual meetings of the Idaho Fish and Game Commission to review recommendations from staff personnel and the public to set seasons and limit regulations.

The Idaho Fish and Game Commission, aided by pre-season and inseason data, establishes non-treaty salmon and steelhead fishing regulations. Pre-season data includes survival of downstream migrants, ocean and river harvest, dam counts, relative strength of the prior year's return, hatchery and wild run composition, recent trends in spawning escapement, and natural smolt production. Inseason data includes daily and cumulative dam counts and hatchery escapements, updated run predictions and escapement estimates, and catch--related factors. The Idaho Fish and Game staff develops preliminary recommendations and submits these to the commission, which adopts the regulations with any modifications it deems appropriate. Generally, the commission sets the salmon fishing season between May 1 and August 15 each year. The starting and closing dates are established during the regulation adoption process. The Fish and Game publishes the regulations, collects inseason data, and monitors the regulations' effectiveness (IDFG 1985).

The Shoshone-Bannock fishing regulations are modified annually based on input from tribal biologists and the Idaho Fish and Game. The Shoshone-Bannock Business Council makes the final decision concerning specific tribal regulations. The Nez Perce Executive Council sets harvest regulations for its members. These regulations are based on run projections, daily fish counts over the Columbia and Snake river dams, and suggestions from tribal and inter-tribal biologists. The run size is projected using a regression analysis of the number of fish over Ice Harbor Dam by April 30. Tribal leaders monitor harvest estimates and escapement to the Rapid River Hatchery trap daily so as not to endanger stock replacement needs. Harvest of chinook is allowed throughout the ceded area of the Salmon River. Efforts to limit harvest occurs primarily on the Rapid River stock.

Chinook fishing regulations have become progressively more restrictive as access has improved and fishing pressure has increased. The Idaho fishing regulations for 1939 stated that anadromous fish waters were open at all times to fishing for salmon and steelhead with hook, line, or spear. However, very few people used hook and line for taking chinook: salmon. This regulation was modified in 1940 so that spearing was permitted on only a few of the state's larger streams. In 1942, spearfishing was prohibited in some of the spawning areas in the headwaters of these larger streams. In 1946, all spearing and snagging were prohibited.

A series of stream closures for salmon protection began in 1947. By 1951 this list of closures included 13 major spawning streams or stream sections. Three more were closed by emergency proclamation. Bag and possession limits on chinook varied from two fish to three fish during this period (Hauck 1951). Fishing seasons were first established on the upper South Fork in 1950 to protect spawning summer chinook and were extended to spring chinook drainages. Prior to 1962, no season limits existed for chinook salmon.

Separate salmon permits to fish for salmon were required for the first time in 1970 (Keating 1971). In 1972, the bag, possession and season limits of chinook were reduced by half to one fish per day, two in possession, and five per season (Reingold 1976). In 1978, the season limits were one fish per day, two in possession and four per season. This was later amended to six per season. The upper Middle Fork was closed to fishing and fishing on the Little Salmon River commenced only after 5,000 chinook had entered the Rapid River Hatchery trap (Ortmann 1979). When a harvestable surplus of hatchery spring chinook salmon returned to Idaho in 1985, allowing for a limited reopening of the sport fishing season, limits were set at two fish per day, including jacks: four in possession; and six per season. These limits were repeated through 1988. For the last two years, non-treaty chinook seasons have generally consisted of weekend fisheries, opened and closed by Fish and Game Commission proclamations, although the latter part of the I988 season also included weekdays.

Every year through 1978, the Idaho Fish and Game sent angler questionnaires to a random sample of salmon permit holders. Anglers responding either returned their original permits or filled in a duplicate permit printed on the reverse side of the survey letter. Follow-up letters were also sent to non-respondents. Incoming data included residence of anglers, days fished, catch, stream section fished, and dates of catches. Data was compiled and expanded to generate total harvest and effort.

In 1985, the first year a salmon sport fishery was allowed since 1978, the Fish and Game Department attempted to contact all permittees by telephone, because of the low number of permit holders. Telephone interviewers were trained to solicit complete replies and read from a standard script. Responses were processed to produce estimates of total effort and harvest (Cochnauer 1986). In 1986, the same procedure was followed. In 1987, when no telephone survey was conducted, creel census information indicated that harvest was less than 500 fish.

Currently, inseason harvest information is derived from random counts and angler interviews conducted by a roving creel clerk along the Little Salmon River. Managers used a series of check stations during the 1960s and 1970s to obtain information, but terminated these when the salmon season closed. Annual tribal harvest figures are derived from direct enumeration by the Shoshone-Bannock conservation officers and close monitoring by Nez Perce Tribe fisheries personnel.

The Shoshone-Bannock Fish and Game Law Enforcement Division is responsible for monitoring tribal members to ensure their adherence to the adopted fishery regulations. Idaho Fish and Game conservation officers and biologists monitor non-treaty fishermen. Nez Perce fishermen are monitored by the Bureau of Indian Affairs.

Summer Chinook Harvest

Little is known of the early summer chinook: fishery in the South Fork Salmon River drainage. An Indian fishery on the South Fork was reported in the early 1900s and early-day miners undoubtedly harvested chinook from nearby streams, since habitation was largely confined to isolated mining settlements prior to the time regulations governing the taking of chinook went into effect (Richards 1963). For many years, the run of summer chinook into the South Fork Salmon River was the source of large numbers of salmon in the sport fishery (Table 20). However, for at least the last 10 years, this fishery has been closed to non-treaty harvest.

The South Fork has been a traditional Indian fishery for many years, but limited data is available. In 1.963, an estimated 150 fish were harvested by Indians (Ortmann 1964:). Ortmann (1966) reported that a virtually complete check was obtained in 1964 on chinook salmon caught by Indians fishing in the well known "Glory Hole". Fishing lasted from July 14 to July 19, during which 54 fish were known to be taken. Little other Indian fishing activity was documented within the drainage that year. In 1987, Shoshone-Bannock tribal members harvested 45 hatchery summer chinook from the South Fork below the South Fork trap. In 1988, an estimated 104 summer chinook were harvested (M. Rowe, Shoshone-Bannock Tribes, pers. commun.).

Chinook fishing regulations, as discussed atbove, became more restrictive with increased pressure and access. Establishment of fishing seasons to protect spawning fish began on the upper South Fork in 1950 and was extended throughout the drainage. The first regulation prohibiting hooks other than a single hook not larger than 0.5 inches from point to shank was placed on the South Fork in 1960 (Richards 1963).

Table 20. Comparable check station harvest data, South Fork of the Salmon River drainage chinook salmon fishery, 1960-1965.

Year	Number of Fishermen Trips	Harvest	Fish per Trip
1960	6,724	3,905	0.58
1961	4,933	1,745	0.35
1962	7,086	2,853	0.40
1963	5,271	1,754	0.33
1964	4,253	1,709	0.40
1965	CS*	CS	CS

* CS = Closed Season

In 1960, the Idaho Fish and Game initiated a check station on the South Fork to obtain precise harvest data for the fishery. By 1962, managers achieved full coverage of major fishing areas. During this period, the relative proportion of the run harvest had not varied over approximately 10 percent throughout the years checked, and harvest patterns for individual streams or stream sections were very similar from year to year. As the summer chinook run in the South Fork drainage declined, this popular fishery lost its prominence.

Specific Considerations

Spring Chinook

The Salmon River Subbasin supports at least two stocks of spring chinook salmon that are distributed throughout the subbasin as naturally reproducing populations, originating in various tributary systems, Rapid River Hatchery and Sawtooth Hatchery. Currently, escapement for wild and natural stocks in the subbasin is depressed. Generally, escapement goals for hatchery egg takes have been met in the last two years. As pointed out in "Production Constraints and Opportunities Analysis, Part I" (MEG 1988), the overriding factor determining the maximum sustainable yield (MSY) run size was the location of the **subbasin** with respect **to the** number of dams downstream. The maximum sustainable yield is that proportion of a population that is surplus to the proportion of fish required to spawn and maintain the population size. The MSY run size is the total population size at the point where the maximum sustainable yield occurs. This variable was most affected by passage survival rates, for both juveniles and adults.

Additionally, the MSY proportion also decreased markedly as passage suwival decreased. The MSY proportion is the proportion of the MSY run size that is surplus to the spawning need. This variable was unaffected by natural or hatchery smolt capacity while fecundity and juvenile survival rates had strong effects. In general, the analysis indicated **that the** population of the **subbasin** is most limited by system variables, usually passage survival. Spawning and rearing habitat for natural production within the **subbasin** is of ample quantity and quality to allow for increased production within the **subbasin** although existing habitat needs restoration, protection, and improvement in localized areas.

Depressed spawning escapement in the Salmon Subbasin, and chronically high Snake and Columbia **mainstem** smolt mortalities associated with hydroelectric projects and insufficient flow conditions during migration are the major impediments to increased production and harvest opportunities for spring chinook. Primary issues pertaining to future spring chinook salmon management objectives and strategies include 1) low habitat seeding levels, 2) insufficient flows during critical smolt migration periods in the Snake and Columbia rivers, 3) hydroelectric system mortalities, 4) the need to increase production of wild runs yet maintain genetic fitness and diversity, 5) supplementation evaluation, 6) land and water management, and 7) mixed-stock fishery conflicts in the mainstems of the Columbia, Snake, and Salmon rivers as well as major Salmon River tributaries.

Current major institutional and legal considerations specific to the Salmon **Subbasin** are 1) the management of artificial production programs, such as LSRCP mitigation and the Idaho Power Company agreement: 2) land management plans such as the U.S. Forest Service plans: 3) the Fort Bridger Treaty of 1868 and the Treaty of 1855 with the Nez Perce: 4) federal laws such as the Pacific Northwest Electric Power Planning and Conservation Act, and the United States-Canada Pacific Salmon Treaty: 5) tributary management plans (state and tribal); 6) United States vs. Oregon; and 7) the Snake River water rights adjudication. Although not a complete list of all the legal concerns affecting salmon and steelhead in the Salmon Subbasin, the above considerations are some of the more important ones. If the recent past is any indication, salmon and steelhead management in the future may be driven more by legal considerations than by biological ones.

The Idaho Fish and Game policies guiding natural and hatchery production of anadromous fish are outlined in the IDFG Anadromous Fishery Management Plan, 1985-1990. The department has designated the entire Middle Fork (spring and summer chinook) and parts of the South Fork (summer chinook) as wild fish production areas and, therefore, does not supplement with hatchery fish. Juvenile anadromous fish are also protected in these tributaries by catch-and-release regulations in certain areas. The plan identifies wild salmon and steelhead populations as having priority consideration in all fisheries management decisions. Fish management practices are also guided by the Nez Perce Tribe and Shoshone-Bannock Tribes, as well as influenced by federal and other state entities. Spring chinook are currently the highest priority species in management decisions of the Nez Perce. The Shoshone-Bannock Tribes place a high priority on wild and natural populations of all anadromous stocks. The Shoshone-Bannocks are currently trying to limit fishing in Idaho to hatchery stocks in terminal fisheries to preserve wild and natural populations. Federal land management agencies have also considered anadromous fish as high priority species in their management plans.

As outlined in the IDFG Anadromous Fisheries Management Plan, the natural total production objective for the Salmon River Subbasin is 57,000 adults, providing a spawning escapement of 22,800 fish in the Salmon Subbasin and the remainder for harvest and mortality throughout the entire range of the run, including the ocean and Columbia River. These goals were based upon a projected smolt-to-adult survival rate of 1.6 percent and a survival of adults to Idaho of 0.8 percent. However at present survival rates, these goals seem overly optimistic in light of system constraints. Accurate run information is not available, but the Technical Advisory Committee of the United States vs. Oregon process estimated the 1986 run at 7,350 natural and wild spring chinook over Lower Granite Dam. The tribes have no specific numerical goal, however an interim management goal of 25,000 natural and wild fish and 10,000 hatchery fish at Lower Granite Dam has been established for the Snake River Basin under United States vs. Oregon. This aggregate goal of 35,000 spring chinook has only been met during two of 13 years from 1975 through 1987.

Hatchery management is a cooperative effort among the Idaho Department of Fish and Game, Idaho Power Company, and the U.S. Fish and Wildlife Service. Spring chinook production occurs at Rapid River and Sawtooth hatcheries. To date, the Fish and Game's major emphasis has been releasing smolts to return to the hatchery as adults, providing egg supplies for expanded outplants to rebuild stocks and eventually enable sport fishing. The IDFG Anadromous Fisheries Management Plan's hatchery objective is 42,700 adults with an escapement of about 5,650 fish for hatchery production in the Salmon Subbasin and the remainder for harvest and mortality throughout the entire range of the run. These objectives assume a survival of 0.36 percent for adults to Idaho. It is difficult to determine current smolt-to-adult survival . rates because the release upstream of at least one-third of the hatchery return to Sawtooth and other weirs provides natural reproduction unaccounted for. Furthermore, all hatchery and natural fish returning to weirs cannot be differentiated. However, estimated returns for Rapid River Hatchery for the 1981 and 1982 brood years have been 0.26 percent and 0.22 percent, respectively, while sustaining a terminal harvest rate of about 42 percent.

According to the IDFG Anadromous Fisheries Management Plan, Rapid River stock will be used as an appropriate supplementation stock in the lower part of the subbasin, while Sawtooth fish will be used in the upper part. The Fish and Game has not identified any suitable donor stocks for the canyon tributaries between the South Fork and the Middle Fork or for the Middle Fork, itself. These areas are being managed strictly for natural production of indigenous, wild populations of spring chinook.

Tributary harvest of both hatchery and natural stocks is an objective of current state and tribal management. The Nez Perce Tribe targets the Rapid River Hatchery run and has a substantial fishery at Rapid River. For the past few years, the Shoshone-Bannock Tribes have targeted excess hatchery spring chinook hauled from Pahsimeroi Hatchery to the Yankee Fork. Shoshone-Bannock tribal members have not harvested natural chinook runs for the past four years and tribal members are instructed to release natural and wild fish. Some Nez Perce tribal harvest may occur on natural runs throughout the subbasin. Low numbers are assumed to be taken due to low escapement, however, the impact on natural and wild populations is unknown. Currently, non-tribal harvest of the Rapid River Hatchery run in Little Salmon River is possible. Expanded tribal and non-tribal harvest is planned in the future when additional adult escapement occurs.

Opportunities within the subbasin to increase natural spring chinook production can only be achieved by increased adult escapement, which is addressed under the objectives and strategies for spring chinook. As discussed in Part II, protection and restoration of important spring chinook habitat will maintain and or increase habitat carrying capacities and increase fish survival.

Important, considerations also include bringing habitat management strategies into line with present land allocations. Wilderness designations in many drainages may prohibit development of mechanized stocking or hatchery development. The legal requirements for wilderness and other federal land management requirements must be considered as a component of fish production strategies. 'Related to this is the logistics factor, which should play a major role in determining where large-scale supplementation occurs. Supplementation of remote areas may exacerbate mixed-stock fisheries, and thus deplete existing wild stocks because the only significant points where harvest could occur would be in mixed-stock areas.

The protection of underescaped, wild, unsupplemented runs is a priority. These runs are critical to the long-term vitality of both natural and hatchery production. Opportunity exists for increasing production of several natural runs by supplementation with genetically appropriate releases. However, a major uncertainty is the long-term effect of hatchery supplementation on the genetic diversity and fitness of natural runs because components of natural selection have been lost. Careful planning and development of methods for brood stock trapping and juvenile rearing in the **subbasin** is essential to this opportunity. Further baseline monitoring of population status and genetic characteristics is needed prior to full implementation of supplementation strategies.

Other subbasin-specific considerations include species interactions with resident fish and other anadromous species, mixed-stock fisheries interactions, and ongoing habitat enhancement projects in the subbasin. These are discussed below, as are specific considerations for the development of objectives and strategies for the major drainages. (The following are listed by geographic area, not priority.)

Lower Salmon River (mouth to French Creek)

Migration corridor and overwintering area for adult and juvenile salmon and steelhead exists.

Several tributaries have unsupplemented populations.

Access above Whitebird Creek affords all user diversity.

Little Salmon River

Idaho Power Company's spring chinook hatchery on Rapid River produces 3 million smolts (2 million currently released into the Salmon River and 1 million into the Snake) and needs about 2,700 adults. Additional outplanting requires a higher adult escapement. Stock was originally transferred from mid-Snake.

Wild summer chinook run into Rapid River, probably with some intergradation of the hatchery spring chinook run.

Late-running wild steelhead run into Rapid River.

Non-tribal harvest of chinook exists from Little Salmon River below Rapid River.

Nez Perce tribal harvest of chinook exists primarily from Rapid River below hatchery and trap facilities.

A series of natural barriers blocks adult anadromous fish below 60 miles of the upper drainage. Removal of these barriers is an amendment in the Columbia River Basin Fish and Wildlife Program, but implementation has been delayed pending the completion of system planning.

Mostly private land exists along the Little Salmon River and lower Rapid River. Non-tribal fishery access is currently limited.

A road follows the length of Little Salmon River.

Rapid River is a "Wild and Scenic River" above Rapid River Hatchery.

Hydroelectric projects have been proposed in the drainage.

Salmon River Canyon (French Creek to Middle Fork)

Canyon is roadless, bounded in part by Frank Church-River of No Return Wilderness Area.

Mainstem is mainly an overwinter and migration corridor.

Unsupplemented wild chinook populations are in several tributaries.

Major tributaries have suitable chinook spawning and rearing habitat, mostly in very good condition.

Some tributaries between the South Fork Salmon River and the Middle Fork studied in the mid-1980s had low-to-zero juvenile chinook densities and very underseeded habitat. Chamberlain Creek was an exception.

Hydroelectric projects have been proposed in the drainage.

South Fork Salmon River

(See summer chinook and steelhead.)

Middle Fork Salmon River

Middle Fork is a Wild and Scenic River, primarily within the Frank Church Wilderness. Most of the drainage is roadless and accessible by boat, foot, aircraft or animal.

Middle Fork is a major recreation area with unique user opportunities. Wild spring chinook population exists. Redd counts in trend areas are increasing, but this drainage is still very underseeded.

Considerable tribal and non-tribal interest in chinook harvest exists, however, the Idaho Department of Fish and Game and Shoshone-Bannocks are committed to managing Middle Fork spring chinook to preserve and protect genetic fitness and diversity for long-term spring chinook management.

Severe habitat degradation due primarily to mining and grazing exists in Bear Valley and Elk creeks. Degradation is primarily from increased sediment, which lowers early rearing survival. Riparian vegetation has also been reduced in quality and quantity. Marsh, Camas and Monumental creeks have some habitat degradation (see Part II), but to a lesser degree. Fencing, riparian revegetation and channel rehabilitation on Camas, Marsh, Bear Valley and Elk creeks are projects in the Columbia River Basin Fish and Wildlife Plan. The stream channel restructuring and bank stabilization by BPA and the Shoshone-Bannocks in the mined area of Bear Valley is nearly complete.

Panther Creek

Some stream reaches in the drainage are toxic due to mine wastes. Toxicity may also create an adult migration barrier. Recent live box tests indicate some improvement in water quality (see Part II).

This drainage has been supplemented with spring chinook. Plans exist to reopen the Blackbird cobalt mine. If litigation over the mine damage is settled and the mine is sold, $7 million will be earmarked for stream restoration (Beebe 1988).

The Bonneville Power Administration has funded the study of rehabilitation feasibility. Implementation of any rehabilitation project has been put on hold pending the outcome of litigation between the state and the mine owners.

Roads provide access to much of the drainage.

Lemhi River

All water in Lemhi River is appropriated and directed by many irrigation diversions, some of them screened.

Hayden Creek Hatchery, currently being used by the University of Idaho for research, could produce about 400,000 smolts.

Redd-count trend in the upper Lemhi appears to be increasing.

Most of Lemhi Valley is private land with limited public access.

Lemhi River and some tributaries have been supplemented with spring chinook.

This system is very productive, especially the upper drainage.

Many tributaries are no longer accessible due to diversion structures and dewatering.

The Lemhi is a measure in the Columbia River Basin Fish and Wildlife Program for protective fencing, improved flows, riparian revegetation, possible dam and storage reservoir development, and passage improvements.

Pahsimeroi River

(See summer chinook and steelhead.)

Upper Salmon River (Middle Fork to Sawtooth Weir)

Some of the major tributaries have been supplemented with spring chinook.

Middle to upper mainstem Salmon supports wild summer chinook spawning.

Upper Salmon River is part of the Sawtooth National Recreation Area.

Carmen Creek and Valley Creek are listed in the Columbia River Basin Fish and Wildlife Program for habitat enhancement projects.

Dewatering, mining, diversion and grazing impacts are problems in some tributaries. Little of the North Fork's habitat will remain undeveloped or unmined. Highway Department practices can also cause excessive sedimentation or poor culvert passage.

The water of several tributaries such as Iron, Challis and Squaw creeks is totally appropriated.

Redfish Lake supports a remnant sockeye run (see Part IV - Sockeye).

The National Marine Fisheries Service is currently pit tagging chinook for transportation research in Valley Creek.

Yankee Fork

A Shoshone-Bannock fishery exists on hatchery spring chinook.

Severe dredge mining degradation exists (see Part II).

Yankee Fork is mentioned with Jordan Creek as items in the Columbia River Basin Fish and Wildlife Program for protective riparian fencing and revegetation. The Shoshone-Bannock feasibility study on restructuring stream channels, stabilizing streambanks, and constructing off-channel rearing habitat is complete. Construction is nearing completion.

Yankee Fork has been supplemented with spring chinook. Natural production is occurring, although the drainage is underseeded.

Roads access much of the drainage.

Mining is still occurring at reduced levels.

Tribal and non-tribal interest in harvest exists.

East Fork Salmon River

East Fork is listed an item in Columbia Basin Fish and Wildlife Program for protective riparian fencing and revegetation. Sediment degrades the lower East Fork from agricultural and mining practices.

Much of the land is private. The upper basin is Forest . Service land and is pristine.

A weir traps spring chinook adults for eggs to rear smolts at the Sawtooth Hatchery. Approximately 600 adults are needed for hatchery egg-take to produce about 1 million smolts. At least one-third of the run is released upstream to produce naturally, even if the egg-take goal has not been meet.

The Shoshone-Bannock and BPA feasibility study is under way to examine the rehabilitation of habitat degraded by agriculture and mining.

National Marine Fisheries Service is pit tagging natural chinook in this drainage for transportation research.

Tribal and non-tribal interest in harvest exists.

Headwaters (from Sawtooth Weir upstream)

The Sawtooth Spring Chinook Hatchery, a Lower Snake River Compensation Plan hatchery, intercepts all fish returning to headwaters.

Approximately 800 spring chinook adults are needed for hatchery egg-take to produce about 1.4 million smolts. At least one-third of the run intercepted at the weir is released upstream for natural production, even if total egg-take is not met.

Sawtooth spring chinook are kept separate from East Fork progeny.

Many of the tributaries have been supplemented with spring chinook.

Supplementation research is currently taking place in selected tributaries: Pole, Frenchman, Smiley, Beaver, and Alturas Lake creeks.

Intensive smolt monitoring and pit tagging of natural chinook is under way to evaluate survival and migration. Smolts are also being pit-tagged for transportation evaluation. A smolt trap is in place during the juvenile migration at Sawtooth Hatchery.

Major diversions on upper Salmon and Alturas Lake Creek cause passage problems, dewatering and mortality. Negotiations are under way between the landowners and Forest Service. Several smaller tributaries are also dewatered by irrigation diversions.

The upper Salmon, Alturas Lake Creek, and Pole Creek are listed in the Columbia River Basin Fish and Wildlife Program for a variety of habitat enhancements.

The headwaters are within the Sawtooth National Recreation Area and are a major recreation area sustaining heavy public usage. Almost all of the spawning and rearing area is within grazing allotments.

Roads access all of the **mainstem** and most of the tributaries.

Tribal and non-tribal interest in harvest exists. Sockeye once inhabited Alturas Lake (see Part IV - Sockeye).

Summer Chinook

The Salmon River **Subbasin** supports a population of summer chinook distributed as natural subpopulations in the South Fork, Pahsimeroi and Rapid rivers. The lower parts of Loon and Big creeks in the Middle Fork, Valley Creek in the upper Salmon section, and the lower East Fork also support summer chinook. Summer chinook also exist in the **mainstem** Salmon, primarily from Ellis to **Redfish** Lake Creek. Whether summer chinook upstream of the Pahsimeroi River are of the same stock as the Pahsimeroi and South Fork runs, which are predominantly 2-ocean fish, is unknown. However, it appears that the upper river and Middle Fork summer chinook are similar to the spring chinook runs in the same area, with the 3-ocean age group predominating. Historically, summer chinook were more widespread throughout the **subbasin** than they are presently.

Overall, **subbasin** escapement of natural and wild populations is depressed. The McCall Hatchery has generally met escapement goals for the last two years. Egg-takes for smolt production at Pahsimeroi Hatchery have been supplemented with McCall eggs from 1985 through 1988. However, the adult return to Pahsimeroi Hatchery in 1988 was adequate for full production. High juvenile mortality and poor **mainstem** flows associated with eight downstream Snake and Columbia hydroelectric projects are major factors inhibiting increased production. Other major impediments and primary issues pertaining to future management have been discussed in the spring chinook section above.

Current fish management practices concerning natural and hatchery production for summer chinook are similar to those discussed for spring chinook. As outlined in the IDFG Anadromous Fisheries Management Plan, 1985-1990, the objective for total natural summer production for the Salmon **Subbasin** is 36,500 . adults with a spawning escapement of 14,600 adults. The hatchery total production objective is 24,000 fish with a spawning escapement objective of 3,500 fish. The summer chinook count over Lower Granite Dam for 1983 through 1987 averaged 6,506 fish, including jacks. Although the United States vs. Oreaon process has not estimated an escapement goal for summer chinook in the Snake River, the United States-Canada Pacific Salmon Treaty escapement goal for Columbia River summer chinook is 85,000 fish at Bonneville Dam. The escapement for 1984 through 1987 averaged only 26,150 summer chinook. The markedly underescaped status at Bonneville reflects **"equally"** poor escapement into the Salmon River Subbasin.

Hatchery management is a cooperative effort among the Idaho Department of Fish and Game, the Forest Service, and Idaho Power Company. Hatchery supplementation has occurred only in the South Fork and Pahsimeroi drainages. Within the South Fork, the Secesh River is being managed for the production of wild, indigenous summer chinook without supplementation. The Middle Fork Salmon River is also managed for wild fish production. To date, managers have not supplemented the upper Salmon River or Rapid River summer chinook populations.

Tributary harvest of both hatchery and natural stocks is an objective of state and tribal management. A non-tribal fishery for summer chinook has not existed for several years, although the South Fork was a major fishery in the 1960s. Since 1987, the Shoshone-Bannock Tribes have targeted a limited summer chinook fishery on primarily hatchery fish just below the South Fork Salmon River Trap. To date, this has been a fishery of less than 200 fish. Expanded tribal and non-tribal harvest is planned in the future when additional adult escapement occurs.

Opportunities in the **subbasin** to increase natural summer chinook production can only be achieved by increased adult escapement, which will be addressed under **"Objectives** and Strategies Summer Chinook." Protection and restoration of important summer chinook habitat, especially in the South Fork, will maintain and/or increase habitat carrying capacities and increase survival. Furthermore, protection of wild, unsupplemented runs is a priority to preserve genetic lineage vital to the future of both natural and hatchery production. Opportunities exist for increasing the production of several natural runs by supplementation with genetically appropriate releases. However, a major uncertainty is the long-term effect of hatchery supplementation on the genetic diversity and fitness of natural runs. Careful planning and development of methods for trapping brood stock and rearing juveniles in the **subbasin** are essential. Thorough baseline monitoring of population and genetic status is also necessary for planning.

Other **subbasin** specific considerations, as mentioned earlier, include species interactions with resident and other anadromous species, mixed-stock fishery interactions, and ongoing habitat enhancement projects in the subbasin. Specific considerations for the development of objectives and strategies are listed for the appropriate major drainages. (The following are listed by geographic area, not by priority.)

Rapid River

(See spring chinook.)

Rapid River supports a wild, indigenous run, but some degree of intergradation with hatchery spring chinook is possible.

Summer chinook are separated from hatchery spring run primarily on the basis of run timing.

Early arriving summer chinook are not protected from spring chinook harvest.

South Fork Salmon River

Secesh River, which is below the South Fork Salmon River **Trap,** is managed for production of wild, indigenous fish without supplementation.

Much of the rest of the South Fork drainage is a mixture of hatchery and naturally producing fish.

McCall Hatchery, a Lower Snake River Compensation Plan facility, produces 1 million smolts. Approximately 1,750 adults are needed for hatchery egg-take. At the weir, managers release upstream at least one-third of the run to produce naturally, even if weir escapement objective for full egg-take is not met.

South Fork is proposed as a **"wild** and **scenic"** river.

Roads access most of main&em, East Fork of South Fork, and Johnson Creek.

Johnson Creek barriers have been removed with BPA funding.

Severe sedimentation problems inhibit production in this drainage, particularly in the mainstem South Fork. The Forest Service has begun restoration; its plan calls for a robust anadromous fishery by 1997. If natural chinook are harvested, some logging constraints will be relaxed.

Mining activity occurs and tanker accidents on river roads occur. Despite precautions, risk of serious fish kills from spilled materials is still high. Furthermore, mining operations are fairly unregulated. Bared hillsides, in preparation for mining, pose the threat of increased sedimentation and mass failure. Illegal suction dredge mining threatens natural reproduction as do extensive patents for several miles of the Secesh River. Tribal and non-tribal interest in harvest exists.

Middle Fork Salmon River

(See spring chinook.) .

Middle Fork is managed for production of wild, indigenous summer chinook.

Little is known about population characteristics.

Redd-count trend in lower Loon Creek from 1985 through 1987 has been fairly stable and well below historical counts.

Pahsimeroi River

Most of the valley is private land.

Many irrigation diversions exist, some unscreened. Many upper tributaries are no longer accessible due to diversions and dewatering.

Idaho Power Company's Pahsimeroi Summer Chinook: Hatchery is located on the river. Approximately 1,250 fish are needed for hatchery egg-take. Managers release upstream at least one-third of the run for natural seeding, regardless of egg-take.

East Fork Salmon River

(See spring chinook.)

Managers know little about the interaction of summer chinook with East Fork spring chinook.

Little is known about population characteristics.

Upper Salmon River (Middle Fork to Sawtooth Weir)

(See spring chinook.)

Lower Valley Creek supports summer chinook. Redd counts are increasing, but may be influenced by Sawtooth Hatchery spring chinook.

Little is known about population characteristics.

Mainstem Salmon River (Ellis to Sunbeam Dam site)

Redd counts in traditional summer chinook areas have been variable.

Objectives and Strateuies for Spring Chinook

The following represent objectives for the entire subbasin. For strategy modeling, these were subdivided by section and are displayed with each modeled subbasin section; if totaled, they represent the following subbasin components. Hatchery needs are shown only by subbasin and are dependent on the level of hatchery production implemented. Individual section biological objectives were calculated based on smolt potential: utilization objectives were derived from Public Advisory Committee information. Objectives listed secondarily do not infer secondary in importance.

Biological Objectives

(Numbers are not additive. For example, hatchery spawners include brood needs also included in the Lower Snake River Compensation Plan mitigation goal.)

la. Provide a minimum of 20,000 spring chinook spawners to the Salmon Subbasin for wild and natural production to maintain the unique biological characteristics and productivity of its naturally reproducing populations, and to rebuild wild and natural populations throughout the subbasin to provide sustainable yield.

lb. Provide a minimum of 5,000 spring chinook spawners to the Salmon Subbasin for hatchery production to maintain biological characteristics and productivity to provide fish for hatchery supported harvest programs and fish for supplementation to aid rebuilding. Strategies that require increased hatchery production or supplementation will require respective increased spawning escapements.

2. Achieve and maintain the compensation level of approximately 19,400 adult spring chinook returning to the Snake River Basin above Lower Granite Dam from Salmon River releases as identified in the Lower Snake River Compensation Plan for harvest and spawning in the subbasin.

3. Contribute to the Northwest Power Planning Council's doubling goal consistent with council policies.

4. Conserve and protect genetic resources represented by wild and natural Salmon **Subbasin** stocks. Maintain genetic fitness and diversity of wild fish and ensure long-term viability and productivity of hatchery and natural fish.

5. Achieve an average smolt-to-adult return rate to the **subbasin** for wild and natural spring chinook of 0.80 percent. Achieve an average smolt-to-adult return to **subbasin** for hatchery spring chinook of 0.40 percent. Current data indicates that the following **flow criteria,** proposed bypass and screening at dams, and smolt transportation would equate to a productive fishery and spawning escapement.

   Flow criteria: During the annual smolt migration period, April 15 to June 15, the weekly average flows at Lower Granite Dam should be maintained at 85 kcfs (85,000 cfs) in 92 percent of the water years, and 115 kcfs in 50 percent of the water years. A minimum of 70 kcfs should be maintained 100 percent of the time during this period. Data indicates that mean flows of 70 kcfs, 85 kcfs, and 115 kcfs would result in wild and natural smolt-to-adult return rates of 0.09 percent, 0.23 percent, and 0.86 percent, respectively. These estimates incorporate passage improvements made to date.

Utilization Objectives

la. In the long term, achieve and maintain a minimum of 47,000 spring chinook, as identified by the public advisory committees, for non-tribal harvest in the **subbasin** once rebuilding is achieved. These would be hatchery, natural, and wild fish. Nez Perce and Shoshone-Bannock tribes would expect to harvest **equal** numbers as non-tribal fishers harvest, for a total of 94,000 fish.

lb. In the short term, develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Achieve returns to terminal areas at levels that will allow selective harvest of hatchery-origin spring chinook until natural and wild origin runs have been rebuilt to .

levels that can sustain fisheries and productive spawning escapements.

2. Provide for a range of mainstem and tributary fishing opportunities for tribal and non-tribal fishers.

3. Restore fishing opportunities in tribal and non-tribal historical areas.

The number of minimum spawners was derived by using the System Planning Model, the smolt potential of the subbasin, earlier planning efforts, and the best knowledge of the Technical Work Team and fish managers. The utilization number was derived from the public advisory committees as their estimate of numbers of fish needed to provide optimal fisheries. It is recognized that through the monitoring and evaluation of adaptive management, these components will be re-evaluated. In regard to model analysis, no objectives will be changed prior to system integration because of the reliance on system parameters for a subbasin above eight dams, thus system integration and analysis of system alternatives may result in different model projections than those displayed in this plan. A priority is to rebuild wild, natural, and hatchery populations to a level that will sustain harvestable surplus while maintaining the biological characteristics that make the Salmon Subbasin populations unique and productive.

Alternative Strategies

Because of its complexity, the Salmon Subbasin was divided into sections for strategy development and model analyses.

Planners used the System Planning Model (SPM) to provide a quantifiable comparison between alternative strategies and baseline conditions. The numbers derived from the SPM are not necessarily representative of current conditions because the model depicted populations at an equilibrium phase and at higher seeding levels than are currently found in the subbasin. The broad interpretation is that the model depicts a "rebuilt condition," and does not address the rebuilding phase, a critical step in the continuation of Salmon Subbasin anadromous runs.

Potential numerical fish production increases for each spring chinook strategy are displayed in Tables 22a-22h. Critical uncertainties include those inherent in any projections of fish numbers or survival since there is presently no general technical agreement among land, water, and fish management agencies and tribes.

In general, spring chinook strategies followed a sequence of actions beginning with utilization of existing hatchery production (if any) and methods to enhance natural production (such as an "all natural" strategy), followed by levels of increased artificial production in addition to the natural actions found in the first strategy. Because of the variability in the spring chinook populations and geography of the Salmon Subbasin, a mix of methods will be found in the alternative strategies that reflect 'wild, natural, and hatchery management. To avoid undue repetition, reference to a previous strategy . includes reference to its major hypotheses, critical assumptions, and actions.

Modeling results for each strategy are presented as fish produced at "maximum sustainable yield" (MSY). The sustainable yield of a fish population refers to that portion of the population that exceeds the number of fish required to spawn and maintain the population over time. Sustainable yield can be "maximized," termed MSY, for each stock at a specific harvest level. The MSY is estimated using a formula (Beverton-Holt function) that analyzes a broad range of harvest rates. Subbasin planners have used MSY as a tool to standardize results so that decision makers can compare stocks and strategies.

In MSY management, managers set a spawning escapement level and the remaining fish (yield) could theoretically be harvested. In practice, a portion of the yield may be reserved as a buffer or to aid rebuilding. Thus, managers may raise the escapement level to meet a biological objective at the expense of a higher utilization objective.

The amount of buffer appropriate for each stock is a management question not addressed in the subbasin plans. For this reason, the utilization objective, which usually refers to harvest, may not be directly comparable to the MSY shown in Tables 22a-22h. At a minimum, a strategy should produce an estimated MSY equal to or greater than the utilization objective. A MSY substantially larger than the subbasin utilization objective may be needed to meet subbasin biological objectives.

Estimated costs of the alternative strategies are summarized in tables below. Standardized cost sheets were developed for each spring chinook strategy and are grouped in Appendix C.

Lower Salmon River (mouth to French Creek, excluding Little Salmon River)

Biological Objective - minimum 661 spawners for natural production.

Utilization Objective - minimum 6,000 fish for non-tribal and tribal harvest. Includes fish that would be passing though the mainstem but produced in another area.

STRATEGY 1: Use current hatchery production and supplementation (capacities and planned levels of production and stocking), complete Forest Service habitat improvement projects, and improve post-release survival of hatchery fish.

Hypotheses: Low-level stocking of hatchery fish and increased survival of juvenile migrants will allow productive spawning escapement and harvestable surplus. Habitat improvements will increase overwinter holding capacity and smolt production capability.

Assumptions: Hatchery fish of Rapid River origin will not negatively affect the genetic resource of natural population. Survival will support low-level stocking to produce spawning needs and surplus. Anglers will have access to mainstem and tributary fisheries. Surplus can be utilized in a mixed-stock mainstem harvest along with tributary harvest without negative impacts on other populations. Habitat will remain at current or enhanced production levels and active mining claims will not interfere with enhancement. Private landowners will allow enhancement. Loggers will meet forest plan standards and guidelines in areas such as French Creek.

ACTIONS: l-3

1. Complete Nez Perce Forest projects on White Bird and Slate creeks. Projects are funded by the Bonneville Power Administration and the Forest Service. They consist of sediment removal, correction of sediment sources, and instream structures in Slate Creek; and barrier removal, bank stabilization, and instream structures in White Bird Creek.

2. Implement level of hatchery production and supplementation of 200,000 fingerlings or equivalents from Rapid River Hatchery, as prescribed in the IDFG Anadromous Fisheries Management Plan, 1985-1990, if agreed to by parties of settlement agreement.

3. Implement hatchery effectiveness actions (Table 21). Single actions or a combination of actions may be required as per monitoring and research results.

STRATEGY 2: Implement large-scale hatchery production and supplementation, improve additional habitat, and implement Strategy 1.

Hypothesis: Additional hatchery production and supplementation will speed process of rebuilding and provide harvestable surplus to meet needs.

Assumptions: Tributary brood stock will be available to meet hatchery and natural spawning escapement needs as well as harvest. Rearing facility and collection of brood stock is feasible. Early rearing capacity is available at a current facility. More improvement projects will greatly add to natural production capacity of habitat.

ACTIONS: l-6

1. -
2. -
3. -

4. Complete the Nez Perce Tribe rearing facility on Slate Creek to release 1 million smolts or equivalents. Sites have been proposed.

5. Complete a brood stock collection facility.

6. Implement Bureau of Land Management habitat improvement projects (not modeled). These would consist of projects such as passage improvements, instream cover, and gravel improvements.

Table 21. Hatchery effectiveness actions that could potentially increase the post-survival rate of hatchery fish.

1. Evaluate size and time of juvenile release to fine-tune smolt releases contingent on water budget releases, as well as assess fall- versus spring-release survival rates.
2. Continue disease research (BKD, IHN) and develop economical and efficient vaccines that do not render fish inedible.
3. Improve hatchery water quality and hygiene through technology and education.
4. Improve hatchery diets through nutrition analyses and testing, as well as develop alternate protein sources.
5. Evaluate acclimation of smolts prior to release to assess improvements in survival and quality. Investigate release time and duration of acclimation.
6. Evaluate raceway loading densities to determine optimum loading with respect to species, temperature, rearing methods, water quality, and adult return rates.
7. Develop and initiate methods to decrease stress of coded-wire tagging and freeze branding, including time of tagging evaluation.
8. Continue participating in basinwide fish health monitoring program to provide baseline data.
9. Determine major points of mortality and rates of mortality for released hatchery fish (fish are dying prior to reaching the Snake River, or in the reservoir due to low flows, or in the estuary due to kidney failure). Determine if fish outplanted as a life stage prior to smolt experience similar mortalities as smolt releases.

STRATEGY 3: Produce additional hatchery fish,.and implement Strategy 2.

Hypothesis: Large-scale hatchery production is necessary to produce harvestable surplus to meet needs.

Assumptions: Physical and biological requirements of a second production facility can be met. Additional early rearing capacity is available. Harvest management will allow optimization of mixed hatchery and natural populations in drainage and **mainstem** Salmon without negative impacts on other populations.

ACTIONS: l-7

1. -
2. -
3. -
4. -
5. -
6. -

7. Complete a second rearing facility and brood stock collection site to release 1 million smolts or equivalents. Sites have not been proposed.

Table 22a. System Planning Model results for spring chinook in the lower mainstem Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:

Provide for range of mainstem and tributary fishing opportunities for tribal and non-tribal fishers.

Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 94,000 fish to allow SO-50 harvest by tribal and non-tribal fishers.

Section objective: minimum 6,000 fish for non-tribal and tribal harvest. Includes fish that would be passing though the mainstem but produced in another area.

Biological Objective:

Optimum utilization of habitat. Minimum spawning escapement of 20,000 for natural production. Minimum spawning escapement of 6,000 for hatchery production.
Contribute to Council's 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness and diversity, and ensure long-term viability. Achieve smolt-to-adult return rate to subbssin of 0.8% for wild/natural and 0.4% for hatchery based on listed flow rates during outmigration.

Section objective: minimum of 661 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	120 -N	294	430	121	0(1.00)
All Nat	190 -N	401	612	171	394(1.42)
1	332 -N	496	872	243	959(2.03)
2*	1,727 -N	2,019	4,113	1,149	7,992(9.56)
3	3,355 -N	3,427	7,455	2,081	15,245(17.33)

*Recommended strategy.

[1] Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Utilize current hatchery production and supplementation (capacities and planned levels of production and stocking), complete USFS habitat improvement projects, and improve post-release survival of hatchery fish. Post Mainstem Implementation.
2. Strategy 1 plus implement large-scale hatchery production and supplementation, improve additional habitat. Post Mainstem Implementation.
3. Strategy 2 plus increase level of hatchery production. Post Mainstem Implementation.

[2] MSY is the nunber of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3] Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4] Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Colunbia harvest.

[6] The increase in the total return to the mouth of the Colunbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 22aa. Estimated costs of alternative strategies for lower mainstem Salmon River spring chinook. Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1	2*	3
Hatchery Costs			
Capital[1]	0	0	1,300,000
O&M/yr[2]	0	0	150,000
Other Costs			
. tal[3]	0	3,297,508	3,297,508
O&M,Capi[4]	0	31,380	31,380
Total Costs			
Capitat	0	3,297,508	4,597,508
O&M/yr	0	31,380	181,380

* Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Little Salmon River

Biological Objective - minimum 805 spawners for natural production.

Utilization Objective - minimum 10,000 fish for non-tribal and tribal harvest to be utilized in Salmon Subbasin.

STRATEGY 1: Improve passage and flow, use current hatchery production and supplementation (capacities and planned levels of production and stocking), and improve post-release survival of hatchery fish.

Hypotheses: No significant resident fish impacts would occur with barrier removal; potential natural habitat should be used for spawning and rearing to produce productive spawning escapement and harvestable surplus, as well as add more area for a fishery close to a municipality. Additional water is essential for production to occur at estimated levels in the System Planning Model and will assist juvenile migration and improve habitat quality and juvenile survival.

Assumptions: Water can be obtained. If water cannot be purchased, then other actions such as diversion improvements or alternate irrigation methods can be implemented, but costs have not been estimated. Habitat above the barrier is of a quality to provide a productive run without enhancement and will not be further degraded by private uses. Harvest management will allow optimization of mixed hatchery and natural populations in the drainage and mainstem Salmon without negative impacts on other populations.

ACTIONS: l-6

1. Remove Hard Creek and Little Salmon barriers.

2. Implement hatchery effectiveness actions (Table 21).

3. Screen irrigation diversions made accessible by barrier removal. Upgrade diversions in drainage where mortality and stranding is occurring.

4. BPA and the IDFG purchase water from Brundage Reservoir for instream flow. Other potential actions to improve instream flow exist, but costs have not been developed.

5. Release 2 million smolts from Rapid River Hatchery, as identified in the Idaho Power Company agreement.

6. Continue supplementation as per supplementation research results, brood stock availability, and seeding levels.

STRATEGY 2: Improve post-release survival of hatchery fish, use current hatchery production and supplementation, and improve **instream** flows.

Hypotheses: Fry could rear in upper drainage, migrate downstream without barrier modification, and provide a fishery as returning adults. Water would assist juvenile migration and improve rearing habitat quality.

Assumptions: Rapid River source of brood stock and rearing space for fry plants is available. Minimal straying of adults from fry plants to hatchery occurs. Adults are fully utilized as harvest or as additional brood collection for hatchery and natural production elsewhere in drainage, since natural spawning would not be expected to occur. Assume angler access and that harvest management will allow optimization of mixed hatchery and natural populations in drainage without negative impacts on other populations.

ACTIONS: 2, 4, 5, 6 (see above)

STRATEGY 3: Improve habitat, increase hatchery production and supplementation, and implement Strategy 1.

Hypotheses: Improvements are needed to optimize available habitat for natural production. Increased hatchery production is needed to supply supplementation needs and harvestable surplus.

Assumptions: Cooperative agreements can be developed with private landowners for improvements. Land management strategies are implemented that protect current and enhanced habitat. Idaho Power Company would allow all of Rapid River Hatchery production to be used for Little Salmon (dependent on agreement of parties in settlement agreement).

ACTIONS: l-4, 6-9

1. -
2. -
3. -
4. -
6. -

7. Improve stream habitat of private lands above barrier. No specific projects or sponsoring agencies have been identified, but riparian improvement, fencing, and bank stabilization would be included.

8. Improve culvert passage at Squaw Creek and improve habitat, including screening and instream structures, at Squaw, Lockwood, Boulder and Sheep creeks (BLM . projects).

9. Release entire Rapid River smolt production of 3 million fish into the Little Salmon drainage, or develop additional rearing capacity for 1 million smolts or equivalents to add to Rapid River 2 million release.

STRATEGY 4: Increase hatchery production and supplementation, and implement Strategy 2.

Hypothesis: Increased hatchery production is needed to supply supplementation needs and harvestable surplus.

Assumption: Idaho Power Company would allow all of Rapid River Hatchery production to be used for Little Salmon (dependent on agreement of parties in settlement agreement.)

ACTIONS: 2, 4, 6, 9 (see above)

Table 22b. System Planning Model results for spring chinook in the Little Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-irrplementation.

Utilization Objective:
Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve minimum return of 94,000 fish to allow SO-50 harvest by tribal and non-tribal fishers'.

Section objective: minimun 10,000 fish for harvest in subbasin.

Biological Objective:
Optimum utilization of habitat. Minimun spawning escapement of 20,000 for natural production. Minimum spawning escapement of 6,000 for hatchery production. Contribute to Council's 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness and diversity, and ensure long-term viability. Achieve smolt-to-adult return rate to subbasin of 0.8% for wild/natural and 0.4% for hatchery based on listed flow rates during outmigration.

Section objective: minimum 805 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	1,371 -N	3,634	5,712	1,594	0(1.00)
All Nat	2,796 -N	4,379	7,987	2,230	4,939(1.40)
1	2,796 -N	4,379	7,987	2,230	4,939(1.40)
2	2,680 -N	3,982	7,444	2,078	3,760(1.30)
3*	5,311 -N	5,234	11,545	3,223	12,659(2.02)
4	5,182 -N	4,670	10,796	3,014	11,034(1.89)

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Improve habitat and passage, and utilize current hatchery production and supplementation (current capacities and planned levels of production and stocking with upper Salmon fish). Post Mainstem Implementation.
2. Strategy 1 plus improve post-release survival of hatchery fish, improve habitat. Post Mainstem Implementation.
3. Strategy 2 plus increase level of hatchery production and supplementation. Post Mainstem Implementation.
4. Strategy 2 plus increase level of hatchery production and supplementation. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4]Total return to the mouth of the subbasin.

[5]Includes ocean, estuary, and mainstem Colunbia harvest.

[6]The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 22bb. Estimated costs of alternative strategies for Little Salmon River spring chinook. Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies			
	1	2	3*	4
Hatchery Costs				
Capital[1]	0	0	1,300,000	1,300,000
O&M/yr[2]	0	0	150,000	150,000
Other Costs				
Capital[3]	118,820	0	1,704,746	0
O&M/yr[4]	8,750	0	22,962	0
Total Costs				
Capital	118,820	0	3,004,746	1,300,000
O&M/yr	8,750	0	172,962	150,000

* Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the Latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Mid-Mainstem of Salmon River (Salmon Canyon from French Creek to Middle Fork)

Biological Objective - minimum 1,398 spawners for natural production.

utilization Objective - 'minimum 12,000 fish for non-tribal and tribal harvest. Includes fish that would be passing though the **mainstem** but produced in another area.

STRATEGY 1: Continue wild fish management.

Hypotheses: Protection of this wild stock is critical to the long-term vitality of potential hatchery and natural production in the basin. Increase in juvenile migrant survival due to full implementation of the Columbia River Basin Fish and Wildlife Program will promote rebuilding to a productive level and produce some harvestable surplus. Wild fish management is compatible with wilderness management.

Assumptions: Migrant survival will increase expeditiously. Wild runs can be maintained in potential mixed-stock harvest in **mainstem** Salmon. Pristine condition of habitat is maintained.

ACTIONS: 1

1. Retain wild fish policy of no supplementation.

STRATEGY 2: Release hatchery fish into the **mainstem** Salmon River and improve post-release survival of hatchery fish.

Hypothesis: **Mainstem** stocking of hatchery fish will help prevent fish from straying into tributaries and, along with improved survival of hatchery fish, will provide a **mainstem** fishery.

Assumptions: Rapid River brood stock are available and a new rearing facility elsewhere in the Salmon **Subbasin** is feasible. **Mainstem** spring chinook fishery is accessible to anglers. Genetic component of wild runs in tributaries can be conserved in light of mixed-stock harvest and hatchery fish potentially straying. No negative impact occurs on wild tributary populations due to mixed-stock **mainstem** harvest.

ACTIONS: 2-4

2. Develop rearing capacity for 1 million smolts at existing facility or construct a new facility outside of the middle **mainstem** area. Site has not been identified or proposed.

3. Collect additional brood stock at Rapid River with Idaho **Power's agreement** for additional hatchery production.

4. Implement hatchery effectiveness actions (Table 21).

STRATEGY 3: Implement Strategy 2, but use sterilized smolts.

Hypothesis: Hatchery smolt sterilization would enable conservation of genetic resources of wild tributary populations, yet still provide a harvestable surplus to meet needs.

Assumptions: Tributary populations could be maintained at productive levels without negative impacts from mixed-stock **mainstem** harvest. Process of sterilizing smolts is feasible and smolts would return to release sites as adults.

ACTIONS: 2-5

2. -
3. -
4. -

5. Implement a smolt sterilization technique at probable new facility.

Table 22c. System Planning Model results for spring chinook in the Mid-Mainstem Salmon Subbasin. Baseline value is for pre-mains&m implementation, all other values are post-implementation.

Utilization Objective:
Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 94,000 fish to allow SO-50 harvest by tribal and non-tribal fishers. .

Section objective: minimum 12,000 fish for harvest in the subbasin, includes fish passing through but produced in other areas.

Biological Objective:
Optimum utilization of habitat. Minimun spawning escapement of 20,000 for natural production. Minimun spawning escapement of 6,000 for hatchery production. Total return above Lower Granite Dam of 19,400. Contribute to Council's 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness and diversity, and ensure long-term viability. Achieve smolt-to-adult return rate to subbasin of 0.8% for wild/natural and 0.4% for hatchery based on listed flow rates during outmigration.

Section objective: minimum 1,398 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	540 -C	578	1,149	379	0(1.00)
All Nat	650 -C	618	1,300	429	337(1.13)
1*	650 -C	618	1,300	429	337(1.13)
2	3,118 -N	106	3,247	906	4,497(2.76)
3	same results as 2				

*Recommended strategy.

[1] Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Continue wild fish management. Post Mainstem Implementation.
2. Release hatchery fish into this area and improve post-release survival of hatchery fish. Post Mainstem Implementation.
3. Strategy 2 except use sterilized smolts. Post Mainstem Implementation.

[2] MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3] Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4] Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the

Northwest Power Council's Fish and Uildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 22cc. Estimated costs of alternative strategies for Hid-Main Salmon spring chinook. Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Uildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1*	2	3
Hatchery Costs			
Capital[1]	0	1,300,000	1,300,000
O&M/yr[2]	0	150,000	150,000
Other Costs			
Capital[3]	0	0	
O&M/yr[4]	0	0	
Total Costs			
Capitat	0	1,300,000	1,300,000
O&M/yr	0	150,000	150,000

* Recommended strategy.

1 Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

2 Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

3 Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

4 Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Middle Fork Salmon River - Bear Valley

Biological Objective - minimum 9,004 spawners for natural production.

Utilization Objective - minimum 16,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Continue wild fish management and complete habitat improvement and screening projects.

Hypotheses: Preservation of genetic fitness and diversity of this wild stock is important to long-term vitality of Salmon Subbasin spring chinook. This stock is adapted to the Middle Fork Salmon River drainage and exhibits better survival than other stocks or hatchery fish. Wild fish management is compatible with wilderness requirements. Fishers prefer wild fish qualities.

Assumptions: Improved juvenile and migrant survival will enable optimal seeding levels and production of a harvestable surplus. Habitat improvements will also add to rearing capacity, enhancing natural production. Mixed-stock harvest that develops in the mainstem Salmon River will not negatively impact this population. Wilderness designation is sufficient to ensure full production capability of habitat. Land management activities such as grazing and mining do not degrade current or enhanced habitat.

ACTIONS: l-6

1. Complete Forest Service and Shoshone-Bannock projects, funded by the Bonneville Power Administration, on Bear Valley, Marsh, Elk and Camas creeks, which include sediment removal, bank stabilization, channel rehabilitation, fencing, and riparian revegetation.

2. Do not produce or supplement with hatchery fish.

3. Screen irrigation diversions.

4. Reduce Forest Service allotments and/or modify grazing practices to reduce livestock impact on riparian areas and stream channels in the Stanley Basin.

5. Fence grazing allotments if land management agencies do not implement alternative grazing strategies that protect riparian vegetation and stream channels. No costs have been estimated.

STRATEGY 2: Implement hatchery production and supplementation, complete habitat improvement and passage projects, improve post-release survival rate of hatchery fish, and retain wild fish management in Bear Valley.

Hypotheses: Additional hatchery production and supplementation is needed to build the population to a productive level and provide a harvestable surplus. Use of tributary brood stock will conserve current genetic resources for long-term viability. Significant funds have already been expended to enhance natural production of wild fish in Bear Valley, which is not compatible with a tributary hatchery program.

Assumptions: The Middle Fork population would sustain hatchery brood stock collection as well as natural spawning escapement. Biological and physical requirements for a rearing facility could be met and would be compatible with land management. Mixed-stock harvest in the mainstem Salmon River and Middle Fork could be developed without negatively impacting natural and wild production. Hatchery fish would retain same qualities as wild fish, which are valuable to fishers. Supplementation methods could be employed that alleviate genetic concerns as per supplementation research results and genetic monitoring.

ACTIONS: l-8

1. -
2. -
3. -
4. -
5. -
6. -
7. Develop a rearing and brood stock collection facility on a feasible tributary capable of rearing 0.5 million smolts or equivalents.
8. Implement hatchery effectiveness actions (Table 21).

STRATEGY 3: Increase scale of hatchery production and supplementation, and implement Strategy 2.

Hypothesis: Large-scale hatchery production and supplementation is needed to provide a harvestable surplus to meet needs.

Assumptions: Genetic resources and natural/wild populations can be conserved. Additional rearing facility and brood stock collection is feasible, and the physical and biological requirements can be met.

ACTIONS: l-9

1-8. -

9. Develop a rearing and brood stock collection facility on a feasible tributary capable of rearing an additional 0.5 million smolts or equivalents.

Table 22d. System Planning Model results for spring chinook in the Middle Fork Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:
Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 94,000 fish to allow 50-50 harvest by tribal and non-tribal fishers. .

Section objective: minimum 16,000 fish for harvest in the subbasin. Also see Bear Valley results.

Biological Objective:
Optimum utilization of habitat. Minimum spawning escapement of 20,000 for natural production. Minimun spawning escapement of 6,000 for hatchery production. Total return above Lower Granite Dam of 19,400. Contribute to Council's 2x goal consistent with policies, conserve genetic resources, maintain genetic fitness and diversity, and ensure long-term viability. Achieve smolt-to-adult return rate to subbasin of 0.8% for wild/natural and 0.4% for hatchery based on listed flow rates during outmigration.

Section objective: minimum 9,004 spawners for natural production. Also see Bear Valley results.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total' Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	3,210 -C	3,580	6,978	2,360	0(1.00)
All Nat	3,927 -C	4,042	8,182	2,768	2,684(1.17)
1*	3,927 -C	4,042	8,182	2,768	2,684(1.17)
2	5,113 -c	4,307	9,647	3,263	5,951(1.38)
3	6,344 -C	4,545	11,130	3,765	9,257(1.60)

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Continue wild fish management and complete habitat improvement and screening projects. Post Hainstem Implementation.
2. Implement hatchery production and supplementation, complete habitat improvement and passage projects, improve post-release survival rate of hatchery fish, and retain wild fish management in Bear Valley. Post Hainstem Implementation.
3. Strategy 2 plus increase scale of hatchery production and supplementation. Post Hainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4]Total return to the mouth of the subbasin.

[5]Includes ocean, estuary, and mainstem Columbia harvest.

[6]The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 22e. System Planning Model results for spring chinook in the Bear Valley Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective: Refer to Table 22d.

Biological Objective: Refer to Table 22d.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	10 -N	304	329	111	0(1.00)
All Nat	642 -C	842	1,529	517	2,675(4.64)
1*	642 -c	842	1,529	517	2,675(4.64)
2	same as 1				
3	same as 1				

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Continue wild fish management and complete habitat improvement and screening projects. Post Mainstem Implementation.
2. Continue wild fish management and complete habitat improvement and screening projects. Post Mainstem Implementation.
3. Continue wild fish management and complete habitat improvement and screening projects. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4]Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6]The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 22ee. Estimated costs of alternative strategies for Middle Fork-Bear Valley Creek spring chinook. Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1*	2	3
Hatchery Costs			
Capital[1]	0	650,000	1,300,000
O&M/yr[2]	0	75,000	150,000
Other Costs			
Capital[3]	115,850	115,850	115,850
O&M/yr[4]	8,750	8,750	8,750
Total Costs			
Capital	115,850	765,850	1,415,850
O&M/yr	8,750	83,750	158,750

* Reccimended strategy.

I Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

2 Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

3 Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

4 Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Panther Creek

(Strategies listed under summer chinook. Biological objective would remain the same regardless of spring or summer natural production.)

Biological Objective - minimum 118 spawners for natural production.

Utilization Objective - minimum 10,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

Lemhi River

Biological Objective - minimum 1,978 spawners for natural production.

Utilization Objective - minimum 10,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Manage for natural population and continue current land management practices.

Hypothesis: Improved juvenile migrant survival will enable this productive system to achieve optimum seeding and harvestable surplus.

Assumptions: Low flows are not a production constraint, and further degradation of habitat quality does not occur. Angler access is available. Significant mortality is not occurring due to diversions. Mixed-stock harvest on **mainstem** Salmon can be developed without negatively impacting other populations.

ACTIONS: 1

1. Do not produce or supplement with hatchery fish.

STRATEGY 2: Improve passage and flows, and manage for natural population.

Hypothesis: Dewatering, irrigation diversions and resultant channel alterations are significant constraints to production and must be rectified to rebuild population and produce harvestable surplus.

Assumptions: Water is available for instream flows by purchase. Water can be made available by other methods, but costs were not estimated. Cooperative agreement can be reached with landowners concerning irrigation diversion improvements and reduction of channel alterations. Assume costs will not be burdensome to property owner and that no lessening of property rights or water usage and river access will be experienced.

ACTIONS: l-3

1. -

2. Screen unscreened diversions and replace or repair existing screens.

3. Purchase water for minimum instream flows. Water rights can be obtained by purchasing water from the land to which it is appurtenant. However the processes under which previously appropriated water could be returned to the stream (to support a minimum streamflow filing by the Water Resources Board) may require new legislation. Other actions could be taken such as constructing permanent and more efficient diversions, lining ditches, converting to sprinkler irrigation, and trapping and hauling around dewatered areas. costs were not estimated.

STRATEGY 3: Implement hatchery production and supplementation, improve post-release survival of hatchery fish, and implement Strategy 2.

Hypothesis: To reach optimum seeding levels and produce harvestable surplus to meet needs, a combination of hatchery and natural production is needed.

Assumptions: Biological and physical requirements can be met for implementation of existing and/or new rearing facilities. Tributary brood stock is available to support hatchery and natural production, as well as harvestable surplus.

ACTIONS: 2-5

2. -
3. -

4. Reactivate and upgrade Hayden Creek Hatchery as a production facility and develop other rearing facilities, such as one at Purcell Springs, to produce a total of 1 million smolts or equivalents plus fry for supplementation. Or develop an entirely new rearing and brood stock collection facility because of water quality and quantity constraints at Hayden Creek and the need for a research facility in the subbasin. No additional sites have been proposed or developed.

5. Implement hatchery effectiveness actions (Table 21).

Table 22f. System Planning Model results for spring chinook in the Lemhi Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:
Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 94,000 fish to allow 50-50 harvest by tribal and non-tribal fishers. .

Section objective: 10,000 fish for harvest in the subbasin.

Biological Objective:
Optimum utilization of habitat. Minimun spawning escapement of 20,000 for natural production. Minimum spawning escapement of 6,000 for hatchery production. Total return above Lower Granite Dam of 19,400. Contribute to Council's 2x goal consistent with policies, conserve genetic resources, maintain genetic fitness and diversity, and ensure long-term viability. Achieve smolt-to-adult return rate to subbasin of 0.8% for wild/natural and 0.4% for hatchery based on listed flow rates during outmigration.

Section objective: minimun 1,978 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	246 -C	782	1,069	330	0(1.00)
All Nat	511 -C	943	1,503	465	956(1.41)
1	342 -C	879,	1,267	392	437(1.19)
2	511 -c	943	1,503	465	956(1.41)
3*	1,964 -N	2,356	4,677	1,446	7,939(4.38)

*Recommended strategy.

[1] Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the! natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Manage for natural population and continue current land management practices. Post Mainstem Implementation.
2. Improve passage and flows, and manage for natural population. Post Mainstem Implementation.
3. Strategy 2 plus implement hatchery production and supplementation, improve post-release survival of hatchery fish. Post Mainstem Implementation.

[2] MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3] Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4] Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the

Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 22ff. Estimated costs of alternative strategies for Lemhi spring chinook. Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1	2	3*
Hatchery Costs			
Capital[1]	0	0	1,300,000
O&M/yr[2]	0	0	1150,000
Other Costs			
tal[3]	0		
O&MCapi[4]	0	2,096,760 150,000	2,096,760 150,000
Total Costs			
Capital	0	2,096,760	3,396,760
O&M/yr	0	150,000	300,000

* Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Upper Salmon River - Headwaters (Middle Fork to headwaters, excluding Panther Creek, Lemhi, and Pahsimeroi rivers)

Biological Objective - minimum 6,036 spawners for natural production.

Utilization Objective - 'minimum 30,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Improve habitat and passage, and use current hatchery production and supplementation (current capacities and planned levels of production and stocking with upper Salmon fish).

Hypotheses: Increased habitat capacity and passage improvement will greatly increase natural production capacity. With increased migrant survival, productive spawning escapements and harvestable surplus will occur.

Assumptions: Expected habitat improvement benefits do occur and habitat is not degraded further by land management or recreation activities. Juvenile migrant survival is increased expeditiously. Mixed-stock harvest can be developed in mainstem Salmon that does not negatively impact other populations. Supplementation methods are employed that allay genetic concerns so that genetic resources of natural and unsupplemented runs, such as Valley Creek, can be maintained as per supplementation research results and genetic monitoring.

ACTIONS: 1-8

1. Complete the Forest Service and Shoshone-Bannock projects including Challis, Twin, Basin, Valley, Thompson, Squaw, Morgan, Beaver and Alturas Lake creeks, Yankee Fork, East Fork, and the upper mainstem Salmon. Projects are funded by BPA and the Forest Service and include passage improvements, erosion control, riparian revegetation and instream structures.

2. Resolve Alturas Lake Creek/upper Salmon dewatering due to irrigation diversions operated by Busterback Ranch.

3. Develop minimum instream flows or provide enough water for productive spawning, rearing, and migration through water purchase or other methods for Squaw, Iron, Challis, Thompson, and Alturas Lake, Owl, Iron, Twelvemile, Colson, Dahlonega, Beaver, and Smiley creeks, and upper Salmon River. Many of these streams are managed by the Forest Service in the upper drainage

and private landowners in the lower end and suffer dewatering. Waterrights can be obtained by purchasing water from the land to which it is appurtenant. However, the processes under which previously appropriated water could be returned to the stream (to support a minimum streamflow filing by the Water Resource Board) may require new legislation. Other actions could be taken such as constructing permanent and more efficient diversions, lining ditches, or converting to sprinkler irrigation. Costs were not estimated.

4. Produce 2.3 million hatchery smolts or equivalents at Sawtooth Hatchery, as prescribed in the IDFG Anadromous Fisheries Management Plan, 1985-1990.

5. Continue supplementing as per supplementation research results, brood stock availability, and seeding levels. Capitalize on biotic potential of forestlands, supplementing juveniles in appropriate tributaries.

6. Screen unscreened diversions and replace or repair existing screens.

7. Reduce Stanley Basin allotments and/or implement alternative grazing strategies in those streams suffering from livestock degradation to provide optimum riparian area, upland area, and stream channel protection in allotments. No costs were estimated.

8. Continue stocking Yankee Fork ponds for production of approximately 25,000 smolts.

STRATEGY 2: Improve post-release survival of hatchery fish, improve additional habitat, and implement Strategy 1.

Hypotheses: Harvestable surplus and spawning escapements are constrained by survival of hatchery fish. Additional habitat improvements will enhance natural production.

Assumptions: Hatchery effectiveness measures will improve post-release survival. Cooperative agreements with private landowners can be developed for fencing, riparian enhancement, and alternative grazing strategies.

ACTIONS: 1-10

l-8. -

9. Fence and implement riparian revegetation on sections of upper mainstem Salmon not covered by current projects where grazing degradation has occurred.

10. Implement hatchery effectiveness actions (Table 21).

STRATEGY 3: Increase level of hatchery production and supplementation, and implement Strategy 2.

Hypothesis: To provide a harvestable surplus to meet needs, hatchery production should be greatly increased.

Assumptions: Migrant survival will not enable rebuilding and a harvestable surplus without additional hatchery production. Sawtooth/East Fork facilities can be modified for additional production and/or new facilities can be developed. Cooperative agreements can be implemented with the LSRCP program for additional production. Brood stock is available to support hatchery and natural production as well as harvest in both the upper Salmon and headwater areas.

ACTIONS: 1-12

l-10. -

11. Complete additional rearing capacity at the Sawtooth/East Fork facility or develop new rearing facilities to produce an additional 2.8 million smolts or equivalents, of which 1 million would be designated for the upper Salmon (Middle Fork to Sawtooth/East Fork weirs). Develop cooperative Lower Snake River Compensation Program agreements for additional production. Sites have not been developed.

12. Complete brood stock collection facility to collect tributary brood stock in the upper Salmon area. No sites have been developed.

Table 22g. System Planning Model results for spring chinook in the upper Mainstem Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:

Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 94,000 fish to allow 50-50 harvest by tribal and non-tribal fishers. .

Section objective combination of upper Salmon and Headwaters sections. Refer to both for results. Minimum 30,000 fish for harvest in the subbasin.

Biological Objective:

Optimum utilization of habitat. Minimum spawning escapement of 20,000 for natural production. Minimum spawning escapement of 6,000 for hatchery production. Total return above Lower Granite Dam of 19,400. Contribute to Council's 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness and diversity, and ensure long-term viability. Achieve smolt-to-adult return rate to subbasin of 0.8% for wild/natural and 0.4% for hatchery based on listed flow rates during outmigration.

Section objective combination of upper Salmon and Headwaters sections. Refer to both for results. Minimum 6,036 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	826 -C	1,831	2,754	881	0(1.00)
All Nat	2,667 -C	2,534	5,333	1,705	5,703(1.94)
1	2,420 -C	2,491	5,043	1,613	5,060(1.83)
2	2,667 -C	2,534	5,333	1,705	5,703(1.94)
3*	3,181 -C	2,904	6,238	1,995	7,703(2.27)

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Improve habitat and passage, and utilize current hatchery production and supplementation (current capacities and planned levels of production and stocking with upper Salmon fish). Post Mainstem Implementation.
2. Strategy 1 plus improve post-release survival of hatchery fish, improve habitat. Post Mainstem Implementation.
3. Strategy 2 plus increase level of hatchery production and supplementation. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4]Total return to the mouth of the subbasin.

5 Includes ocean, estuary, and mainstem Columbia harvest.

6 The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Uildlife Program), from the baseline scenario. The index 0 is the strategy's total production divided by the baseline's total production.

Table 22h. System Planning Model results for spring chinook in the headwaters Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective: See Table 22g.

Biological Objective: See Table 22g.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	2,686 -N	3,380	6,247	1,998	0(1.00)
All Nat	5,053 -C	2,698	7,895	2,525	3,644(1.26)
1	4,051 -C	2,673	6,867	2,197	1,370(1.10)
2	5,064 -C	2,704	7,912	2,530	3,681(1.27)
3*	7,947 -N	6,172	14,450	4,622	18,135(2.31)

*Recommended strategy.

1 Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Improve habitat and passage, and utilize current hatchery production and supplementation (current capacities and planned levels of production and stocking with upper Salmon fish). Post Hainstem Implementation.
2. Strategy 1 plus improve post-release survival of hatchery fish, improve habitat. Post Mainstem Implementation.
3. Strategy 2 plus increase level of hatchery production and supplementation. Post Mainstem Implementation.

2 MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximiized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

3 Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

4 Total return to the mouth of the subbasin.

5 Includes ocean, estuary, and mainstem Columbia harvest.

6 The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Uildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 22hh. Estimated costs of alternative strategies for upper Salmon-headuaters spring chinook. Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Louer Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1	2	3*
Hatchery Costs			
Capital[1]	0	0	3,600,000
O&M/yr[2]	0	0	400,000
Other Costs			
Capital[3]	2,732,590	2,882,964	2,882,964
O&M/yr[4]	190,000	191,900	191,900
Total Costs			
Capital	2,732,590	2,882, 984	6,482,964
O&M/yr	190,000	191,900	55'1 ,900

* Recommended strategy.

I Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well uater is used and, if the latter, the number and depth of the wells.

2 Estimated operation and maintenance costs per year directly associated uith neu hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

3 Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

4 Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

The following are actions that, while not modeled or evaluated for cost, would need to accompany any strategy for any species.

- Improve and/or acquire fishing access sites.
- Monitor and enforce compliance with tribal and non-tribal fishing regulations.
- Monitor and evaluate production and harvest to assess the degree to which subbasin objectives are being met.
- Monitor juvenile survival to determine benefits and relation to production and harvest.
- Continue smolt-timing research and development of relative abundance indices to aid water budget decisions and reservoir management.
- Continue mixed-stock harvest research to 'develop methodology and stock identification.

Recommended Strategies

Effective management of mixed-stock tributary and mainstem fisheries should be considered a critical component for all recommended strategies for the Salmon River Subbasin. Harvest research and methodology development must parallel production increases to meet utilization objectives to the greatest degree, as well as meet biological objectives.

Planners used a technique called the Simple Multi-Attribute Rating Technique (SMART) as a decision-making tool. Refer to Appendix B for a list of the decision criteria and the analysis methodology.

A cost sheet that summarizes the cost of recommended strategies for all species is in Part V.

In many cases, subbasin numerical objectives were not met in terms of the System Planning Model analyses. However, decisions should not rest on subbasin actions alone. Decisions must take into account benefits or impacts of system integration and potential implementation of system alternatives that, presumably, will have considerable impact on alternative and recommended strategy results. Thus, these are preliminary recommendations.

Lower Salmon River (mouth to French Creek excluding Little Salmon River)

Biological Objective - minimum 661 spawners for natural production.

Utilization Objective - 'minimum 6,000 fish for non-tribal and tribal harvest. Includes fish that would be passing though the **mainstem** but produced in another.area.

STRATEGY 2: Produce and supplement 1 million hatchery smolts or equivalents, complete Forest Service habitat improvement projects, implement Bureau of Land Management habitat improvement projects (not modeled), and improve post-release survival of'hatchery fish.

Hypothesis: Additional hatchery production and supplementation, as well as improved migrant survival and habitat improvements, will speed rebuilding process and provide harvestable surplus to meet needs.

Assumptions: Tributary brood stock will be available to meet hatchery and natural spawning escapement needs as well as harvest. Hatchery fish of Rapid River origin will not negatively affect the genetic resource of the natural population. Biological and physical requirements for rearing facilities and collection of brood stock can be met, and early rearing capacity is available at an existing and/or new facility. Land use activities and management will not further degrade current or enhanced **quality** of habitat. Anglers will have access to **mainstem** and tributary fisheries. Harvestable surplus can be utilized in a **mixed-**stock **mainstem** harvest along with tributary harvest without negatively impacting natural populations or other species.

Index: The System Planning Model projected MSY to be 1,727 fish. Total spawning return, including hatchery and natural fish, was projected to be 2,019 fish. The contribution to the Power Planning Council's goal index was 9.56. The index is the strategy's total production divided by the baseline's total production.

Rationale: This strategy combines elements of current management with the need to accelerate rebuilding and harvest opportunities to meet both biological and utilization objectives. Habitat improvement is also important to speed rebuilding of low level populations and support fish for long-term adaptation and fitness for future brood and genetic needs. Strategy 1 did not meet utilization needs and Strategy 3 was not chosen because of genetic impacts due to large hatchery releases in relation to potential natural rearing habitat. Strategy 2 had the highest SMART rating.

Little Salmon River

Biological Objective - minimum 805 spawners for natural production.

Utilization Objective - minimum 10,000 fish for non-tribal and tribal harvest to be utilized in Salmon Subbasin.

STRATEGY 3: Improve habitat, passage, and flow; increase hatchery production and supplementation; and improve post-release survival of hatchery fish.

Hypotheses: No significant resident fish impacts would occur with barrier removal; potential habitat should be used for natural production. Habitat improvement and tributary flow enhancement is needed to optimize available habitat for natural production and assist juvenile migration. Increased hatchery production is needed to provide harvestable surplus to meet needs.

Assumptions: Cooperative agreements can be developed with private landowners for habitat improvement, and land management strategies are implemented that protect current and enhanced quality of habitat. A settlement agreement could be negotiated with Idaho Power that would allow release of Rapid River's total production (3 million smolts) into the Little Salmon drainage, yet would also fulfill Idaho Power's commitment to Oregon.

Index: The System Planning Model projected MSY to be 5,311 fish. Total spawning return, including hatchery and natural fish, was projected to be 5,324 fish. The contribution to the Power Planning Council's goal index was 2.02. The index is the strategy's total production divided by the baseline's total production.

Rationale: Of the four alternative strategies, Strategy 3 had the lowest SMART rating. This was due to subbasin planners' lowered confidence in meeting assumptions regarding habitat improvement and water availability. However, subbasin planners and regional System Planning Group members felt that the benefits of more hatchery production, as well as the extension of natural production capacity, fulfilled the objectives to a greater degree than other strategies. Habitat improvements and barrier removal would provide greater utilization opportunities as well as provide habitat conditions that would benefit production above and below the barrier. Extended natural production would better meet biological objectives and genetic maintenance for hatchery and natural brood stock.

Mid-Mainstem Salmon River (Salmon River Canyon from French Creek to the Middle Fork)

Biological Objective - minimum 1398 spawners for natural production.

Utilization Objective - minimum 12,000 fish for non-tribal and tribal harvest. Includes fish that would be passing though the mainstem but produced in another area.

STRATEGY 1: Continue wild fish management.

Hypotheses: Protection of this wild stock is critical to the long-term vitality of future hatchery and natural production in the basin. Increased juvenile migrant survival due to full implementation of the Columbia River Basin Fish and Wildlife Program will promote rebuilding and produce harvestable surplus. Wild fish management is compatible with wilderness management.

Assumptions: Migrant survival will increase expeditiously. Wild runs can be maintained in potential mixed-stock fisheries in the mainstem Salmon. Pristine condition of habitat is maintained.

Index: The System Planning Model projected MSY to be 650 fish. Total spawning return was projected to be 618 fish. The contribution to the Power Planning Council's goal index was 1.13. The index is the strategy's total production divided by the baseline's total production.

Rationale: Subbasin planners and regional System Planning Group members recommended this strategy because it exhibited the highest SMART rating and they considered wild fish management appropriate for this pristine environment. This strategy best meets the biological objective of maintaining wild fish genetics. Maximum utilization opportunities could be provided by other production units. Critical to this strategy is effective harvest management of a mixed-stock fishery in the mainstem corridor to meet utilization objectives.

Middle Fork Salmon River - Bear Valley

Biological Objective - minimum 9,004 spawners for natural production.

Utilization Objective - minimum 16,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: continue managing for wild fish, and complete habitat improvement and screening projects.

Hypotheses: Preservation of genetic fitness and diversity of this wild stock is important to long-term vitality of Salmon Subbasin spring chinook. This stock is adapted to the Middle Fork drainage and exhibits better survival than other stocks or hatchery fish. Wild fish management is compatible with wilderness requirements.

Assumptions: Improved juvenile and migrant survival will enable optimal seeding levels and production of a harvestable surplus. Habitat improvements will also add to rearing capacity to enhance natural production. Mixed-stock harvests that develop in the mainstem Salmon River will not negatively impact this population. Wilderness designation is sufficient to ensure full production capability of habitat and that land management activities, such as grazing and mining, do not degrade current or enhanced habitat.

Index: The System Planning Model projected MSY to be 3,927 fish for the Middle Fork and 642 fish for Bear Valley. Total spawning return was projected to be 4,042 fish for the Middle Fork and 842 for Bear Valley. The contribution to the Power Planning Council's goal index was 1.17 for the Middle Fork and 4.64 for Bear Valley. The index is the strategy's total production divided by the baseline's total production.

Rationale: This strategy exhibited the highest SMART rating and is compatible with wilderness management and strategies recommended for other species in the basin. This strategy best meets the biological objective of maintaining unique wild fish genetics and could still provide some utilization opportunities in traditional areas. Natural efforts to support rebuilding and increase survival such as screening are important. Strategies 2 and 3 were considered too great a genetic risk at this time. Critical to this strategy are accurate escapement estimates and effective harvest management of mixed-stock fishery in mainstem corridors. Spring and summer chinook differentiation and timing is also needed to meet utilization objectives without negative impacts on populations..

Lemhi River

Biological Objective - minimum 1978 spawners for natural production.

Utilization Objective - minimum 10,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 3: Implement hatchery production and supplementation of 1 million smolts or equivalents, improve post-release survival of hatchery fish, and improve passage and flows.

Hypothesis: To reach optimum seeding levels and produce harvestable surplus to meet needs, a combination of hatchery and natural production is needed.

Assumptions: Biological and physical requirements can be met for implementation of existing and/or new rearing facilities. Tributary brood stock is available to support hatchery and natural production as well as harvestable surplus. Water is available for **instream** flows by purchase or other methods. Cooperative agreements can be reached with landowners concerning irrigation diversion improvements and reduction of channel alterations. Angler access is available.

Index: The System Planning Model projected MSY to be 1,964 fish. Total spawning return, including hatchery and natural fish, was 2,356 fish. The contribution to the Power Planning Council's goal index was 4.38. The index is the strategy's total production divided by the baseline's total production.

Rationale: Strategies 1 and 2 were not felt to be aggressive enough in terms of rebuilding natural populations and meeting utilization objectives. A combination of hatchery and natural actions is needed to support both objectives. Lemhi passage and flow improvement is needed to prevent losses of hatchery and natural fish, and to promote rebuilding of natural populations to sustain genetic fitness. This strategy also exhibited the highest SMART rating. Criticalto this strategy is water management and landowner cooperation in this system, where demand for water generally exceeds the supply.

Upper Salmon River - Headwaters (Middle Fork to headwaters, excluding Panther Creek, Lemhi, and Pahsimeroi rivers)

Biological Objective - minimum 6,036 spawners for natural production.

Utilization Objective - 'minimum 30,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 3: Improve habitat and passage, improve post-release survival of hatchery fish, and increase level of hatchery production and supplementation to 5 million smolts or equivalents using upper Salmon Basin stock.

Hypothesis: To provide for a harvestable surplus to meet needs, hatchery production should be greatly increased and natural production should be enhanced through habitat improvements and mainstem Salmon and tributary flow improvements.

Assumptions: Migrant survival will not enable rebuilding and a harvestable surplus without additional hatchery production. Sawtooth/East Fork facilities can be modified for additional production and/or biological and physical requirements can be met for the development of new facilities. Cooperative agreements can be developed for additional production under the Lower Snake River Compensation Plan. Brood stock is available to support hatchery and natural production, as well as harvest, in both the upper Salmon and headwater areas.

Index: The System Planning Model projected MSY to be 3,181 fish for the upper Salmon and 7,947 fish for the headwaters. Total spawning return, including hatchery and natural fish, was 2,904 for the upper Salmon and 6,172 fish for the headwaters. The contribution to the Power Planning Council's goal index was 2.27 for the upper Salmon and 2.31 for the headwaters. The index is the strategy's total production divided by the baseline's total production.

Rationale: This strategy exhibited the lowest SMART rating, mainly due to lower confidence in the feasibility of increasing production to modeled levels and impacts on utilization during brood stock development. Subbasin planners and regional System Planning Group members acknowledge that the production of 5 million smolts may not be feasible, but recommend a strategy that incorporates some level of increased hatchery production to provide increased harvestable surplus. Habitat and passage improvements are important to sustain natural production for genetic fitness and meet biological objectives. Critical to this strategy will be effective mixed-stock harvest management and identification of suitable locations for additional production facilities.

Objectives and Strategies for Summer Chinook

The following represent objectives for the entire subbasin. For strategy modeling, these were subdivided by section and are displayed with each modeled subbasin section: if totaled, they represent the following subbasin components. Hatchery needs are shown only by subbasin and are dependent on the level of hatchery production implemented. Individual section biological objectives were calculated based on smolt potential and the utilization components were derived from Public Advisory Committee information. Objectives listed secondarily do not infer secondary in importance.

Biological Objectives

(Numbers are not additive. For example, hatchery spawners includes brood needs also included in the Lower Snake River Compensation Plan mitigation goal.)

1a. Provide a minimum of 11,000 summer chinook spawners to the Salmon Subbasin for wild and natural production to maintain the unique biological characteristics and productivity of its naturally reproducing populations, and to rebuild wild and natural populations throughout the subbasin to provide sustainable yield.

1b. Provide a minimum of 3,000 summer chinook spawners to the Salmon Subbasin for hatchery production to maintain biological characteristics and productivity to provide fish for hatchery supported harvest programs and fish for supplementation to aid rebuilding. Strategies that require increased hatchery production or supplementation will require respective increased spawning escapements.

2. Achieve and maintain the compensation level of approximately 8,000 adult summer chinook returning to the Snake River Basin above Lower Granite Dam from Salmon River releases as identified in the Lower Snake River Compensation Plan for harvest and spawning in the subbasin.

3. Contribute to the Northwest Power Planning Council's doubling goal, consistent with council policies.

4. Conserve and protect genetic resources represented by wild and natural Salmon Subbasin stocks. Maintain genetic fitness and diversity of wild fish and ensure long-term viability and productivity of hatchery and natural fish.

5. Achieve an average smolt-to-adult return rate to the subbasin for wild and natural summer chinook of 0.80 percent. Achieve an average smolt-to-adult return rate to the subbasin for hatchery summer chinook of 0.40 percent. Current data indicates that the following flow criteria, proposed bypass and screening at dams, and smolt transportation would equate to a productive fishery and spawning escapement.

   Flow criteria: During the smolt migration period, April 15 to June 15, the weekly average flows at Lower Granite Dam should be maintained at 85 kcfs in 92 percent of the water years, and 115 kcfs in 50 percent of the water years. A minimum of 70 kcfs should be maintained 100 percent of the time during this period. Data indicates that mean flows of 70 kcfs, 85 kcfs, and 115 kcfs would result in wild/natural smolt-to-adult returns of 0.09 percent, 0.23 percent, and 0.86 percent, respectively. These estimates incorporate passage improvements made to date.

Utilization Objectives

1a. In the long term, achieve and maintain a minimum of 56,000 summer chinook, as identified by the public advisory committees, for non-tribal harvest in the subbasin once rebuilding is achieved. These would be hatchery, natural, and wild fish. Nez Perce and Shoshone-Bannock tribes would expect to harvest equal numbers as non-tribal fishers harvest, for a total of 112,000 fish.

1b. In the short term, develop and implement stair steps of opportunities and harvest that reflect increases in escapement contingent on the maintenance of viable, productive runs. Achieve returns to terminal areas at levels that will allow selective harvest of hatchery-origin summer chinook until natural and wild origin runs have been rebuilt to a level that can sustain fisheries and productive spawning escapements.

2. Provide for a range of mainstem and tributary fishing opportunities for tribal and non-tribal fishers.

3. Restore fishing opportunities in tribal and non-tribal historical areas.

The number of minimum spawners was derived by using the System Planning Model, the Smolt potential of the subbasin, earlier planning efforts, and the best knowledge of the Technical Work Team and fish managers. The utilization number was derived from the public advisory committees as their estimate of numbers of fish needed to provide optimal fisheries. It is recognized that through the monitoring and evaluation of adaptive management, these components will be re-evaluated. In regard to model analysis, no objectives will be changed prior to system integration because of the reliance on system parameters for a subbasin above eight dams. Thus system integration and analysis Of System alternatives may result in different model projections than those displayed in this plan. A priority is to rebuild wild, natural, and hatchery populations to a level that will sustain harvestable surplus while maintaining the biological characteristics that make the Salmon Subbasin populations unique and productive.

Alternative Strategies

Because of its complexity, the Salmon Subbasin was divided into sections for strategy development and model analyses.

Planners used the System Planning Model (SPM) to provide a quantifiable index of comparison between alternative strategies and baseline conditions. The numbers derived from the SPM are not necessarily representative of current conditions because the model depicted populations at an equilibrium phase and at higher seeding levels than are currently found in the subbasin. The broad interpretation is that the model depicts a "rebuilt condition," and does not address the rebuilding phase, a critical step in the continuation of Salmon Subbasin anadromous runs.

Potential numerical fish production increases for each summer chinook strategy are displayed in Tables 23a-23g. Critical uncertainties include those inherent in any projections of fish numbers or survival since there is presently no general technical agreement among land, water, and fish management agencies and tribes.

In general, summer chinook strategies followed a sequence of actions beginning with utilization of existing hatchery production (if any), and methods to enhance natural production (such as an "all natural" strategy), followed by levels of increased artificial production in addition to the natural actions found in the first strategy. Because of the variability in the summer chinook populations and geography of the Salmon Subbasin, a mix of methods will be found in the alternative strategies that reflect wild, natural, and hatchery management. To avoid undue repetition, reference to a previous strategy includes reference to its major hypotheses, critical assumptions, and actions.

Modeling results for each strategy are presented as fish produced at "maximum sustainable yield" (MSY). The sustainable yield of a fish population refers to that portion of the population that exceeds the number of fish required to spawn and maintain the population over time. Sustainable yield can be "maximized," termed MSY, for each stock at a specific harvest level. The MSY is estimated using a formula (Beverton-Holt function) that analyzes a broad range of harvest rates. Subbasin planners have used MSY as a tool to standardize results so that decision makers can compare stocks and strategies.

In MSY management, managers set a spawning escapement level and the remaining fish (yield) could theoretically be harvested. In practice, a portion of the yield may be reserved as a buffer or to aid rebuilding. Thus, managers may raise the escapement level to meet a biological objective at the expense of a higher utilization objective.

The amount of buffer appropriate for each stock is a management question not addressed in the subbasin plans. For this reason, the utilization objective, which usually refers to harvest, may not be directly comparable to the MSY shown in Tables 23a-23g. At a minimum, a strategy should produce an estimated MSY equal to or greater than the utilization objective. A MSY substantially larger than the subbasin utilization objective may be needed to meet subbasin biological objectives.

Estimated costs of the alternative strategies are summarized in tables below. Standardized cost sheets were developed for each summer chinook strategy and are grouped in Appendix C. These should be referred to for estimated, relative costs.

<u>Little Salmon River</u>

Biological Objective - minimum 399 spawners for natural production.

Utilization Objective - minimum 2,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Continue wild fish management.

Hypotheses: Protection of this wild stock is critical to the long-term vitality of potential future hatchery and natural production in the basin. Out-of-basin survival improvements will allow this population to rebuild to a productive level to provide a harvestable surplus.

Assumptions: This population of summer chinook will not integrate with the Rapid River spring chinook program at a level that will affect population characteristics. Summer chinook can be accurately differentiated from spring chinook at the Rapid River weir on the basis of timing. Rapid River's wild and scenic designation will protect important spawning and rearing habitat from degradation. Mixed-stock harvests that develop in the Salmon **Subbasin** will not decimate this small population.

No additional costs to the Columbia River Basin Fish and Wildlife Program are anticipated.

ACTIONS: 1, 2

1. Do not supplement the Rapid River summer chinook population.

2. Forest Service ensure that timber sale contract implementation meets forest plan standards and guidelines and other site-specific requirements.

Table 23a. System Planning Model results for summer chinook in the Little Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:
Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 112,000 fish to allow 50-50 harvest by tribal and non-tribal fishers.'

Section objective: minimun 2,000 fish for harvest.

Biological Objective:
Optimum utilization of habitat. Minimum spawning escapement of 11,000 for natural production. Minimum spauning escapement of 3,000 for hatchery production. Total return above Lower Granite Dam of 19,400. Contribute to Council's 2X goal consistent uith policies, conserve genetic resources, maintain genetic fitness and diversity, and ensure long-term viability. Achieve smolt-to-adult return rate to subbasin of 0.8% for wild/natural and 0.4% for hatchery based on listed flow rates during outmigration.

Section objective: minimun 399 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Basel ine	75 -N	184	269	71	0(1.00)
All Nat	100 -N	212	323	85	117(1.20)
1*	100 -N	212	323	85	117(1.20)

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Continue wild fish management. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections uhere the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection uhere sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spauning return.

[4]Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6]The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Uildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

South Fork Salmon River (includes Secesh River)

Biological Objective - minimum 5,760 spawners for natural production.

Utilization Objective - minimum 18,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Complete **BPA-** and Forest Service-funded habitat projects (some of which are part of the Forest Service's south Fork Initiative), improve post-release survival of hatchery fish, use current hatchery production and supplementation (capacities and planned level of production), and continue wild fish management in Secesh River.

Hypotheses: Increased migrant survival, current McCall Hatchery capacity, and increased natural capacity and early rearing survival will rebuild population to produce optimum spawning escapement and harvestable surplus. Protection of wild stocks, because of their unique genetic fitness and diversity, is critical to the long-term vitality of both natural and hatchery production in this drainage.

Assumptions: Habitat projects and improved hatchery effectiveness will provide expected increases in juvenile capacity and survival. Migrant survival will improve expeditiously. Very little straying of hatchery and natural chinook into Secesh will occur. No land perturbations occur that would degrade the restored quality of spawning and rearing habitat. Land and mineral management strategies that protect riparian areas, stream channels, and water and substrate quality will be implemented. No catastrophic toxic spills occur. Harvest management will allow optimization of mixed hatchery, natural and wild populations in the drainage, and in the **mainstem** Salmon without negatively impacting other populations.

ACTIONS: l-5

1. Complete Forest Service habitat improvement projects, including Johnson Creek bank stabilization and vegetation management; Sand Creek riparian enhancement; Landmark Creek pool habitat enhancement; Riordan, Trapper and Ditch creeks FERC mitigation; and Oxbow Breach restoration.

2. Release 1 million smolts or equivalents into drainage from McCall Hatchery, as identified in the IDFG Anadromous Fisheries Management Plan, 1985-1990, and the Lower Snake River Compensation Plan.

3. Continue supplementation as per supplementation research results, brood stock availability, and seeding levels.

4. Implement hatchery effectiveness actions (Table 21).

5. Continue wild fish management in the Secesh River with no supplementation.

STRATEGY 2: Complete Forest Service South Fork Initiative (SFI) and implement Strategy 1.

Hypotheses: The full complement of basinwide **SFI** projects must be implemented to attain expected increases in juvenile survival and capacity, and to meet the Forest Service's interim objective of improving habitat to a condition capable of supporting fishable populations by I997 and restoring the river to near full productive capability by 2007. Completion of the **SFI** and current McCall Hatchery capacity will rebuild the population to produce optimum spawning escapement and harvestable surplus. I?rotection of wild stocks, because of their unique genetic fitness and diversity, is critical to the long-term vitality of both natural and hatchery production.

Assumptions: See Strategy 1.

ACTIONS: 1-6

1. -
2. -
3. -
4. -
5. -

6. Complete Forest Service South Fork restoration strategy.

STRATEGY 3: Increase hatchery production and supplementation, continue wild fish management in Secesh River, and implement Strategy 2.

Hypotheses: Additional hatchery production is needed in addition to **inbasin** and out-of-basin survival improvements and natural capacity increases to produce productive spawning escapements and harvestable surplus to meet needs.

Assumptions: Water and land is available for rearing pond production in drainage upstream from Secesh River. Space is available for additional brood stock collection, egg incubation, and early rearing at McCall hatchery or another facility. Cooperative agreements can be developed for additional production at said facility. Development of additional artificial rearing facilities will **not** impact Forest Service land and resource management plan. A **mixed-**stock harvest can be developed that does not prevent productive natural and wild populations. Genetic fitness and diversity of natural/wild run is retained.

ACTIONS: l-7

1. -
2. -
3. -
4. -
5. -
6. -

7. Develop rearing capacity for an additional 1 million smolts or equivalents at existing facility or construct a new facility such as a rearing pond. Site has not been developed. Use existing facility for early rearing and brood stock collection.

Table 23b. System Planning Model results for summer chinook in the South Fork Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:

Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 112,000 fish to allow 50-50 harvest by tribal and non-tribal fishers:

Section objective a combination of South Fork and Secesh. Refer to Secesh results also. Minimum 18,000 fish for harvest in subbasin.

Biological Objective:

Optimum utilization of habitat. Minimum spawning escapement of 11,000 for natural production. Minimum spawning escapement of 3,000 for hatchery production. Total return above Lower Granite Dam of 19,400. Contribute to Council's 2x goal consistent with policies, conserve genetic resources, maintain genetic fitness and diversity, and ensure long-term viability. Achieve smolt-to-adult return rate to subbasin of 0.8% for wild/natural and 0.4% for hatchery based on listed flow rates during outmigration.

Section objective a combination of South Fork and Secesh. Refer to Secesh results also. Minimum of 5,760 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total' Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Basel ine	1,035 -N	3,230	4,501	1,215	0(1.00)
All Nat	3,795 -C	2,659	6,659	1,751	4,617(1.47)
1	3,795 -C	2,659	6,659	1,751	4,617(1.47)
2	3,795 -C	2,659	6,659	1,751	4,617(1.47)
3*	5,009 -N	6,989	12,522	3,330	17,285(2.78)

● Recormsended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Complete BPA and USFS funded habitat projects, improve post-release survival of hatchery fish, utilize current hatchery production and supplementation (capacities and planned level of production), and continue wild fish management in Secesh River. Post M
2. Strategy 1 plus complete USFS South Fork Initiative (SFI). Post Mainstem Implementation. (Since no information on expected benefits from SFI was available, Strategy 2 results are identical to results from Strategy 1.
3. Strategy 2 plus increase hatchery production and supplementation, continue wild fish management in Secesh River. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where tne sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

4Total return to the mouth of the subbasin.

5 Includes ocean, estuary, and mainstem Columbia harvest.

6The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 23c. System Planning Model results for summer chinook in the Secesh Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective: See Table 23b.

Biological Objective: See Table 23b.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	325 -C	793	1,159	343	0(1.00)
All Nat	430 -C	909	1,386	410	497(1.20)
1	430 -C	909	1,386	410	497(1.20)
2	430 -C	909	1,386	410	497(1.20)
3*	430 -c	909	1,386	410	497(1.20)

*Recommended strategy.

1Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Complete BPA and USFS funded habitat projects, improve post-release survival of hatchery fish, utilize current hatchery production and supplementation (capacities and planned level of production), and continue uild fish management in Secesh River. Post M
2. Strategy 1 plus complete USFS South Fork Initiative (SFI). Post Mainstem Implementation. (Since no information on expected benefits from SFI uas available, Strategy 2 results are identical to results from Strategy 1).
3. Strategy 2 plus increase hatchery production and supplementation, continue wild fish management in Secesh River. Post Mainstem Implementation.

2MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

3Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

4Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Uildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 23cc. Estimated costs of alternative strategies for South Fork-Secesh River summer chinook. Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Uildlife Program; they do not represent projects funded under other programs, such as the Louer Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1	2	3*
Hatchery Costs			
Capital[1]	0	0	1,300,000
O&M/yr[2]	0	0	150,000
Other Costs			
Capital[3]	1,017,146	1,017,146	1,017,146
O&M/yr[4]	1,330	1,330	1,330
Total Costs			
Capital	1,017,146	1,017,146	2,317,146
O&M/yr	1,330	1,330	151,330

* Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs par year directly associated with neu hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Middle Fork Salmon River

Biological Objective - minimum 1,326 spawners for natural production.

Utilization Objective - minimum 10,000 fish for non--tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Continue wild fish management.

Hypotheses: Preservation of the genetic fitness and diversity of this wild stock is important to the long-term vitality of summer chinook in the basin. This stock is adapted to Middle Fork drainage and exhibits better survival than other stocks or hatchery fish. Wild fish management is compatible with wilderness requirements. Fishers prefer wild fish qualities.

Assumptions: Improved migrant survival will enable optimal seeding levels and production of a harvestable surplus. Wilderness designation is sufficient to protect important spawning and rearing habitat from degradation from mining and grazing. Mixed-stock harvest that develop in mainstem Salmon Subbasin will not negatively impact this population.

No additional costs are anticipated.

ACTIONS: 1

1. Do not supplement.

Table 23d. System Planning Model results for summer chinook in the Middle Fork Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:
Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 112,000 fish to allow SO-50 harvest by tribal and non-tribal fishers.'

Section objective: minimum 10,000 fish for harvest in subbasin.

Biological Objective:
Optimum utilization of habitat. Minimum spawning escapement of 11,000 for natural production. Minimum spawning escapement of 3,000 for hatchery production. Total return above Lower Granite Dam of 19,400. Contribute to Council's 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness and diversity, and ensure long-term viability. Achieve smolt-to-adult return rate to subbasin of 0.8% for wild/natural and 0.4% for hatchery based on listed flow rates during outmigration.

Section objective: minimum 1,326 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Basel i ne	451 -C	517	1,025	335	0(1.00)
All Nat	546 -C	578	1,188	389	362(1.16)
1*	546 -C	578	1,188	389	362(1.16)

*Recommended strategy.

[1] Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Continue wild fish management. Post Mainstem Implementation.

[2] MSY is the nunber of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3] Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4] Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Panther Creek

Biological Objective - minimum 118 spawners for natural production.

Utilization Objective - minimum 4,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Reintroduce summer chinook into the drainage through low-level supplementation.

Hypotheses: Drainage was a mixture of springs and summers. Summer chinook are more accessible and more desirable to anglers. Spring chinook were essentially eradicated by toxic water due to mining, therefore intraspecific competition would not be significant.

Assumptions: Toxicity has diminished enough to allow supplementation in Clear Creek and the lower drainage. Summer chinook would produce a viable population, and Pahsimeroi or South Fork brood stock would be ecologically appropriate and available. A mixed-stock harvest plan can be developed for the mainstem Salmon River that will not negatively impact other populations.

ACTIONS: 1

1. Supplement with 200,000 fingerlings from Pahsimeroi hatchery, as prescribed in the IDFG Anadromous Fisheries Management Plan, 1985-1990.

STRATEGY 2: Implement tributary hatchery production, and increase post-release survival rate of hatchery fish.

Hypotheses: Within a few cycles of supplementation and/or rearing pond releases, a Panther Creek population capable of providing eggs for artificial rearing could be developed. Increased scale of stocking and hatchery-survival improvements is needed to produce a harvestable surplus to meet needs.

Assumptions: Physical and biological requirements for brood stock collection and rearing facility can be met in the drainage, or rearing capacity is available elsewhere in the basin. Toxicity is not a barrier to adult migration for brood stock collection. Water quality is sufficient for artificial production. Future mining activities in the drainage will not negatively impact natural and artificial production.

ACTIONS: l-3

1. -

2. Implement hatchery effectiveness actions (Table 21).

3. Construct a brood stock collection and rearing facility, such as a rearing pond, for 1 million smolts. Site has not been proposed.

STRATEGY 3: Trap and haul adults and juveniles around the most toxic segment of stream (from Clear Creek to Blackbird Creek), and implement Strategy 2.

Hypothesis: Habitat is available and should be optimized for natural production along with hatchery production, particularly to produce a population more "fit" to the parameters of the drainage.

Assumptions: Summer chinook will spawn and rear in the upper end of the drainage in traditional spring chinook habitat. Large-scale trapping and hauling of adults and juveniles is feasible and mortality due to handling is minimal. Adult return will support hatchery spawning needs, natural production needs, and harvestable surplus. Naturally produced fish can be identified to promote natural run.

ACTIONS: l-4

1. -
2. -
3. -

4. Implement a trap-and-haul program of adults and smolts, bypassing toxic sections of mainstem Panther Creek. Construct upstream and downstream weirs and traps.

STRATEGY 4: Rehabilitate Panther Creek and implement Strategy 2.

Hypotheses: Full rehabilitation of toxic area, primarily to improve water quality, is needed for juvenile and adult survival to produce any level of spawning escapement (hatchery and natural) and harvestable surplus. BPA is already involved, but involvement has been delayed pending outcome of litigation.

Assumptions: Pending litigation is resolved, rehabilitation project research is completed, and project is deemed feasible. Multiple agency and industry agreements can be developed to implement rehabilitation plan.

ACTIONS: l-3, 5

1. -
2. -
3. -

5. **BPA** or appropriate agency fund completion of the feasibility study's final design and subsequently fund restoration of Panther Creek. Negotiate reimbursement of funding agency from monies awarded to state if pending litigation is successful.

Table 23e. System Planning Model results for summer chinook in the Panther Creek Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:

Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 112,000 fish to allow SD-50 harvest by tribal and non-tribal fishers.'

Section objective: minimum 4,000 fish for harvest in subbasin.

Biological Objective:

Optimum utilization of habitat. Minimum spawning escapement of 11,000 for natural production. Minimum spawning escapement of 3,000 for hatchery production. Total return above Louer Granite Dam of 19,400. Contribute to Council's 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness and diversity, and ensure long-term viability. Achieve smolt-to-adult return rate to subbasin of 0.8% for wild/natural and 0.4% for hatchery based on listed flow rates during outmigration.

Section objective: minimum 118 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	0 -N	19	20	7	0(1.00)
All Nat	311 -C	600	943	302	2,040(46.43)
1	112 -N	55	430	116	884(20.68)
2	2,060 -N	1,391	3,614	962	7,752(*****)
3*	2,132 -N	1,695	4,023	1,092	8,654(*****)
4*	2,296 -N	2,170	4,687	1,305	10,122(*****)

*Recommended strategy.

[1] Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Reintroduce summer chinook into the subbasin through low-level supplementation. Post Mainstem Implementation.
2. Implement tributary hatchery production, and increase post-release survival rate of hatchery fish. Post Mainstem Implementation.
3. Strategy 2 plus trap and haul adults and juveniles around the most toxic segment of stream (from Clear Creek to Blackbird Creek). Post Mainstem Implementation.
4. Strategy 2 plus rehabilitate Panther Creek. Post Mainstem Implementation.

[2] MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spauning component and is shown uhen the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3] Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4] Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northuest Power Council's Fish and Uildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 23ee. Estimated costs of alternative strategies for Panther Creek summer chinook. Cost estimates represent neu or additional costs to the 1987 Columbia River Basin Fish and Uildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies			
	1	2	3*	4*
Hatchery Costs				
Capital[1]	0	1,300,000	1,300,000	1,300,000
O&M/yr[2]	0	150,000	150,000	150,000
Other Costs				
Capital[3]	0	0	101,500	6,000,000
O&M/yr[4]	0	0	31,900	2110,000
Total Costs				
Capital	0	1,300,000	1,401,500	7,300,000
O&M/yr	0	150,000	181,900	350,000

* Recommended strategy.

[1] Estimated capital costs of constructing a neu, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on uhether surface or well uater is used and, if the latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated with neu hatchery production. For consistency, O&M costs are based on 50 years.

Pahsimeroi River

Biological Objective - minimum 709 spawners for natural production.

Utilization Objective - minimum 7,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Use current hatchery production and supplementation (capacities and planned levels of production a:nd stocking).

Hypothesis: Increase in migrant survival through full implementation of the Columbia River Basin Fish and Wildlife Program will provide adequate hatchery brood stock, rebuild the natural population, and provide a harvestable surplus.

Assumptions: Significant losses are not occurring due to numerous diversions, and instream flow is met and adequate for spawning, rearing, and migration. Angler access can be developed through purchase and cooperative agreement. Methods for a mainstem Salmon River harvest can be developed that does not negatively impact other populations in a mixed-stock corridor.

ACTIONS: 1, 2

1. Release 1 million smolts or equivalents into drainage from Pahsimeroi Hatchery, as identified in the Idaho Power Company agreement.

2. Continue supplementation as per supplementation research results, brood stock availability, and seeding levels.

STRATEGY 2: Improve flows and passage, use current hatchery production and supplementation, and improve post-release survival rate of hatchery fish.

Hypotheses: Additional natural capacity is needed to produce optimum spawning escapement and harvestable surplus. Drainage is fairly productive and major limitation is water.

Assumptions: Water can be obtained for instream flow in addition to legislated instream flow. Current habitat is not degraded further by agricultural and grazing practices. Angler access can be developed through purchase and cooperative agreement with private landowners. Methods for a mainstem Salmon harvest can be developed that does not negatively impact other populations in a mixed-stock corridor.

ACTIONS:' l-5

1. -
2. -

3. Screen unscreened diversions and replace or repair existing screens.

4. Refer to Action 3, Lemhi River spring chinook. Improve **instream** flow for Morse, Little Morgan, Big and Goldberg creeks, and for **mainstem** Pahsimeroi River from Goldberg Creek to Doublespring Creek and from Doublespring Creek halfway to Burnt Creek.

5. Implement hatchery effectiveness actions (Table 21).

STRATEGY 3: Increase hatchery production and supplementation, and implement Strategy 2.

Hypothesis: Increased hatchery production is needed to produce a harvestable surplus to meet needs.

Assumptions: Biological and physical requirement of a new rearing facility can be met. Pahsimeroi Hatchery would probably not have enough early rearing space to accommodate a new rearing pond so a new facility or other facility in the basin may be used for early rearing if cooperative agreements can be developed for additional production. Genetic diversity and fitness of natural run can be maintained. Angler access can be developed through purchase and cooperative agreements. Methods for a **mainstem** Salmon harvest can be developed that does not negatively impact other populations in a mixed-stock corridor.

ACTIONS: l-6

1. -
2. -
3. -
4. -
5. -

6. Develop rearing capacity for 1 million smolts or equivalents at existing facility, or construct new facility such as a rearing pond. Site has not been developed. Use existing facility for early rearing and brood stock collection. Disease impacts would have to be considered.

Table 23f. System Planning Model results for summer chinook in the Pahsimeroi Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:
Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 112,000 fish to allow SO-50 harvest by tribal and non-tribal fishers..

Section objective: minimun 7,000 fish for harvest in subbasin.

Biological Objective:
Optimun utilization of habitat. Minimum spauning escapement of 11,000 for natural production. Minimum spawning escapement of 3,000 for hatchery production. Total return above Louer Granite Dam of 19,400. Contribute to Council's 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness and diversity, and ensure long-term viability. Achieve smolt-to-adult return rate to subbasin of 0.8% for wild/natural and 0.4% for hatchery based on listed flou rates during outmigration.

Section objective: minimun 709 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Base line	1,445 -N	1,735	3,361	888	0(1.00)
All Nat	2,897 -N	2,620	5,794	1,529	5,243(1.72)
1	2,274 -N	2,225	4,737	1,250	2,964(1.41)
2	2,897 -N	2,620	5,794	1,529	5,243(1.72)
3*	3,753 -N	3,971	8,159	2,153	10,338(2.43)

*Recommended strategy.

[1] Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Utilize current hatchery production and supplementation (capacities and planned levels of production and stocking). Post Mainstem Implementation.
2. Improve flows and passage, utilize current hatchery production and supplementation, and improve post-release survival rate of hatchery fish. Post Mainstem Implementation.
3. Strategy 2 plus increase hatchery production and supplementation. Post Mainstem Implementation.

[2] MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections uhere the sustainable yield is maximized for the natural and hatchery components combined and the natural spauning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3] Total return to subbasin minus MSY minus pre-spauning mortality equals total spauning return.

[4] Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the

Northwest Power Council's Fish and Uildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 23ff. Estimated costs of alternative strategies for Pahsimeroi summer chinook. Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Uildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1	2	3*
Hatchery Costs			
Capital[1]	0	0	1,300,000
O&M/yr[2]	0	0	150,000
Other Costs			
Capital[3]	0	501,310	501,310
O&M/yr[4]	0	35,000	35,000
Total Costs			
Capital	0	501,310	1,801,310
O&M/yr	0	35,000	185,000

* Recommended strategy.

1 Estimated capital costs of constructing a new, modern fish hatchery. In some s&basins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

2 Estimated operation and maintenance costs per year directly associated uith neu hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

3 Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

4 Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Upper Salmon River (Middle Fork to Sawtooth/East Fork weirs)

Biological Objective - minimum 2,688 spawners for natural production.

Utilization Objective - minimum 15,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Complete BPA and Forest Service funded habitat projects, improve passage, and use current hatchery production and supplementation (capacities and planned levels of production and stocking).

Hypotheses: Increased habitat capacity and passage improvement will greatly increase natural production capacity. With increased migrant survival, productive spawning escapements and harvestable surplus will occur.

Assumptions: Expected habitat improvement benefits do occur and habitat is not degraded further by land management or recreation activities. Juvenile migrant survival is increased expeditiously. Mixed-stock harvest can be developed in mainstem Salmon that does not negatively impact other populations. Supplementation methods are employed that allay genetic concerns so that genetic resources of unsupplemented runs can be maintained,as per supplementation research results and genetic monitoring.

ACTIONS: 1-6

1. Complete Forest Service and Shoshone-Bannock projects including Basin, Valley, Thompson, Squaw, Morgan, Yankee Fork, East Fork, and the upper mainstem Salmon rivers. Projects are funded by BPA and the Forest Service and include passage improvement, erosion control, riparian revegetation and instream structures.

2. Develop minimum instream flows for Squaw, Iron, Challis and Thompson creeks through water purchases or other methods. Water rights can be obtained by purchasing water from the land to which it is appurtenant. However, the processes under which previously appropriated water can be returned to the stream (to support a minimum streamflow filing by the Water Resource Board) may require new legislation. Other actions could be taken such as constructing permanent and more efficient diversions, lining ditches, and converting to sprinkler irrigation. Cost, however, were not estimated.

3. Produce 600,000 hatchery fingerlings or equivalents from Pahsimeroi Hatchery, as prescribed in IDFG Anadromous Fisheries Management Plan, 1985-1990.

4. Supplement as per supplementation research results, brood stock availability, and seeding levels. Capitalize on biotic potential of forestlands, supplementing juveniles in appropriate tributaries.-

5. Screen unscreened diversions and replace or repair existing screens.

6. Reduce Stanley Basin allotments and/or implement alternative grazing strategies in those streams suffering from livestock degradation to provide optimum riparian area, upland area, and stream channel protection in allotments. No costs were estimated.

STRATEGY 2: Improve post-release survival of hatchery fish, and implement Strategy 1.

Hypotheses: Harvestable surplus and spawning escapements are constrained by survival of hatchery fish.

Assumptions: Hatchery effectiveness measures will improve post-release survival.

ACTIONS: l-7

l-6. -

7. Implement hatchery effectiveness actions (Table 21).

STRATEGY 3: Increase level of hatchery production and supplementation, and implement Strategy 2.

Hypothesis: To provide for harvestable surplus to meet needs, hatchery production should be greatly increased.

Assumptions: Migrant survival will not enable rebuilding and a harvestable surplus without additional hatchery production. Current facilities can be modified for additional production and/or new facilities can be developed. Cooperative agreements can be implemented with Idaho Power or the LSRCP for additional production. Pahsimeroi brood stock is available to support hatchery and natural production, as well as harvest in the upper Salmon.

ACTIONS: l-8

1-7. -

8. Complete additional rearing capacity at Pahsimeroi Hatchery or develop new rearing facilities to produce 1 million smolts or equivalents. Develop cooperative agreements with Idaho Power Company for additional production and brood stock collection at **Pahsimeroi** Hatchery. Sites for additional rearing have not been developed.

STRATEGY 4: Implement habitat and improvement projects in Strategy 1, but do not supplement wild run (not modeled).

Hypotheses: Preservation of genetic fitness and diversity of this wild stock is important because it differs from lower Salmon **Subbasin** summer chinook populations. These fish are adapted to spawning and rearing in a large **mainstem** and survive better than hatchery fish or another stock. Migrant survival improvements and increased habitat capacity will enable optimum spawning escapement and a harvestable surplus.

Assumptions: upper Salmon River summer chinook are still a distinct component and have not integrated with Sawtooth Hatchery fish dropping out below the weir. Mixed-stock harvest could be developed in **mainstem** Salmon without negatively impacting this population.

ACTIONS: 1, 2, 5, 6, 9

1. -
2. -
5. -
6. -

9. Do not supplement.

Table 23g. System Planning Model results for summer chinook in the upper mainstem Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:
Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 112,000 fish to allow SO-50 harvest by tribal and non-tribal fishers.'

Section objective: minimun 15,000 fish for harvest in subbasin.

Biological Objective:
Optimum utilization of habitat. Minimum spawning escapement of 11,000 for natural production. Minimum spawning escapement of 3,000 for hatchery production. Total return above Lower Granite Dam of 19,400. Contribute to Council's 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness and diversity, and ensure long-term viability. Achieve smolt-to-adult return rate to subbasin of 0.8% for wild/natural and 0.4% for hatchery based on listed flow rates during outmigration.

Section objective: minimun 2,688 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Basel i ne	818 -C	1,073	1,944	6 5 4	0(1.00)
All Nat	1,574 -c	1,417	3,087	988	2,490(1.57)
1	1,495 -c	1,403	2,989	963	2,281(1.53)
2	1,574 -C	1,417	3,087	988	2,490(1.57)
3	3,751 -C	1,539	5,436	1,577	7,521(2.73)
4	1,111 -c	1,344	2,526	851	1,291(1.30)
5*	3,241 -C	2,058	5,493	1,596	7,648(2.76)

*Recommended strategy.

[1] Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Complete BPA and USFS funded habitat projects, improve passage, and utilize current hatchery production and supplementation (capacities and planned levels of production and stocking). Post Mainstem Implementation.
2. Strategy 1 plus improve post-release survival of hatchery fish. Post Mainstem Implementation.
3. Strategy 2 plus increase level of hatchery production and supplementation. Post Mainstem Implementation.
4. Implement habitat and improvement projects in Strategy 1, but do not supplement wild run. Post Mainstem Implementation.
5. Strategy 2 plus increase level of hatchery production and supplementation. Collect natural brood stock for rearing pond. Post Mainstem Implementation.

[2] MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[4]Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6]The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Uildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 23gg. Estimated costs of alternative strategies for upper Salmon-headwaters summer chinook. Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Uildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies				
	1	2	3	4	5*
Hatchery Costs					
Capital[1]		0	1,300,000	0	1,300,000
O&M/yr[2]		0	150,000	0	150,000
Other Costs					
Capital[3]	2,732,590	2,732,590	2'732,590	2,732,590	2,732,590
O&M/yr[4]	190,000	190,000	190,000	190,000	190,000
Total Costs					
Capital	2,732,590	2,732,590	4,032,590	2,732,590	4,032,590
O&M/yr	190,000	190,000	340,000	190,000	340,000

* Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Recommended Strategies

Effective management of mixed-stock tributary and mainstem fisheries should be considered a critical component for all recommended strategies for the Salmon River Subbasin. Harvest research and methodology development must parallel production increases to meet utilization objectives to the greatest degree, as well as meet biological objectives.

Planners used a technique called the Simple Multi-Attribute Rating Technique (SMART) was used as a decision-making tool. Refer to Appendix B for a list of the decision criteria, and the analysis methodology.

A cost sheet summarizing the costs of recommended strategies for all species is in Part V.

In many cases, subbasin numerical objectives were not met in terms of the SPM analyses. However, decisions should not rest on subbasin actions alone. Decisions must take into account benefits or impacts of system integration and potential implementation of system alternatives which, presumably, will have considerable impact on alternative and recommended strategy results. Thus, these are preliminary recommendations.

Little Salmon River

Biological Objective - minimum 399 spawners for natural production.

Utilization Objective - minimum 2,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Continue wild fish management.

Hypotheses: Protection of this wild stock is critical to the long-term vitality of future hatchery and natural production in the basin. Out-of-basin survival improvements will allow this population to rebuild to a productive level to provide a harvestable surplus.

Assumptions: This population of summer chinook will not integrate with the Rapid River spring chinook program at a level that will affect population characteristics. Summer chinook can be accurately differentiated from springs at the Rapid River weir. Rapid River's wild and scenic designation will protect important spawning and rearing habitat from degradation. Mixed-stock harvest that develops in the lower Salmon will not decimate this small population.

Index: The System Planning Model projected MSY to be 100 fish. Total spawning return was projected to be 212 fish. The contribution to the Power Planning Council's goal index was 1.20. The index is the strategy's total production divided by the baseline's total production.

Rationale: No other alternative strategies existed. This population is not a priority in terms of providing maximum utilization opportunities, but meeting biological objectives of genetic conservation was considered important. Critical to this strategy is the need to separate spring and summer chinook through genetic and timing characteristics to meet utilization, brood stock, and escapement needs.

South Fork Salmon River

Biological Objective - minimum 5,760 spawners for natural production.

Utilization Objective - minimum 18,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 3: Increase hatchery production and supplementation to produce 2.3 million smolts or equivalents, complete BPA and Forest Service funded habitat projects, implement or complete the South Fork Initiative, improve post-release survival of hatchery fish, and continue wild fish management in the Secesh River.

Hypotheses: -Additional hatchery production, inbasin and out-of-basin survival improvements, and natural capacity increases are needed to produce productive spawning escapements and harvestable surplus. A full complement of basinwide SFI projects must be implemented to attain expected increases in juvenile survival and capacity, and to meet the Forest Service's interim objective of improving habitat to a condition capable of supporting fishable populations by 1997 and restoring the river to near full productive capability by 2007. Protection of wild stocks, because of their unique genetic characteristics, is critical to the long-term vitality of both natural and hatchery production.

Assumptions: Water and land is available for rearing pond production in the drainage upstream from Secesh River. Space is available for additional brood stock collection, egg incubation, and early rearing at McCall Hatchery or another facility. Cooperative agreements can be developed for additional production at either facility under the Lower Snake River Compensation Plan or another program.

Development of additional artificial rearing facilities will not impact the Forest Service land and resource management plan. Mining and logging activities will not negatively impact natural and artificial production. A mixed-stock fishery can be developed that does not prevent productive natural and wild populations. Genetic fitness and diversity of natural/wild run is retained.

Index: The System Planning Model projected MSY to be 5,009 fish for the South Fork and 430 fish for the Secesh. Total spawning return, including hatchery and natural fish, was projected to be 6,989 for the South Fork and 909 wild fish for the Secesh. The contribution to the Power Planning Council's goal index was 2.78 for the South Fork and 1.2 for the Secesh. The index is the strategy's total production divided by the baseline's total production.

Rationale: This strategy received a midrange SMART rating resulting from lower confidence ratings concerning feasibility of habitat projects and developing new rearing capacity. However, **subbasin** planners and regional System Planning Group members felt that the benefits of additional hatchery production, along with the extension of natural production capacity and survival, fulfilled the objectives to a greater degree than other strategies. Current levels of hatchery production are not providing utilization in traditional areas. Furthermore, improvement of degraded habitat is necessary to support biological and utilization objectives for naturally produced fish. The planners also felt that habitat improvement aspects of the strategy were probably feasible.

Middle Fork Salmon River

Biological Objective - minimum 1,326 spawners for natural production.

Utilization Objective - minimum 10,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Continue wild fish management.

Hypotheses: Preservation of the genetic fitness and diversity of this wild stock is important to the long-term vitality of summer chinook in the basin. This stock is endemic to the Middle Fork drainage and is better adapted for survival than other stocks or hatchery fish. Wild fish management is compatible with wilderness requirements.

Assumptions: Improved migrant survival will enable optimal seeding levels and production of a harvestable surplus. Wilderness designation is sufficient to protect important spawning and rearing habitat from degradation from mining and grazing activities. Mixed-stock harvests that will develop in the mainstem Salmon will not negatively impact this population.

Index: The System Planning Model projected MSY to be 546 fish. Total spawning return was projected to be 578 fish. The contribution to the Power Planning Council's goal index was 1.16. The index is the strategy's total production divided by the baseline's total production.

Rationale: Subbasin planners and regional System Planning Group members recommended this strategy because it exhibited the highest SMART rating and they considered wild fish management appropriate for this pristine environment. This strategy best meets biological objective of maintaining wild fish genetics. Maximum utilization opportunities could be provided by other production units. Critical to this strategy is effective harvest management of a mixed-stock fishery in the mainstem corridor to meet utilization objectives.

Panther Creek

Biological Objective - minimum 118 spawners for natural production.

Utilization Objective - minimum 4,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

Because of the uncertainties associated with litigation and financial responsibilities for rehabilitation in this drainage, subbasin planners and regional System Planning Group members recommend a "short-term" and a "long-term" strategy. The short-term strategy is Strategy 3, which is compatible with and will build a framework for the long-term strategy, Strategy 4.

STRATEGY 3: Trap and haul adults and juveniles around the most toxic segment of the stream (from Clear Creek to Blackbird Creek), implement tributary hatchery production to produce 1 million smolts or equivalents, and increase post-release survival rate of hatchery fish.

Hypotheses: Within a few cycles of supplementation and rearing pond releases, a Panther Creek population capable of providing eggs for artificial rearing could be developed. Increased stocking and hatchery-survival improvements are needed to produce harvestable surplus. Habitat is available and should be **optimized for** natural production, along with hatchery production, particularly to produce a population more **"fit"** for the drainage.

Assumptions: Physical and biological requirements for brood stock collection and rearing can be met in the drainage, or are available elsewhere in the basin. Toxicity is not **a** barrier to adult migration for brood stock collection. Additional water quality and habitat degradation does not occur. Water quality is sufficient for artificial production. Future mining activities in the drainage will not have a negative impact on natural and artificial production. Summer chinook will spawn and rear in the upper end of the drainage in traditional spring habitat. **Large-**scale trapping and hauling of adults and juveniles is feasible and mortality due to handling is minimal. Adult returns will support hatchery spawning needs, natural production needs, and harvestable surplus. Naturally produced fish can be identified to promote natural run.

STRATEGY 4: Rehabilitate Panther Creek, implement tributary hatchery production to produce 1 million smolts or equivalents, and increase post-release survival rate of hatchery fish.

Hypotheses: Full rehabilitation of toxic area, primarily to improve water quality, is needed to produce any level of spawning escapement (hatchery and natural) and a harvestable surplus. BPA is already involved, but progress has been delayed by pending outcome of litigation.

Assumptions: Pending litigation is resolved, rehabilitation project research is completed, and project is deemed feasible. Multiple agency and industry agreements can be developed to implement rehabilitation plan.

Index: The System Planning Model projected MSY to be 2,132 fish for Strategy 3 and 2,296 for Strategy 4. Total spawning return, including hatchery and natural fish, was projected to be 1,695 fish for Strategy 3 and 2,170 for Strategy 4. The contribution to the Power Planning Council's goal index was over 50 for both strategies. The index is the strategy's total production divided by the baseline's total production.

Rationale: Strategy 1 provides little in terms of utilization opportunities of spawners to maintain genetic fitness. While Strategy 2 provides utilization, no natural production to sustain genetic fitness would be provided.

Strategy 3 exhibited **the highest** SMART rating and would provide harvest opportunities and brood stock. However, **subbasin** planners and regional System Planning Group members recommend that Strategy 4, the rehabilitation of mining damage in this drainage, is critical to long-term production of anadromous species in this tributary and should not be ignored in lieu of 'short-term actions. Without this action, little natural production can be supported. Because the. litigation process has been lengthy, and funding for rehabilitation has been linked to the sale of the mine, an interim strategy is recommended to begin rebuilding populations and provide some harvestable surplus.

<u>Pahsimeroi River</u>

Biological Objective - minimum 709 spawners for natural production.

Utilization Objective - minimum 7,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 3: Increase hatchery production and supplementation to produce 2 million smolts or equivalents, improve flows and passage, and improve post-release survival rate of hatchery fish.

Hypotheses: Increased hatchery production is needed to produce harvestable surplus. Drainage is fairly productive and major limitation is water.

Assumptions: Water can be obtained for **instream** flow, in addition to current legislated **instream** flow. Current habitat is not degraded further by agricultural and grazing practices. Biological and physical requirements of a new rearing facility can be met. Pahsimeroi Hatchery would probably not have enough early rearing space to accommodate a new rearing pond so a new facility or other facility in the basin may be used for early rearing if cooperative agreements can be developed for additional production. Genetic diversity and fitness of natural run can be maintained. Angler access can be developed through purchase and cooperative agreements. A **mainstem** Salmon harvest can be developed that does not negatively impact other populations in a mixed-stock corridor.

Index: The System Planning Model projected MSY to be 3,753 fish. Total spawning return, including hatchery and natural fish, was projected to be 3,971 fish. The contribution to the Power Planning Council's goal index was 2.43. The index is the strategy's total production divided by the baseline's total production.

Rationale: This strategy exhibited a midrange SMART rating.. Lower confidence in meeting requirements for additional rearing capacity and water resulted in the lower rating. However, a major aspect of this strategy would be additional hatchery production to provide more utilization benefits. than Strategies 1 or 2. Improved Pahsimeroi flows and passage would provide additional natural production and improved survival to ensure genetic fitness. Subbasin planners and regional System Planning Group members feel that although additional hatchery production would benefit utilization objectives, sites for additional rearing capacity will be a major constraint. Thus, Strategy 2 (which contains all aspects of Strategy 3 except increased hatchery production) would be the alternative recommendation if a rearing site could not be identified.

Upper Salmon River (Middle Fork to Sawtooth/East Fork weirs)

Biological Objective - minimum 2,688 spawners for natural production.

Utilization Objective - minimum 15,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 5 (a new strategy combining Strategies 2 and 3): Complete BPA and Forest Service funded habitat projects, improve passage, improve post-release survival of hatchery fish, and increase level of hatchery production and supplementation by collecting tributary brood stock and obtaining a new rearing facility to produce 200,000 smolts to 1 million smolts or equivalents.

Hypotheses: Increased habitat capacity and passage improvements will greatly increase natural production capacity, and migrant survival will enhance production. However, to provide a harvestable surplus to meet needs, hatchery production and survival should be increased.

Assumptions: Expected habitat improvement benefits do occur and habitat is not degraded further by land management activities. Juvenile migrant survival is increased expeditiously. Mixed-stock harvest in mainstem Salmon does not negatively impact other populations. Supplementation methods are employed that allay genetic concerns so that genetic resources of unsupplemented runs can be maintained as per supplementation research results and genetic monitoring. Cooperative agreements can be implemented for additional production.

Index: The System Planning Model projected MSY to be 3,241 fish. Total spawning return, including hatchery and natural fish, was projected to be 2,058 fish. The contribution to the Power Planning Council's goal index was 2.76. The index is the strategy's total production divided by the baseline's total production.

Rationale: This strategy incorporates elements of Strategy 4, which received the highest SMART rating. Subbasin planners and regional System Planning Group members felt that the potential existed for taking more aggressive action to produce more fish for utilization and supplementation by identifying new, additional rearing facilities, yet using tributary brood stock to maintain the genetic resource. Other strategies did not provide this level of utilization benefits and provide for maintenance of this unique genetic resource. This strategy may be incompatible with the recommended strategy for spring chinook because a limited number of sites are available for a new rearing pond facilities. Thus, a realistic concept may be that production will be increased through a combination of spring and summer chinook natural and hatchery production for this area and feasible levels of hatchery production may not meet those modeled. Thus both components could provide utilization and biological benefits.

SUMMER STEELHEAD

Fisheries Resource

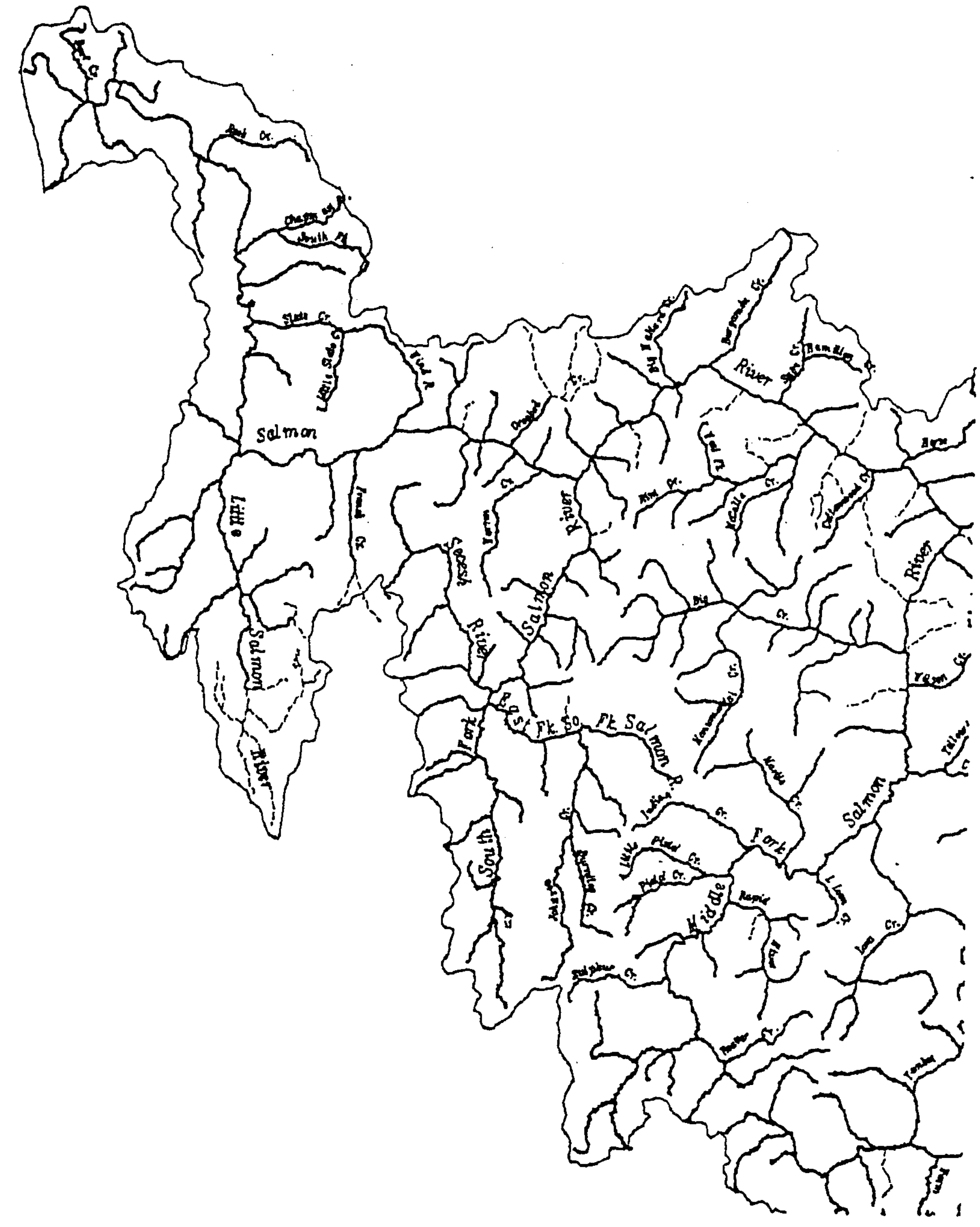
Natural Production

Steelhead in the Salmon River drainage occupy much of the same areas for spawning, rearing, and migration as do chinook. Managers estimate that Idaho waters produce 55 percent of the summer steelhead that enter the Columbia River (Mallet 1974). Precise escapement estimates for steelhead are not available on a stream-by-stream basis due to water stages when steelhead are found in spawning areas. Annual escapement into the Salmon River averaged about 25,600 fish from 1962 to 1971 (Table 24). Most wild steelhead in the Salmon River are destined for the Middle Fork and South Fork Salmon rivers and major tributaries in the roadless River-of-No-Return canyon, such as Sheep, Bargamin, Chamberlain and Horse creeks (Reingold 1987).

Wild steelhead populations were extremely depressed in the middle and late 1970s for reasons discussed earlier, such as development of the Columbia and Snake river dams. A combination of protective regulations, downstream passage improvements, and excellent habitat conditions has allowed some increases in wild steelhead populations. Although biologists have noted some increases in spawning escapement and smolt production, they have estimated potential to be only 20 percent to 50 percent (IDFG 1985). An indication of production potential, steelhead smolt capacities for all of the Columbia subbasins were estimated by using a "standard density method" developed for the Preliminary Information Report, July 8, 1988. Smolt capacity for natural steelhead production in the Salmon Subbasin is about 2.7 million (Table 25).

Summer steelhead pass through the lower Columbia River from June through October. Two groups of steelhead occur in the Salmon drainage. The separation between the groups is based on the time of passage over Bonneville Dam. Steelhead passing Bonneville before August 25 are termed "A-run" steelhead. These fish are predominantly l-ocean fish and generally are 25 inches to 27 inches long and average about 6 pounds. Fish that pass the dam after August 25 are termed "B-run" steelhead and are predominantly 2-ocean fish and are thus larger than the A-run, ranging from about 32 inches to 34 inches long and from 12 pounds to 14 pounds (Mallet 1974). Overlap in timing, range, and size occurs. Both groups of steelhead inhabit the Salmon River drainage. While most of the drainage is inhabited by A-run fish, the populations of the Middle Fork and the South Fork exhibit B-run size characteristics.

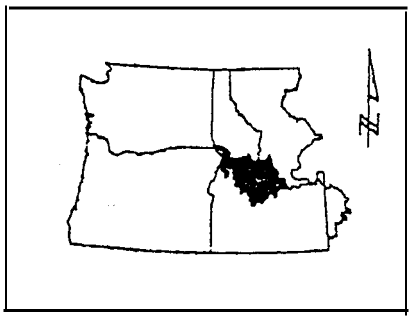
SALMON SUBBASIN-WEST HALF



SUMMER STEELHEAD DISTRIBUTION*

PRESENT/POTENTIAL

ABSENT

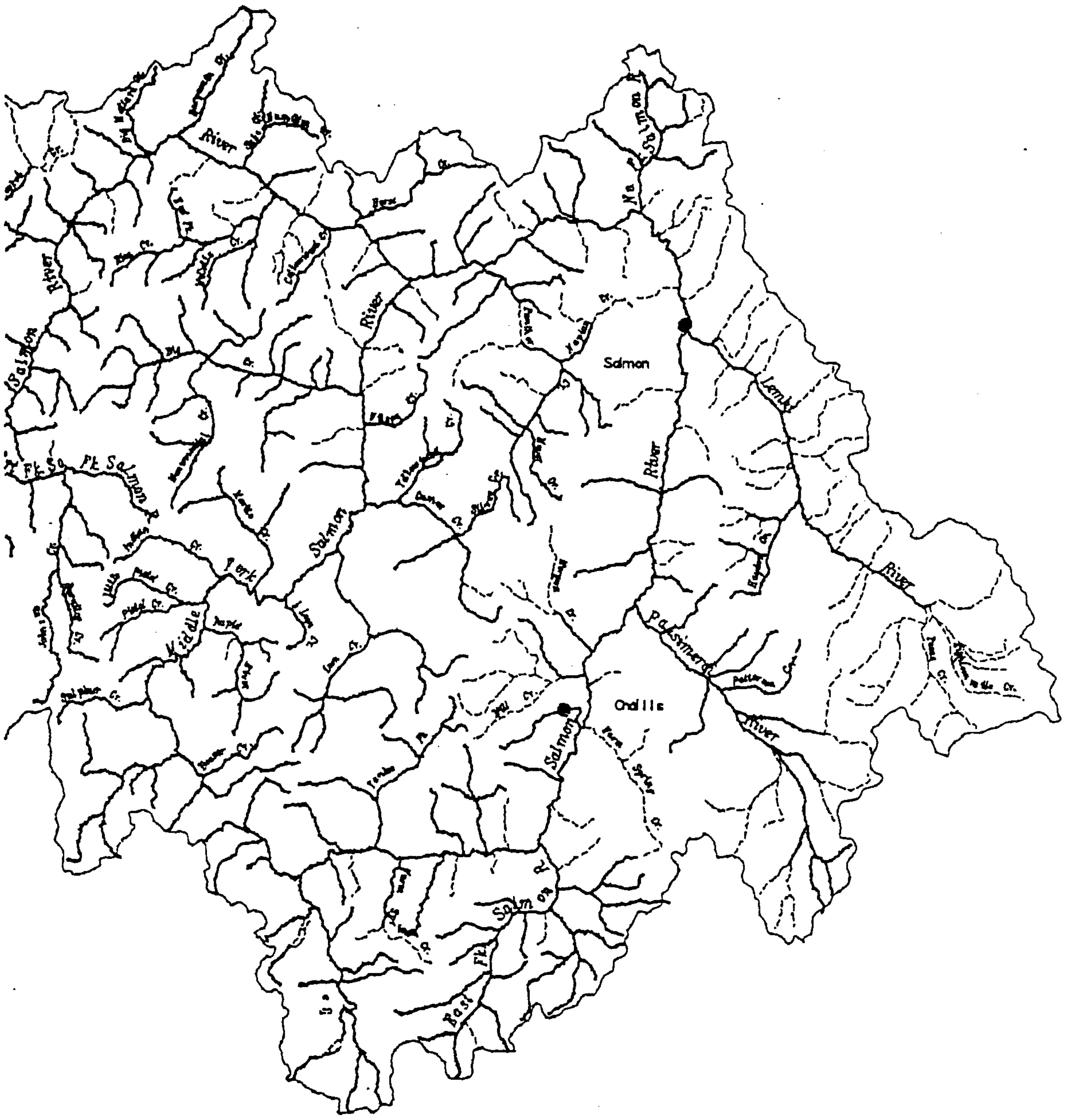


GIS GEOGRAPHIC INFORMATION SYSTEM

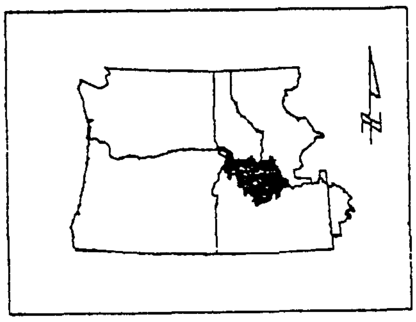
BONNEVILLE POWER ADMINISTRATION

* Due to the limitations of scale, al! streams which support anadromous fish are not shown on this map.

SALMON SUBBASIN-EAST HALF



SUMMER STEELHEAD DISTRIBUTION*



——————— PRESENT/POTENTIAL

---------------- ABSENT

* Due to the limitations of scale, all streams which support anadromous fish are not shown on this map.

GIS GEOGRAPHIC INFORMATION SYSTEM
BONNEVILLE POWER ADMINISTRATION

Table 24. Adult steelhead returns to major Idaho streams, 1962-1971 (Mallet 1974).

Year	Snake River*	Idaho Steelhead**	Clearwater River***	Salmon River
1962-63	108,021	76,695	43,196	33,499
1963-64	72,150	51,226	21,636	29,590
1964-65	58,311	41,401	17,330	24,071
1965-66	62,540	44,403	21,899	22,504
1966-67	64,916	46,090	23,305	22,785
1967-68	47,548	33,759	19,626	14,133
1968-69	85,237	60,518	25,277	35,241
1969-70	58,240	41,350	16,121	25,229
1970-71	54,499	38,694	14,616	24,078
Average	67,940	48,237	22,556	25,681

* Snake River total as counted at Ice Harbor Dam.
** Idaho steelhead run approximates 71 percent of the Snake River run.
*** Clearwater River total as counted at Lewiston Dam. Salmon River total is then calculated by subtracting Clearwater River count from Idaho count.

Table 25. Natural steelhead'smolt capacity for Salmon **Subbasin** as determined by the standard density method.

Drainage	Run	Capacity
Lower Salmon (Mouth-French Cr)	A	94,949
Little Salmon	A	118,759
Mid-Mainstem Salmon (French Cr-Middle Fork)	A	186,722
South Fork Salmon	B	365,825
Secesh	B	79,384
Middle Fork Salmon	B	998,666
Bear Valley	B	69,785
Panther Cr	A	8,201
Lemhi	A	97,998
Pahsimeroi	A	29,930
Upper Salmon (Middle Fork-Weirs)	A	545,406
Headwaters Salmon	B	42,402
Headwaters Salmon	A	77,658
Total **Subbasin**		**2,715,685**

Many steelhead destined for Idaho and the Salmon River **Subbasin** enter rivers in the fall while a portion of the run overwinter in the lower Snake River and Columbia River near **McNary** Dam. Steelhead caught in the Salmon River in the fall are **"fresh"** fish that have migrated into the **subbasin** without any delay. Fish caught in winter in the upper Salmon are fish that enter the river in the fall and lie in big holes over the winter. Once the spring thaw begins, steelhead resume their upstream migration, some being caught in the spring fishery. Biologists have determined that wild steelhead stocks in the main Salmon River canyon prior to spring spawning migrations are not clearly segregated above and below their target spawning streams. These fish stage in the **mainstem** Salmon River and do not enter tributary rivers and creeks to any significant degree until spawning time approaches (Reingold 1987).

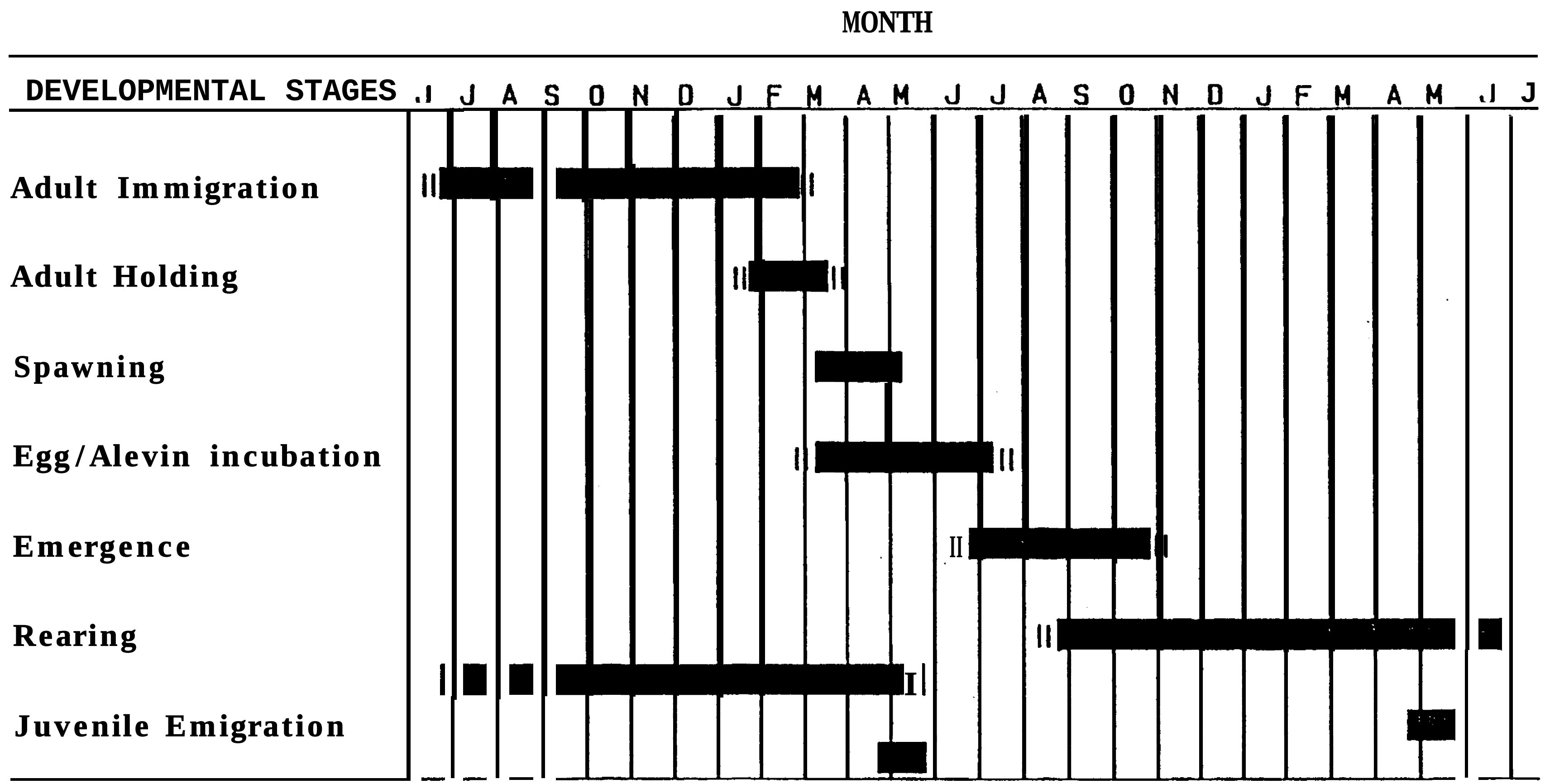
The spawning season may last from late March into June. Steelhead do not necessarily die after spawning, however, the rigors of migration and spawning cause high mortality. Juvenile steelhead emerge from the gravel in late summer and usually remain in fresh water for one to three years (normally two years) before migrating to the ocean (Table 26). In certain areas, many of the 4-inch to 7-inch rainbow trout caught in the spring are actually steelhead smolts (Bjornn 1960).

The Middle Fork Salmon River steelhead run is a wild, native, summer steelhead population. This run uses spawning and rearing areas throughout the Middle Fork drainage. This . population once supported a vigorous sport fishery; between 1980 and 1982, exploitation approached or exceeded 50 percent (Thurow 1983). The sport fishery in this drainage was closed in 1974 and differential release harvest regulations have been in effect since 1983 to protect this wild group of fish. Current escapements are believed to be about 2,000 fish. Historically, this drainage supported a run of about 10,000 steelhead.

Spawning generally commences in early April and continues through May. Thurow (1983) observed the most spawners and redds from May 1 through May 15. This is a predominantly 2-ocean race of fish exhibiting "B-run" characteristics. The average length of a sample of 172 fish in 1981 to 1982 was 31 inches. Thurow (1985) reported that sex ratios averaged l-to-l for steelhead observed in holding and spawning areas, although the proportion of females collected by angling during October and November 1981, and March through April 1982, was 78 percent (R. Thurow, IDFG, pers. commun.). Biologists have noted that adults returning to the Middle Fork will stage in large numbers in the river's lower one-fourth mile during March and April. Currently no information on fecundity exists. Life history timing is similar to Table 26, with fry emerging from July through September and smolt migration occurring from April through May (Howell et al. 1985). Howell also reported that wild steelhead smolts averaged about 7 inches. Thurow (1985) reported juvenile densities of 0.2 fish to 10 fish per 100 square meters, and an average of four fish per 100 square meters.

Researchers have electrophoretically examined steelhead in the Middle Fork. The analysis indicated that this group exhibited some similarities to other inland steelhead trout populations sampled in the Snake and mid-Columbia rivers. The data also indicated that locally isolated populations existed within the drainage (Thurow 1983).

Table 26. **Freshwater** life **history for** natural/wild steelhead **runs** in **the** Salmon River subbasin.



Notes:

1. **The** developmental stage timing **represents** basin-wide **averages,** local conditions **may cause some** variability.
2. Solid **bars** indicate periods **of** heaviest adult immigration, spawning **and** juvenile emigration.
3. Rearing **and** juvenile emigration **take** place over a three year period **and are shown above** in a **rap-around** fashion.

The South Fork Salmon River steelhead population is similar to the Middle Fork's in that it exhibits "B" characteristics. Managers also manage this group as a wild population although there was limited supplementation with fish from Dworshak National Fish Hatchery in this drainage prior to 1982. Survival of these fish was apparently very poor. Current escapement is estimated to be about 1,000 fish, although historically this drainage supported runs exceeding 3,000 fish (Howell et al. . 1985). These fish also contributed heavily to the sport harvest, however, the South Fork has been closed to steelhead fishing for a number of years and differential harvest regulations have helped to protect this run.

This population is also primarily a 2-ocean group of fish. Ortmann (1964) reported that the average length of a sample of 112 steelhead measured at a check station was 32.5 inches, and Thurow (1985) reported that a sample of 50 adults averaged 33 inches. Howell et al. (1985) reported that sex ratios averaged 1.3 males per female for steelhead observed in holding and spawning areas. No fecundity information is available and life history timing is similar to the Middle Fork. Also similar to the Middle Fork, adults will stage near the river's mouth in the fall through early spring. Thurow (1987) reported that juvenile densities averaged 2.6 per 100 square meters in 1984 and 1985.

Preliminary electrophoretic analysis indicated some differences in enzyme systems between the Middle Fork and the South Fork runs. Cluster analysis of genetic characteristics illustrated that the South Fork steelhead were similar to other wild populations sampled in the Salmon and Clearwater rivers (Thurow 1987).

Naturally produced A-run steelhead are present throughout much of the Salmon Subbasin due to supplementation with mid-Snake River stock (see Pahsimeroi Hatchery brood stock information) and the presence of indigenous steelhead. Little information exists for natural A-run steelhead in the Salmon Subbasin, other than for natural fish that are intercepted at hatchery weirs. In general, these are l-ocean fish. Average total length of natural steelhead passing over the E?ahsimeroi Hatchery weir in 1987 was 25.7 inches. Average total length of natural steelhead at the Sawtooth weir was 27.4 inches in 1986 and 26.2 inches in 1987.

An indigenous run of wild steelhead enters the Rapid River drainage and is enumerated and released upstream at the Rapid River Hatchery weir. A few futile attempts were made to spawn and rear these fish in the late 1960s and early 1970s, otherwise the run is unsupplemented. Run sizes have ranged from 39 fish to 299 fish from 1971 through 1988. Unlike the rest of the Salmon River drainage, this steelhead run returns late. Steelhead begin showing up at the weir in late spring and continue to enter Rapid River through late June. The average length for the 1980 through 1987 brood years was 28.1 inches and total lengths ranged from 18 to 35 inches. On the average for this period, females outnumbered males 2 to 1. The l-ocean proportion ranged from 18 percent to 61 percent of the run (Table 27).

Steelhead supplementation history is combined with hatchery production in Appendix D. Major production constraints for salmon and steelhead within the subbasin are listed in Appendix E. Reference should also be made to Part II.

In the Salmon River Subbasin, managers have identified a number of data gaps for both salmon and steelhead. These are listed in PART III.

Hatchery Production

Many of the hatcheries involved in steelhead production have already been described in the spring and summer chinook section. Additional information specifically about steelhead is presented here: extant programs are described first.

Big Springs Creek Incubation Channel

In the spring of 1962, managers began a program taking eggs from steelhead at Lewiston Dam and planting them in the Lemhi River. From 1962 through 1967, biologists placed almost 2.2 million eyed steelhead eggs into the Big Springs Creek Incubation Channel. Survival to fry averaged 58.3 percent and ranged from 31.6 percent to 95.3 percent. Emergence occurred about 50 days after the eggs were collected (Bjornn and Holubetz 1966). Eggs planted in the channel in 1962 through 1965 were collected from adults at the Lewiston Dam, while the eggs planted in 1966 and 1967 were from mid-Snake River brood stock from Pahsimeroi Hatchery (Bjornn 1978). The Columbia River Fisheries Development Program funded the study. The incubation channel is no longer in use.

Hayden Creek Research Station

Hayden Creek Research Station was constructed in 1966 to initiate and investigate pond-rearing techniques of summer steelhead. This project was funded through the Commercial Fisheries Research and Development Act of 1964. The initial program reared steelhead on a l-year pond rearing release cycle. In 1970, the station also began annual fall releases of 5-month pond reared spring chinook. Researchers also experimented with a 2-year rearing cycle for steelhead in 1971 through 1973. Steelhead eggs came from the Lemhi, Clearwater (originally

Lewiston Dam and later, Dworshak), and Snake river stocks as well as from Washougal, Washington stock.

Table 27. Ocean age breakdown of Rapid River steelhead. Ocean age total lengths: age-1 is **<=27"** for males and **<=26"** for females; age-11 is **>27"** for males and **>26"** for females. Total lengths based on lengths used at Pahsimeroi Hatchery.

Year	**Age**	Male	Female
1980	I	8	10
	II	11	26
1981	I	24	19
	II	8	28
1982	I	20	26
	II	13	50
1983	I	8	6
	II	8	56
1984	I	19	18
	II	4	20
1985	I	17	22
	II	13	48
1986	I	25	11
	II	8	33
1987	I	19	12
	II	3	40
Total	I	140	124
	II	68	301

Steelhead rearing experimentation indicated that fewer subsmolts produced during a two-year cycle were offset by a high incidence of non-migrating sexually precocial males. A one-year cycle apparently gave the maximum cost-benefit returns. Researchers found that grading, or separating the fish by size, prior to placing them in ponds was also necessary to reduce pond mortalities (Reingold 1975). As a result of experimenting with various genetic stocks and their poor returns, researchers recommended that no downriver steelhead stocks be considered for replacement or enhancement of indigenous Idaho steelhead stocks (Anderson 1979). Beginning with the spring release in 1979, all steelhead smolt releases were discontinued and spring chinook smolt production became the priority (Beers 1979). This station is now a research facility for the University of Idaho.

Sawtooth Hatchery

As mentioned earlier with spring chinook, Sawtooth Hatchery and the East Fork Trap are part of the Lower Snake River Compensation Plan. The design criteria includes the collection of 4.5 million steelhead eggs to be reared off-site at hatcheries in the Hagerman Valley. Although Sawtooth Hatchery only rears spring chinook smolts on-site, it has the capacity to raise up to 5 million steelhead fry for outplanting. Actual production in 1987 was 931,756 steelhead fry (405 pounds).

The Sawtooth steelhead brood stock exhibits the strong 1-ocean return characteristic of the Snake River A-run. This brood stock was derived from wild and natural escapement and returns from adults, fry, and smolt from Pahsimeroi Hatchery, which were planted in the upper Salmon River throughout the 1970s. Information on rack returns, ocean age proportion, life history, and fecundity appears in Appendix F.

Today, managers are developing the East Fork brood stock into a B-run steelhead run. The original B-run fish were of Dworshak National Fish Hatchery origin from the Clearwater River; offspring were subsequently transferred to the Pahsimeroi Hatchery for experimental purposes. This group of fish exhibits a strong 2-ocean return and, thus, consists of generally larger fish. In the late 1970s and early 1980s, managers stocked both A- and B-run fish into the East Fork and the upper Salmon River. Currently, managers are stocking only B-run fish in the East Fork.

To perpetuate the natural runs of steelhead that exist in the upper Salmon River, managers release at least one-third of the steelhead returning to the Sawtooth and East Fork weirs, including all non-adipose clipped steelhead, upstream to produce naturally.

Pahsimeroi Hatchery

The Pahsimeroi Hatchery was constructed as part of a program to relocate a portion of the mid-Snake River steelhead run to the Salmon River drainage. This facility is owned and financed by Idaho Power. One of the station's primary goals is to take steelhead eggs for rearing at Niagara Springs, also owned by Idaho Power, to sustain the hatchery steelhead run into the . Salmon River drainage.

The program began in spring 1966, when the Idaho Power Company released 73,200 steelhead smolts into the Lemhi River and 65,500 into the Pahsimeroi River. These smolts were the progeny of A-run adults collected at Hells Canyon Dam and were reared at Hager-man State Fish Hatchery. The adults originally inhabited waters of the upper Snake, including the Weiser and Powder rivers. The stocking was part of a program designed to relocate mid-Snake River steelhead and chinook runs blocked by Idaho Power dams into the Salmon River drainage. The original plans were to introduce these steelhead into the Lemhi River because downstream migrant enumeration facilities already existed. However, because of the increased use of the Lemhi River for irrigation, recurring periods of drought adversely affected downstream migration. In May 1966, managers transferred this run to the Pahsimeroi River, which was not subject to extreme irrigation demands (Reingold 1967).

The relocation program of the mid-Snake River A-run steelhead has been an extremely successful one. According to the settlement agreement between Idaho Power and the fishery agencies of Idaho, Washington, and Oregon, a main goal is to trap a sufficient number of adults and eye a sufficient number of eggs to raise 200,000 pounds of steelhead trout at Idaho Power's Niagara Springs Hatchery. The agreement also states that at the agencies' request, additional eyed eggs can be provided to raise up to 400,000 pounds of smolts. While not part of its mitigation objectives, Pahsimeroi Hatchery does rear steelhead eggs to fry, as well as outplant adults excess to hatchery egg-taking needs. The Idaho Department of Fish and Game has produced excess eggs and fry after requesting that such production be allowed. The 1987 production was 1,550,443 (912 pounds) A-run steelhead fry. Information on rack returns, ocean-age proportion, life history, and fecundity is presented in Appendix E. To perpetuate the natural run of steelhead that exists in the Pahsimeroi River, all non-adipose clipped steelhead are released upstream to produce naturally.

In 1974, managers released Clearwater River B-run steelhead smolts from Dworshak National Fish Hatchery into the Pahsimeroi River. These fish were substituted for the Pahsimeroi progeny that were lost when Niagara Springs Hatchery suffered an infectious pancreatic necrosis (IPN) epizootic in 1973. This stocking resulted in the lowest smolt-to-adult ratio experienced at Pahsimeroi Hatchery. This information, coupled with similar findings from other Salmon River research indicated that the use of Clearwater River race steelhead for substitution, enhancement or replacement of Salmon River runs needed to be approached with caution (Reingold 1979).

Managers continued stocking B-run smolts from Dworshak in the late 1970s and early 1980s as part of a variety of research projects, including testing relative smolt-to-adult returns between A- and B-strain steelhead released in the upper Salmon River, and investigating effects of hatchery imprinting on the homing ability of smolts (Reingold 1979). Managers also spawned B-run adults returning to Pahsimeroi Hatchery and planted B-run fry and smolt into the Salmon drainage in subsequent years. Managers discontinued stocking Pahsimeroi Hatchery B-run fry in 1984 and discontinued stocking B-run smolts into the Pahsimeroi River. Remaining Pahsimeroi Hatchery B-run adults and their progeny were used to enhance the East Fork B-run steelhead program.

Niagara Springs Hatchery

Idaho Power's Niagara Springs Hatchery, one of America's largest privately owned steelhead rearing facilities, is part of the company's fish program under Federal Energy Regulatory Commission (FERC) License 1971 for the Hells Canyon Hydroelectric Complex. The facility is operated by the Idaho Department of Fish and Game and has been in production since the mid-1960s. The facility's purpose has been to preserve a run of anadromous steelhead trout in the lower Snake River below Hells Canyon Dam and to relocate a portion of that run to the Salmon River drainage (Mowery 1988).

The hatchery is 10 miles south of Wendell in the Snake River Canyon in Gooding County. The hatchery receives up to 132 cfs of water from Niagara Springs at a constant temperature of 58 F. The mitigation goal of Niagara Springs, as stated in a FERC-approved settlement agreement, is to rear a total of 400,000 pounds of steelhead smolts, not to exceed a total of 3.2 million smolts. Of these., 200,000 pounds are targeted for release into the Pahsimeroi River and 200,000 pounds for release into the Snake River just below Hells Canyon Dam.

The facility's design capacity for production is 400,000 pounds of fish. The targeted steelhead smolt size is four to five fish per pound. The 1987 smolt release consisted of 1,811,900 smolts weighing 417,100 pounds, and 39,995 fingerlings weighing 1,900 pounds. Managers released fish into the Snake River, Panther Creek, and the Pahsimeroi River.

Brood stock for Niagara Springs are A-run steelhead adults returning to Pahsimeroi Hatchery and the Idaho Power fish trap below Hell's Canyon Dam, which is associated with Oxbow Hatchery. Originally, these fish had occupied rivers such as the Weiser, the Powder and the upper Snake rivers above Hells Canyon Dam. In the 1960s, part of this'run was transplanted from the mid-Snake River to the Pahsimeroi River and subsequently the Salmon River Basin. This is discussed in more detail in the Pahsimeroi Hatchery steelhead narrative. Rearing-cycle information in presented in Appendix E.

Idaho Power is investigating the possibility of increasing the number of incubators and vats at Niagara Springs to more efficiently meet the mitigation production goal, not for the purpose of increasing production above the stated goals. Also, at a production level of 400,000 pounds, each raceway is loaded to its maximum potential. Idaho Power is planning to add two more raceways to ensure a more efficient facility to rear the existing production goal.

Hagerman National Fish Hatchery

Hagerman National Fish Hatchery is located in the Thousand Springs area above the Snake River near Hagerman, Idaho. The hatchery is owned and operated by the U.S. Fish and Wildlife Service and was originally built to rear catchable trout for the region. On-site springs with a constant temperature of 58 F supply water for hatching and rearing. Under the Lower Snake River Compensation Plan, the hatchery has been rebuilt and expanded: reconstruction was completed in 1983. Although the new facility was completed in 1983, Hager-man had been rearing steelhead under Lower Snake River Compensation Plan funding since 1978; Pahsimeroi Hatchery supplied eyed eggs (Partridge 1984).

The current mitigation requirement is to return 13,600 adults to the Salmon Subbasin. The design capacity is to rear 340,000 pounds of steelhead smolts from eyed eggs, 60 percent being A-run and 40 percent being B-run steelhead (HNFH 1987). Targeted size is four to five fish per pound. Smolts are released into the Salmon River drainage and, recently, Sawtooth Hatchery has supplied eyed eggs from adults trapped at Sawtooth, the East Fork Trap, and from Pahsimeroi Hatchery. Steelhead production in 1987 consisted of 1,000,533 A-run smolts (217,899 pounds) and 534,818 B-run smolts (118,705 pounds). Rearing-cycle information in presented in Appendix E.

Hagerman National Fish Hatchery has also participated in the fall chinook salmon egg bank and in rearing experimental lots of spring chinook salmon in conjunction with Dworshak National Fish Hatchery.

A major production constraint in 1987 was that the B-run egg-take for the 1987 brood year was only 17.3 percent, far short of the production goal; 82.7 percent of the eggs were A-run.

Magic Valley Hatchery

Purchased in March 1981 as part of the LSRCP, the Magic. Valley Steelhead Hatchery produces fish as partial compensation for losses of steelhead caused by the lower Snake River dams. Previously a private trout farm known as Crystal Springs Hatchery, the facility was rebuilt to rear 291,500 pounds of steelhead smolts (Partridge 1984). The U.S. Fish and Wildlife Service owns and administers Magic Valley, while the Idaho Department of Fish and Game operates it.

The hatchery is seven miles northwest of Filer, in the Snake River Canyon. Located on the north side of the Snake River, Crystal Springs supplies approximately 125 cfs of water, which is piped to the hatchery (Ainsworth 1988). The spring water is a constant 58 F. From 1982 through 1984, the Idaho Department of Fish and Game used the original raceways at the hatchery to rear steelhead smolts for the Salmon River. Construction of the new facility began in 1985 and was completed in March 1987. Managers released the first smolts reared at Magic Valley in April 1988. During the construction phase, Hagerman National Fish Hatchery raised a portion of Magic Valley's allotment of steelhead smolts. The compensation goal of the hatchery is to raise 2 million steelhead smolts at four to five fish per pound for stocking in the upper Salmon River and tributaries. The adult return goal for Magic Valley Hatchery is 11,660 steelhead adults to the Snake River Basin. The 1988 smolt release consisted of 2,064,000 smolts weighing 454,400 pounds.

Prior to construction of the new facility both A-run and B-run steelhead eggs from Pahsimeroi Hatchery brood stock were reared and released into the Salmon River. Hagerman raised part of the allotment. Currently, eggs from A-run steelhead returning to the Sawtooth Hatchery are hatched and reared at this facility and at Hagerman. This brood stock is a combination of the returns from indigenous steelhead in the upper Salmon River and mid-Snake River steelhead plants from the Pahsimeroi Hatchery. The B-run brood stock is offspring from Dworshak National Fish Hatchery steelhead eggs that were transferred to Pahsimeroi Hatchery. Brood stock origin is presented in more detail in the Sawtooth Hatchery and Pahsimeroi Hatchery steelhead discussions. Rearing-cycle information in presented in Appendix E.

Harvest

Steelhead harvest by the Nez Perce and the Shoshone-Bannock tribes has been and is minimal in the Salmon River Subbasin. Non-treaty steelhead harvest has fluctuated greatly from 1977 to 1987 (McArthur 1988) and has ranged from 298 steelhead to 27,107 steelhead (Table 28). Results for the fall 1987-spring 1988 season show that 17,524 non-treaty anglers harvested almost 6,983 steelhead. An estimated 18,886 steelhead were released, of which 26 percent were hatchery fish.

Only the main Salmon River has been open for steelhead fishing during the last 10 years: tributaries have been closed for a number of years, including the last 10. The fishery for steelhead on the South Fork has been closed since 1968. It is estimated that in earlier days, 10 percent to 15 percent of the angling effort occurred in the South Fork (Thurow 1987). The exception to tributary closures has been the Little Salmon River, which was first opened in 1985 to take advantage of a hatchery smolt outplant program. The upper Salmon River from the Middle Fork to the North Fork has produced the highest numbers of harvested fish. However, with the advent of the Sawtooth Hatchery steelhead program, the headwater section has seen an increase in angler effort and harvest.

Historically, the greatest concentration of steelhead also occurred from the North Fork downstream to Corn Creek, a distance of about 45 miles. In 1969, the estimated steelhead harvest for the Salmon River totaled 27,000 fish, of which 3,469 were harvested from the South Fork, 2,985 from the Middle Fork, 14,400 from the mainstem Salmon below the mouth of the Middle Fork, and 5,795 from the mainstem Salmon above the Middle Fork (Bjornn 1961). Mallet (1974) reported that the mainstem Salmon produced 45.6 percent of the statewide steelhead harvest, the Middle Fork of the Salmon River produced 2.2 percent, the South Fork produced 1.2 percent, and other tributaries produced 0.8 percent. Prior to 1980, anglers harvested only small numbers of steelhead from the section of river between the North Fork and the Pahsimeroi River. However, a fishery developed during the 1981 and 1982 spring seasons; this section has since become a popular fishing area.

Table 28. Salmon River non-treaty steelhead harvest by subsection.

	Year									
Section	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87
Salmon (incl. Little Salmon R.)	1,876	CS	597	1,175	2,160	2,545	2,367	2,080	2,457	5,103
Mid-Mainstem (French Ck.-Middle Fork)	2,773	cs	890	2,687	3,496	2.660	2,740	1,358	3,401	5,499
South Fork	cs	CS	cs	cs	cs	CS	cs	CS	cs	cs
Middle Fork	cs	cs	cs	cs	cs	cs	cs	cs	cs	cs
Lemhi River	cs	cs	cs	CS	cs	cs	cs	CS	cs	cs
Upper Salmon-Headwaters (Middle Fork upstream, excluding Lemhi)	3,068	298	1,156	3,374	3,806	8,043	13,658	2,890	12,239	16,505
Total	7,717	298	2,643	7,236	9,462	13,248	18,765	6,328	18,097	27,107

cs = Closed season.

Harvest management goals for the Salmon Subbasin have already been discussed under spring chinook. In addition to harvest goals already stated, a goal for steelhead is to achieve a known-stock harvest for hatchery steelhead through adipose clipping and selective smolt outplanting. The IDFG Anadromous Fisheries Management Plan, 1985-1990, also proposes to provide the maximum amount of sport fishing opportunity in the mainstem Salmon from the mouth to the Sawtooth Hatchery weir, in the Little Salmon, and in the Lemhi River. The tribes seek to also maximize harvest opportunities in areas that allow the use of traditional fishing methods.

Coordination activities concerning steelhead harvest in the Salmon Subbasin include an annual Dworshak Coordination Meeting between the state, U.S. Fish and Wildlife Service, and tribal representatives. The Idaho Fish and Game Commission also meets annually to listen to recommendations from staff personnel and to set season regulations. Setting steelhead harvest regulations is similar to the process used for spring chinook. Generally, the Fish and Game Commission sets the steelhead fishing season sometime during September 1 through April 30 each year.

Prior to 1962, no season limit for steelhead existed. In 1962, managers implemented bag and possession limits: an angler could take two fish and not more than four fish during any seven consecutive days. An angler could not take more than 20 fish in a calendar year (Anonymous 1962). More recently, the bag, possession, and season limits have varied each year relative to the strength and composition of the run. Limits have ranged widely, from one fish per day, one in possession, and three per season in fall 1979 to four per day, 10 in possession, and 10 per season in fall 1984. In addition, managers set a Salmon River bonus season limit and anglers who had filled their fall lo-fish limit could obtain a free bonus permit to harvest an additional 10 steelhead. Fall 1988 steelhead limits were three per day, six in possession and 12 per season while the spring 1988 steelhead season limits were two fish per day, two in possession, and four per season.

Managers documented wild stocks to be below adequate escapement levels in the mid-1970s. With the decline of wild steelhead, hatchery programs and outplanting increased. Harvest management of steelhead in the Salmon Basin turned toward protection of wild fish and consumption of hatchery--origin fish. Regulations have become more complex since the late 1970s as managers implemented time and area fishing closures,, catch-and-release only seasons, mandatory barbless hooks, and other regulatory measures. In the late 1970s and early 1980s, differential size and possession limits were used on the Salmon River to encourage harvest of hatchery fish returning to Pahsimeroi Hatchery.

Since 1983, steelhead harvest regulations in the Salmon River upstream of Deer Creek have specified that only fish with dorsal fins less than 2.5 inches long could legally be reduced to possession; observations of dorsal fins of hatchery fish since 1972 had indicated that the majority of Salmon River hatchery steelhead had dorsal fins less than 2 inches high (Reingold 1982). Beginning in 1984, all hatchery-produced steelhead smolts released in Idaho rivers and streams have had the adipose fin excised before release. Returning adults could then be identified to be of hatchery origin and selectively harvested (Ball 1988) and the fin regulation was no longer needed.

In addition to harvest regulations, managers have used another measure of harvest management. To develop known-stock harvest opportunities for hatchery steelhead, managers have stocked hatchery smolts in areas where harvest of hatchery fish can be maximized without imposing significant conflicts to the management of natural stocks. Furthermore, harvest of salmon and steelhead in Idaho by non-treaty fishermen for commercial purposes has essentially been banned: the Idaho Fish and Game

Commission's policy is not to issue commercial permits for the sale of anadromous fish taken in Idaho waters.

Idaho has obtained information concerning steelhead harvest from a statewide questionnaire sent to a random sample of fishing license holders. Prior to 1959, the state surveyed the harvest of all sport fish. In i959, the Idaho Fish and Game developed a separate survey for salmon and steelhead. According to Hauck (1960), questionnaire results in 1959 indicated an increase of 51 percent in steelhead anglers. The increased angling participation was credited to the increased steelhead run as a result of cessation of the Indian dip net fishery at Celilo Falls, due to inundation by The Dalles Dam and pool,, Biologists estimated the run to be twice the size of previous years.

In 1962, managers began a new method of collecting, information about steelhead harvest, a punch card system similar to ones in effect in Oregon and Washington. The free punch card provided reliable information on the total state catch and helped provide data regarding the catch in specific waters and the time of year harvest took place (Anonymous 1962). A permit to fish specifically for steelhead was required for the first time in 1970 (Keating 1971).

Up through 1982, the Idaho Fish and Game sent the questionnaire to a random sample of steelhead permit holders. For example, in 1980, the Fish and Game obtained a sample of 5,017 anglers, 22 percent of the 22,640 permit holders statewide (Ortmann 1981). After approximately one month, a second request for the return of information was sent to non-respondents. The Fish and Game compiled catches by date and stream section, and the numbers of days fished. Expansions were derived and reported annually.

In 1983, managers changed the survey technique to a telephone survey to shorten the time frame and increase the contact rate, providing better use and harvest estimates. Two surveys, spring and fall, were conducted from a random sample of names drawn from computer files of steelhead permit buyers. Each survey consisted of a preliminary letter explaining the purpose of the survey and the questions to be asked, followed by a phone call. Interviewers were trained to solicit complete replies to questions and read from a standard script. The Fish and Game processed the data to produce estimates of total fishing effort and harvest.

Other monitoring activities occur during the steelhead seasons to provide inseason data. Prior to 1969, steelhead check stations were operated only periodically at North Fork and Riggins. However, since 1969, the steelhead check station at North Fork has been operated in the same manner to monitor the steelhead fishery (Ball 1985). The station checks anglers who have been fishing in the 46-mile roaded section below North Fork and also checks anglers returning from the jet boat fishery below that point. Managers also use a jet boat to check anglers in the unroaded section below Corn Creek. Information is collected on the number of anglers, hours fished, and fish caught. Managers also inspect the catch for marks (Reingold 1980).

In 1983, the Idaho Fish and Game initiated an additional creel census to evaluate the contribution of hatchery steelhead in the spring fishery between North Fork and the Pahsimeroi, a developing fishery (Ball 1985). Today, managers monitor the steelhead harvest to assess the wild and\or hatchery composition of harvest and the distribution and performance of mark groups. Coded wire tags are retrieved and tag returns are used to estimate the harvest of fish produced in the Lower Snake River Compensation Program (Ball 1988).

Specific Considerations

The Salmon Subbasin supports several populations of summer steelhead, which are distributed throughout the subbasin as wild and natural populations originating in various tributary systems and at the Pahsimeroi and Sawtooth hatcheries. Both A- and B-run steelhead are distributed throughout the subbasin. The Middle Fork and South Fork steelhead exhibit B-run qualities. The East Fork is a hatchery supplemented "B" run. Managers have also supplemented B fish in the Lemhi and Pahsimeroi rivers, but have discontinued this. A few lower Salmon River tributaries have also been supplemented with B's, but stocking has been inconsistent due to limited supplies. The remainder of the subbasin supports A-run fish.

Hatchery "A" steelhead are the largest anadromous component in the Salmon Subbasin. However, natural habitat, especially in B-run management areas, is vastly underseeded. The A-run populations in the canyon tributaries and the lower Salmon appear to be rebuilding. Hatchery fish, harvested primarily by non-tribal anglers, are providing an exploitation rate of up to 84 percent for A-run fish and 70 percent for B-run (Ball 1988). Depressed Salmon River Subbasin natural and wild steelhead spawning escapement, chronically high smolt mortalities associated with Snake and Columbia hydroelectric projects, and flow conditions in the Snake River are major impediments to increased production and harvest opportunities for summer steelhead. Columbia River commercial sockeye and fall chinook harvests are having an impact on wild upriver steelhead runs, particularly B-run steelhead. Spawning and rearing habitat for natural production within the subbasin is of ample quantity and quality to allow increased production within the subbasin.

Habitat **needs restoring** and improving in localized areas as well as subbasinwide protection.

Primary issues pertaining to future steelhead management, objectives and strategies include 1) low seeding levels, 2) flows of insufficient magnitude during critical migration periods in the Snake and Columbia rivers, 3) hydroelectric system mortalities, 4) **mainstem** Columbia River harvest rates, 5) need to increase production of wild runs and also maintain genetic fitness and diversity, 6) supplementation evaluation, 7) land and water management, and 8) mixed-stock fishery conflicts in the mainstems of the Columbia, Snake, and Salmon rivers as well as major Salmon River tributaries.

Current fish management practices for steelhead are primarily guided by the IDFG Anadromous Fisheries Management Plan, 1985-1990) and the Nez Perce and Shoshone-Bannock tribes. Federal and other state entities also influence management. As outlined in the IDFG Anadromous Fisheries Management Plan, the natural total production objective for the Salmon Basin is 48,000 fish, providing a spawning escapement in the Salmon **Subbasin** of 19,200 fish and the remainder for harvest and mortality throughout the entire range of the run (including ocean and Columbia River). These goals were based upon a **projected smolt-**to-adult survival rate of 2 percent and a survival of adults to Idaho of 1 percent.

Summer steelhead counts over Lower Granite for run years 1980-1981 through 1986-1987 averaged 84,587 fish. The natural component has varied between 20 percent and 39 percent of each run. Since 1984, -the wild steelhead run over Lower Granite has averaged 25,860 steelhead. The interim management goal of United States vs. **Oregon** is for 75,000 natural/wild steelhead at Bonneville Dam, which is expected to produce 30,000 natural/wild steelhead at Lower Granite Dam. The **"expected** to **produce"** goal is to provide 20,000 A-run natural/wild steelhead and 10,000 **B-**run natural/wild steelhead.

Hatchery management is a cooperative effort among the Idaho Department of Fish and Game, Idaho Power Company and the U.S. Fish and Wildlife Service. Brood stock and egg collection occurs at Sawtooth and Pahsimeroi hatcheries. Smolts are raised at facilities in the **Hagerman** Valley. The IDFG Anadromous Fisheries Management Plan's total hatchery production objective is 81,600 adults for a hatchery escapement of about 3,500 fish and the remainder for harvest and mortality throughout the run's entire range. These objectives assume an adult-to-Idaho survival of 0.8 percent. Hatchery steelhead can be differentiated from naturally produced fish because the adipose fin is removed prior to release. Smolt-to-adult survival rates for hatchery steelhead are about 1 percent.

A-run hatchery steelhead comprise the major anadromous harvest in the subbasin. This species is not heavily targeted by tribal members in the Salmon Subbasin, however steelhead are a very important species for non-tribal anglers. The average steelhead harvest for the last five years was 16,709 fish. Anglers may harvest only hatchery steelhead, primarily in mainstem Salmon River fisheries. Managers assume levels of . hooking mortalities are low (Pettit 1978). Steelhead with their adipose fins intact ("non ad-clipped" fish) are allowed to pass through the fishery to spawning tributaries. These are natural and wild fish as well as fry outplants. All other hatchery production is adipose-clipped as pre-smolts.

Opportunities within the subbasin to significantly increase natural and wild steelhead production can only be achieved by increased adult escapement. As discussed in Part II, protection and restoration of important habitat will maintain and/or increase habitat carrying capacities and increase survival. The protection and rebuilding of underescaped, wild, unsupplemented runs is a priority. These fish are essential to the future vitality of both natural and hatchery production. Opportunity also exists for increasing production of several natural runs by supplementation with genetically appropriate releases. However, a major uncertainty is the long-term effect of hatchery supplementation on the genetic diversity and fitness of natural runs because of the loss of components of the natural selection process. Careful planning and development of brood stock trapping and juvenile rearing programs in the subbasin is essential to this opportunity.

Other specific considerations include ongoing habitat enhancement projects in the subbasin and species interactions with resident and other anadromous species. These are discussed below as are specific considerations for the development of objectives and strategies for the major drainages. Considerations listed in conjunction with spring and summer chinook should also be referred to. (The following are listed by geographic area, not by priority.)

Mainstem Salmon River to Redfish Lake Creek

Area is open fall and spring for steelhead fishing.

Steelhead fishing provides a major economic benefit for some communities.

Area provided an estimated 127,558 angler days for the 1986 season (McArthur 1988).

The lower river is primarily a migration corridor and overwintering area for a mixture of wild, **natural,** and hatchery populations.

Little Salmon River Drainaae

Wild steelhead run'into Rapid River. Little is known about population characteristics, but the l-ocean proportion . appears variable. Run timing is also much later than the rest of the Salmon Subbasin. Recent population size has been fairly stable, about 70 fish to 100 fish. This is the only wild run that is enumerated.

Little Salmon River is supplemented with hatchery A-run fish.

This is the only tributary open to steelhead harvest. About 800 steelhead were harvested in 1986.

South Fork and Middle Fork

Both of these drainages are managed for the production of wild, indigenous steelhead. The South Fork received some supplementation prior to 1982, but impact is believed to be minimal. These populations appear to be B-run fish. Studies in the mid-1980s indicated that **natural** habitat was substantially underseeded and run sizes were less than 2,000 fish. Current adult population levels are unknown, but managers are monitoring juveniles.

Because these are large, wild fish, anglers are very interested in them. Idaho Department of Fish and Game is committed to long-term management for preserving the genetic integrity of these wild fish during rebuilding, and thus has constrained harvest. These fish are protected from consumptive harvest, but provide a significant **catch-and-release** (nonconsumptive) benefit, especially in the Salmon River canyon.

Salmon River **Canyon** Tributaries (French Creek to Middle Fork)

In the **mid-1980s,** researchers studied the tributaries primarily between the South Fork and the Middle Fork and found them to contain juveniles, however the habitat was very underseeded. Current monitoring shows moderate seeding levels and a rebuilding trend consistent with the A-run trend in most of the rest of the basin. Managers have never supplemented the major tributaries with steelhead.

Panther Creek

Mining practically eliminated steelhead in the 1960s. Managers have supplemented this drainage with steelhead since 1979 to compensate for mining pollution impacts on production. Survival still appears to be poor.

Lemhi River

Managers have supplemented with a mix of steelhead, including A-run, B-run, and a Washington stock, which did not survive well.

Continuous supplementation has been de-emphasized due to uncertainties about water diversions and low **flow** impacts on spawning and production.

Although no longer in use for production, Hayden Creek Hatchery did have a steelhead program.

Pahsimeroi River

A-run fish were originally transferred from the mid-Snake as part of Idaho Power's mitigation. Managers used this established stock, in combination with natural escapement, to build the Sawtooth Hatchery program.

Idaho Power Company's Pahsimeroi Hatchery collects brood stock to produce 200,000 pounds of steelhead smolts (1.4 million at seven fish per pound). Until recently, managers released all natural fish and some hatchery (to total at least one-third of the run) upstream to produce naturally, regardless of egg-take needs. Only natural fish are currently released upstream.

The hatchery has also outplanted adults to 'seed other tributaries.

Smolts are raised in **Hagerman** Valley rearing facilities, but the Pahsimeroi Hatchery has fry production capabilities.

During the early **1980s,** managers implemented a B-run program, but have replaced it with the East Fork program.

Yankee Fork

Managers have supplemented with steelhead. The West Fork and upper **mainstem** and tributaries provide good spawning and rearing habitat for natural production.

East Fork Salmon River

Managers collect brood stock at the Lower Snake River compensation Plan (LSRCP) East Fork weir.

Managers have supplemented with A-run steelhead. More recently, B-run steelhead have been stocked into the drainage to establish that strain. Since the program's . inception, weir returns have not met hatchery egg needs to produce the goal of 1 million smolts.

At least one-third of the run, including all natural fish, is released upstream, regardless of egg-take needs.

Restrictive regulations to protect fish returning to the East Fork hatchery program were initiated in spring 1988 to compensate for low flows, delayed movement and angling susceptibility. Managers supplemented from Clearwater River brood sources to circumvent further restrictive regulations.

Headwaters (Sawtooth Weir upstream)

No harvest is allowed. This area provides valuable natural production habitat.

Managers collect brood stock at LSRCP Sawtooth Hatchery.

Sawtooth Hatchery has fry production capabilities, but smolts are produced in Hager-man Valley rearing facilities.

Managers release upstream at least one-third of the run, including all natural fish, regardless of egg-take needs.

Objectives

The following represent objectives for the entire subbasin. For strategy modeling, these were subdivided by section and are displayed with each modeled **subbasin** section: if totaled, they represent the following **subbasin** components. Hatchery needs are shown only by **subbasin** and are dependent on the level of hatchery production implemented. Individual section biological objectives were calculated based on smolt potential and the utilization components were derived from Public Advisory Committee information. Objectives listed secondarily do not infer secondary in importance.

Biological Objectives

(Numbers are not additive. For example, hatchery spawners includes brood needs also included in the Lower Snake River Compensation Plan mitigation goal.

1a. Provide a minimum of 19,000 summer steelhead spawners to the Salmon **Subbasin** for wild and natural production to maintain the unique biological characteristics and productivity of its naturally reproducing populations, and to rebuild wild and natural populations throughout the **subbasin** to provide sustainable yield.

1b. Provide a minimum of 4,000 summer steelhead spawners to the Salmon **Subbasin** for hatchery production to maintain biological characteristics and productivity to provide fish for hatchery supported harvest programs and fish for supplementation to aid rebuilding. Strategies that require increased hatchery production and supplementation will require respective increased spawning escapements.

2. Continue adipose-fin clipping program to target hatchery fish and protect wild and natural fish from high rates of terminal harvest until productive spawning escapements are met.

3. Achieve and maintain the compensation level of approximately 25,260 adult summer steelhead returning to the Snake River Basin above Lower Granite Dam from Salmon River releases, as identified in the Lower Snake River Compensation Plan for harvest and spawning in the subbasin.

4. Contribute to the Northwest Power Planning' Council's doubling goal, consistent with council policies.

5. Conserve and protect genetic resources represented by wild and natural Salmon **Subbasin** stocks. Maintain genetic fitness and diversity of wild fish and ensure long-term viability and productivity of hatchery and natural fish.

6. Attain an average smolt-to-adult return rate to **subbasin** for wild and natural steelhead of 2.5 percent, and maintain a minimum of 2 percent. Attain an average smolt-to-adult return rate to **subbasin** for hatchery steelhead of 2 percent, and maintain a minimum of 1.5 percent.

Utilization Objectives

1a. In the long term, achieve and maintain a minimum of 63,000 summer steelhead, as identified by the public advisory committees, for non-tribal harvest in the Salmon **Subbasin** once rebuilding is achieved. These would be hatchery, natural, and wild fish. Nez Perce and Shoshone-Bannock tribes would expect to harvest **equal** numbers as non-tribal fishers, for a total of 126,000 fish.

1b. In the short term, develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Achieve returns that will allow selective harvest of hatchery-origin summer steelhead until natural and wild -origin runs have been rebuilt to a level that can sustain fisheries and productive spawning escapements.

2. Provide for a range of **mainstem** and tributary fishing opportunities for tribal and non-tribal fishers.

3. Restore fishing opportunities in tribal and non-tribal historical areas.

The number of minimum spawners was derived by using the System Planning Model, the smolt potential of the subbasin, earlier planning efforts, and the best knowledge of the Technical Work Team and fish managers. The utilization number was derived from the public advisory committees as their estimate of numbers of fish needed to provide optimal fisheries. It is recognized that through the monitoring and evaluation of adaptive management, these components will be re-evaluated. In regard to model analysis, no objectives will be changed prior to system integration because of the reliance on system parameters for a **subbasin** above eight dams. Thus system integration and analysis of system alternatives may result in different model projection than those displayed in this plan. A priority is to rebuild wild, natural, and hatchery populations to a level that will sustain harvestable surplus while maintaining the biological characteristics that make the Salmon **Subbasin** populations unique and productive.

Alternative Strategies

Because of its complexity, the Salmon **Subbasin** was divided into sections for strategy development and model analyses.

Planners used the System Planning Model to provide a quantifiable comparison between alternative strategies and baseline conditions. The numbers derived from the SPM are not necessarily representative of current conditions because the model depicted populations at an equilibrium phase and at higher seeding levels than are currently found in the subbasin. The broad interpretation is that the model depicts a "rebuilt condition," and does not address the rebuilding phase, a critical step in the continuation of Salmon Subbasin anadromous runs.

Potential numerical fish production increases for each . summer steelhead strategy are displayed in Tables 29a-29n. Critical uncertainties include those inherent in any projections of fish numbers or survival since there is presently no general technical agreement among land, water, and fish management agencies and tribes.

In general, summer steelhead strategies followed a sequence of actions beginning with utilization of existing hatchery production (if any), and methods to enhance natural production (an "all natural" strategy), followed by levels of increased artificial production in addition to the natural actions found in the first strategy. Because of the variability in the summer steelhead populations and geography of the Salmon Subbasin, a mix of methods will be found in the alternative strategies that reflect wild, natural and hatchery management. To avoid undue repetition, reference to a previous strategy includes reference to its major hypotheses, critical assumptions, and actions.

Modeling results for each strategy are presented as fish produced at "maximum sustainable yield" (MSY). The sustainable yield of a fish population refers to that portion of the population that exceeds the number of fish required to spawn and maintain the population over time. Sustainable yield can be "maximized," termed MSY, for each stock at a specific harvest level. The MSY is estimated using a formula (Beverton-Holt function) that analyzes a broad range of harvest rates. Subbasin planners have used MSY as a tool to standardize results so that decision makers can compare stocks and strategies.

In MSY management, managers set a spawning escapement level and the remaining fish (yield) could theoretically be harvested. In practice, a portion of the yield may be reserved as a buffer or to aid rebuilding. Thus, managers may raise the escapement level to meet a biological objective at the expense of a higher utilization objective.

The amount of buffer appropriate for each stock is a management question not addressed in the subbasin plans. For this reason, the utilization objective, which usually refers to harvest, may not be directly comparable to the MSY shown in Tables 29a-29n. At a minimum, a strategy should produce an estimated MSY equal to or greater than the utilization objective.

A MSY substantially larger than the subbasin utilization objective may be needed to meet subbasin biological objectives.

Estimated costs of the alternative strategies are summarized in tables below. Standardized cost sheets were developed for each summer steelhead strategy and are grouped in Appendix C. These should be referred to for estimated, relative costs.

Lower Salmon River (mouth to French Creek, excluding Little Salmon River)

Biological Objective - minimum 664 spawners for natural production.

Utilization Objective - minimum 10,000 fish for non-tribal and tribal harvest. Includes fish that would be passing though the mainstem but produced in another area.

STRATEGY 1: Refer to spring chinook. Strategy includes stocking both A- and B-run steelhead, however, model could only analyze one type for each strategy, thus only B-run projections are displayed in Table 29b. Hatchery A-run smolts slated for this section were modeled separately and are shown in Table 29a.

Hypotheses: Addition of B-run fish would provide more diversity to anglers. These large fish are more desirable to anglers.

Assumption! Clearwater stock would produce viable population in Salmon Subbasin.

ACTIONS: l-3, 8

1. Complete Nez Perce Forest projects on White Bird and Slate creeks. Projects are funded by the Bonneville Power Administration and the Forest Service. Projects consist of sediment removal, correction of sediment sources, and instream structures in Slate Creek: and barrier removal, bank stabilization, and instream structures in White Bird Creek.

2. Implement level of hatchery production and supplementation of 700,000 B-run smolts from Clearwater Anadromous Hatchery and 400,000 A-run smolts from Magic Valley (modeled under Little Salmon) prescribed in the IDFG Anadromous Fisheries Management Plan, 1985-1990.

3. Implement hatchery'effectiveness actions (Table 21). Single actions or a combination of actions may be required as per monitoring and research results.

8. Continue supplementation per supplementation research results, brood stock availability, and seeding levels.

STRATEGY 2: Refer to spring chinook. Convert B-run smolt releases to A-run, and acquire tributary brood stock for egg-take.

Hypotheses: A-run fish would provide more harvestable surplus because of lower harvest rates in the Columbia River. A-run brood stock for egg-take already exists; parr counts indicate that these fish are rebuilding steadily.

Assumptions: Brood stock collection facility for steelhead is feasible and rearing capacity can be developed at an existing or new facility.

ACTIONS: l-4, 6-8

1. -
2. -
3. -

4. Convert B-run hatchery releases to A-run.

6. Complete a brood stock collection facility to collect tributary brood stock.

7. Implement Bureau of Land Management habitat improvement projects (not modeled). These consist of passage improvements, **instream** cover, and gravel improvements.

8. -

STRATEGY 3: Refer to spring chinook. Use A-run production.

ACTIONS: l-8

1. -
2. -
3. -
4. -

5. Develop additional"rearing capacity at an existing facility, or develop or acquire a new facility to rear an additional 1.3 million smolts. Temperature requirements for one year of rearing would have to be met.

6. -
7. -
8. -

Table 29a. System Planning Model results for summer steelhead (A's) in the lower mainstem Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:

Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 126,000 fish to allow 50-50 harvest by tribal and non-tribal fishers.'

Section objective: minimum 10,000 fish for harvest. Includes fish passing through mainstem but produced in other areas. Total results would also include Table 29b, Strategy 1.

Biological Objective:

Optimum utilization of habitat. Min. spawning escapement of 19,000 for natural prod. Min. spawning escapement of 4,000 for hatchery prod. Adipose clip all hatchery fish. Total return above Lower Granite Dam of 25,260. Contrib. to 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness/diversity, ensure long-term viability. Attain average smolt-to-adult subbasin return rate of 2.5% for wild/natural (2.0% minimum) and of 2.0% for hatchery (1.5% minimun).

Section objective: minimun 664 spauners for natural production. Total results would also include Table 29b, Strategy 1.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spauning Return	Total' Return to Subbasin	out of[5] Subbasin Harvest	Contribution' To Council's Goal (Index)
Baseline	3,308 -N	1,977	5,336	1,814	0(1.00)
All Nat	4,136 -N	2,368	6,565	2,231	2,757(1.23)
1*	3,600 -N	2,062	5,715	1,942	849(1.07)
2	8,948 -N	4,106	13,159	4,473	17,556(2.47)
3	26,776 -N	7,798	34,774	11,817	66,062(6.52)

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Refer to Spring Chinook. Strategy includes stocking A & B stocks. Post Mainstem Implementation.
2. Refer to Spring Chinook. Convert g-run smolt releases to A-run, and acquire tributary brood stock for egg-take. Post Mainstem Implementation.
3. Refer to Spring Chinook. Use A-run production. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections uhere the sustainable yield is maximized for the natural and hatchery components combined and the natural spauning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spauning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4]Total return to the mouth of the subbasin.

[5]Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 29b. System Planning Model results for summer steelheed (B's) in the lower mainstem Salmon Subbesin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective: Refer to Table 29a.

Biological Objective: Refer to Table 29a.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution' To Council% Goal (Index)
Basel ine	0 -N	0	0	0	0(0.00)
All Nat	0 -N	0	0	0	0(0.00)
1	5,342 -N	2,930	8,347	7,700	24,124(0.00)

*Recommended strategy.

[1] Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Supplementation. Post Mainstem Implementation.

[2] MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3] Total return to s&basin minus MSY minus pre-spawning mortality equals total spawning return.

[4] Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index 0 is the strategy's total production divided by the baseline's total production.

Table 29bb. Estimated costs of alternative strategies for lower mainstem Salmon River summer steelhead (A and B). Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1*	2	3
Hatchery Costs			
Capital[1]	0	0	5,980,000
O&M/yr[2]	0	0	650,000
Other Costs			
	0		
Capital[3]	0	3,297,508	3,297,508
Total Costs			
Capital	0	3,297,508	9,277,508
O&M/yr	0	31,380	681,380

* Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the nunber and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Little Salmon River

Biological Objective - minimum 832 spawners for natural production.

Utilization Objective - minimum 22,000 fish for non-tribal and tribal harvest to be utilized in Salmon Subbasin.

All strategies, hypotheses and assumptions are the same as those for spring chinook except that smolts are from Magic Valley Hatchery. Model projections in Table 29c for Strategies 1 and 2 account for A-run steelhead slated for the Lower Salmon. A component of all strategies is to maintain a wild steelhead run above Rapid River Weir.

STRATEGY 1: ACTIONS l-6

1. Remove Hard Creek and Little Salmon barriers.

2. Implement hatchery effectiveness actions'(Table 21).

3. Screen irrigation diversions made accessible by barrier removal. Upgrade diversions in drainage where mortality and stranding is occurring.

4. BPA and Idaho Department of Fish and Game purchase water from Brundage Reservoir for **instream** flow. Other potential actions to improve **instream** flow exist, but costs have not been developed.

5. Release 800,000 A-run smolts from Magic Valley Hatchery, as prescribed in the IDFG Anadromous Fisheries Management Plan, 1985-1990.

6. Continue supplementation as per supplementation research results, brood stock availability, and seeding levels.

STRATEGY 2: ACTIONS 2, 4, 5, 6 (see above)

STRATEGY 3: ACTIONS l-10

l-6. -

7. Improve stream habitat of private lands above barrier. No specific projects or sponsoring agencies have been identified, but riparian improvement, fencing, and bank stabilization would be included.

8. Improve culvert passage at Squaw Creek, and improve habitat including screening and instream structures at Squaw, Lockwood, Boulder, and Sheep creeks (BLM projects).

9. Develop rearing capacity for additional 0.8 million A-run smolts.

10. Collect brood stock at Rapid River if feasible, or develop brood stock collection elsewhere in drainage.

STRATEGY 4: ACTIONS 2, 4, 5, 6, 9, 10 (see above)

Table 29c. System Planning Model results for summer steelhead (A's) in the Little Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:

Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 126,000 fish to allow 50-50 harvest by tribal and non-tribal fishers.'

Section objective: minimun 22,000 fish for harvest in subbasin.

Biological Objective:

Optimum utilization of habitat. Min. spawning escapement of 19,000 for natural prod. Min. spawning escapement of 4,000 for hatchery prod. Adipose clip all hatchery fish. Total return above Lower Granite Dam of 25,260. Contrib. to 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness/diversity, ensure long-term viability. Attain average smolt-to-adult subbasin return rate of 2.5% for wild/natural (2.0% minimum) and of 2.0% for hatchery (1.5% minimun).

Section objective: minimun 832 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Basel i ne	9,931 -N	4,150	14,187	4,822	0(1.00)
All Nat	12,335 -N	5,404	17,877	6,076	8,281(1.26)
1	16,027 -N	6,077	22,260	7,564	18,115(1.57)
2	16,264 -N	5,286	21,686	7,370	16,828(1.53)
3*	27,142 -N	8,357	35,713	12,136	48,306(2.52)
4	27,638 -N	7,163	34,984	11,889	46,671(2.47)

*Recommended strategy.

'Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Remove migration barriers, hatchery effectiveness actions, upgrade and install irrigation diversion screens, purchase water for instream flow, release A-run stock from Magic Valley Hatchery, continue supplementation activities. Post Hainstem Implementation
2. Strategy 1 excluding remove migration barriers and upgrade/install irrigation diversion screens. Post Mainstem Implementation.
3. Strategy 1 plus improve habitat, improve culvert passage at Squaw Creek, increase hatchery rearing capacity for 0.8 million A-run smolts, collect brood stock at Rapid River or elsewhere. Post Mainstem Implementation.
4. Strategy 2 plus increase hatchery rearing capacity for 0.8 million A-run smolts and collect brood stock at Rapid River or elsewhere. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4] Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 29cc. Estimated costs of alternative strategies for Little Salmon River summer steelhead (A). Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies			
	1	2	3*	4
Hatchery Costs				
Capital[1]	0	0	3,700,000	3,700,000
O&M/yr[2]	0	0	400,000	400,000
Other Costs				
		0		0
Capital[3]	118,820 8,750	0	1,704,746 22,962	0
Total Costs				
Capital	118,820	0	5,404,746	3,700,000
O&M/yr	8,750	0	422,962	400,000

* Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Mid-Mainstem Salmon River (French Creek to Middle Fork)

Biological Objective - minimum 1,306 natural spawners.

Utilization Objective - minimum 2,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

All strategies, hypotheses and assumptions are the same as those for spring chinook. Strategies 2 and 3 assume brood stock collection at Pahsimeroi.

STRATEGY 1: ACTION 1

1. Retain wild fish policy of no supplementation.

STRATEGY 2: ACTIONS 2-4

2. Develop rearing capacity for 1 million smolts at an existing facility or construct a new facility outside of mid-mainstem area. Site has not been identified or proposed.

3. Collect additional brood stock at Rapid River with Idaho Power's agreement for additional hatchery production.

4. Implement hatchery effectiveness actions (Table 21).

STRATEGY 3: ACTIONS 2-5

2. -
3. -
4. -

5. Sterilize smolts at the rearing facility.

Table 29d. System Planning Model results for summer steelhead (A's) in the mid-mainstem Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:

Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 126,000 fish to allow 50-50 harvest by tribal and non-tribal fishers.'

Section objective: minimum 2,000 fish for harvest in the subbasin.

Biological Objective:

Dptimun utilization of habitat. Min. spawning escapement of 19,000 for natural prod. Min. spawning escapement of 4,000 for hatchery prod. Adipose clip all hatchery fish. Total return above Lower Granite Dam of 25,260. Contrib. to 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness/diversity, ensure long-term viability. Attain average smolt-to-adult subbasin return rate of 2.5% for wild/natural (2.0% minimum) and of 2.0% for hatchery (1.5% minimum).

Section objective: minimum 1,306 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Basel ine	684 -c	1,136	1,849	629	0(1.00)
All-Nat	797 -c	1,215	2,043	694	435(1.10)
1*	797 -c	1,215	2,043	694	435(1.10)
2	13,514 -N	2,892	16,481	5,601	32,835(8.91)
3	same results as #2				

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Retain wild fish policy of no supplementation. Post Mainstem Implementation.
2. Develop rearing capacity for 1 million smolts, collect brood stock at Rapid River, implement hatchery effectiveness actions. Post Mainstem Implementation.
3. Strategy 2 plus sterilize smolts at rearing facility. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3]Total return to s&basin minus MSY minus pre-spawning mortality equals total spawning return.

[4]Total return to the mouth of the subbasin.

[5]Includes ocean, estuary, and mainstem Columbia harvest.

[6]The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the

Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total produdtion divided by the baseline's total production.

Table 29dd. Estimated costs of alternative strategies for mid-mainstem Salmon River summer steelhead (A). cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1*	2	3
Hatchery Costs			
Capita	0	4,600,000	4,600,000
O&M/yr[a]	0	500,000	500,000
Other Costs			
Capital[3]	0	0	0
O&M/yr[4]	0	0	0
Total Costs			
Capital	0	4,600,000	4,600,000
O&M/yr	0	500,000	500,000

* Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

South Fork Salmon River

Biological Objective - minimum 3,114 natural spawners.

Utilization Objective - minimum 4,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Complete BPA- and Forest Service-funded habitat. projects (some of which are part of the Forest Service's South Fork Initiative), and continue wild fish management.

Hypotheses: Increased migrant survival, along with increased natural capacity and early rearing survival, will rebuild population to produce optimum spawning escapement and harvestable surplus. Protection of wild stocks, because of their unique genetic fitness and diversity, is critical to the long-term vitality of this drainage.

Assumptions: Habitat projects will provide expected increases in juvenile capacity and survival. Migrant survival will improve expeditiously. No land perturbations occur that would degrade the restored quality of spawning and rearing habitat. Land and mineral management strategies that protect riparian areas, stream channels, and water and substrate quality will be implemented. No catastrophic toxic spills occur. Harvest management will allow optimization of mixed hatchery, natural and wild populations in the mainstem Salmon without negative impacts on other populations.

ACTIONS: 1, 2

1. Complete Forest Service habitat improvement projects, including Johnson Creek bank stabilization and vegetation management: Sand Creek riparian enhancement: Landmark Creek pool habitat enhancement; Riordan, Trapper, and Ditch creeks FERC mitigation; and Oxbow Breach restoration.

2. Continue wild fish management with no supplementation.

STRATEGY 2: Complete Forest Service South Fork Initiative (SFI), and implement Strategy 1.

Hypotheses: The full complement of basinwide SFI projects must be implemented to attain expected increases in juvenile survival and capacity, and to meet the Forest Service's interim objective of improving habitat to a condition capable of supporting fishable populations by 1997 and restoring the river to near full productive capability by 2007.

Assumptions: See Strategy 1.

ACTIONS: l-3

1. -
2. -

3. Complete U.S. Forest Service restoration strategy.

STRATEGY 3: Implement hatchery production and supplementation, improve post-release survival of hatchery fish, continue wild fish management in Secesh River, and implement Strategy 2.

Hypotheses: Additional hatchery production is needed in addition to **inbasin** and out-of-basin survival improvements and natural capacity increases to produce productive spawning escapements and harvestable surplus to meet needs.

Assumptions: Space is available for additional brood stock collection, egg incubation, and early rearing at McCall Hatchery or another facility. Rearing capacity is available at a current facility or new capacity can be developed. Cooperative agreements can be developed for additional production at said facility. Development of additional artificial rearing facilities will not impact Forest Service's land and resource management plan. A mixed-stock harvest can be developed that does not prevent productive natural and wild populations. Genetic fitness and diversity of natural and wild run is retained.

ACTIONS: 1, 3-5

1. -
3. -

4. Develop rearing capacity for 500,000 smolts at existing facility or construct new facility. Site has not been developed. Use McCall Hatchery for brood stock collection if feasible, or develop alternate means to collect South Fork brood stock. Retain wild fish management in Secesh River.

5. Implement hatchery effectiveness actions (Table 21).

Table 29e. System Planning Model results for summer steelhead (B's) in the South Fork Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:

Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 126,000 fish to allow SO-50 harvest by tribal and non-tribal fishers.'

Section objective: minimum 4,000 fish for harvest. Table 29f also needs to be included in results consideration.

Biological Objective:

Optimum utilization of habitat. Min. spawning escapement of 19,000 for natural prod. Min. spawning escapement of 4,000 for hatchery prod. Adipose clip all hatchery fish. Total return above Lower Granite Dam of 25,260. Contrib. to 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness/diversity, ensure long-term viability. Attain average smolt-to-adult subbasin return rate of 2.5% for wild/natural (2.0% minimum) and of 2.0% for hatchery (1.5% minimum).

Section objective: minimum 3,114 spawners for natural production. Table 29f also needs to be included in results consideration.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution' To Council's Goal (Index)
Basel i ne	0 -C	1,295	1,328	1,225	0(1.00)
All Nat	197 -C	1,940	2,186	2,016	2,478(1.65)
1	197 -C	1,940	2,186	2,016	2,478(1.65)
2*	197 -C	1,940	2,186	2,016	2,478(1.65)
3	4,637 -C	2,127	6,818	6,290	15,867(5.13)

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Complete BPA and USFS funded habitat projects, and continue wild fish management. Post Mainstem Implementation.
2. Strategy 1 plus complete USFS South Fork Initiative (SFI). Post Mainstem Implementation. (Since no information on expected benefits from SFI was available, Strategy 2 results are identical to results from Strategy 1).
3. Strategy 2 plus implement hatchery production and supplementation, improve post-release survival of hatchery fish, continue wild fish management in Secesh River. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4] Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 29f. System Planning Model results for summer steelhead (b's) in the Secesh subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective: See Table 29e.

Biological Objective: See Table 29e.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	24 -N	373	407	376	0(1.00)
All Nat	45 -N	394	449	414	122(1.10)
1	45 -N	394	449	414	122(1.10)
2*	45 -N	394	449	414	122(1.10)
3	45 -N	394	449	414	122(1.10)

*Recommended strategy.

[1] Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Complete BPA and USFS funded habitat projects, and continue wild fish management. Post Mainstem Implementation.
2. Strategy 1 plus complete USFS South Fork Initiative (SFI). Post Mainstem Implementation. (Since no information on expected benefits from SFI was available, Strategy 2 results are identical to results from Strategy 1.)
3. Same as Strategy 2.

[2] MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3] Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4] Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 29ff. Estimated costs of alternative strategies for South Fork-Secesh River summer steelhead (g). Cost estimates represent neu or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Louer Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1	2*	3
Hatchery Costs			
Capital[1]	0	0	2,300,000
O&M/yr[2]	0	0	2150,000
Other Costs			
Capital[3]	1,017,146	1,017,146	1,017,146
O&M[4]	1,330	1,330	1,330
Total Costs			
Capital	1,017,146	1,017,146	3,317,146
O&M/yr	1,330	1,330	251,330

• Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on uhether surface or well uater is used and, if the latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated uith neu hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Middle Fork Salmon River - Bear Vallev

Biological Objective - minimum 7,475 spawners for natural production.

Utilization Objective - minimum 2,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Refer to spring chinook strategy, hypotheses and assumptions. Strategy assumes harvest management will allow optimization of mixed hatchery, natural and wild populations in the mainstem Salmon River without negatively impacting this population.

Estimated costs come to $115,850 in capital and $8,750 in operation and maintenance over 50 years.

ACTIONS: 1-6

1. Complete Forest Service and Shoshone-Bannock projects on Bear Valley, Marsh, Elk, and Camas creeks, which include sediment removal, bank stabilization, channel rehabilitation, fencing, and riparian revegetation. Projects are funded by BPA.

2. Do not produce or supplement hatchery fish.

3. Screen irrigation diversions.

4. Reduce Forest Service allotments and/or modify grazing practices to reduce livestock impact on riparian areas, upland areas, and stream channels in the Stanley Basin.

5. Fence grazing allotments if land management agencies will not implement alternative grazing strategies that protect riparian vegetation and stream channels. No costs have been estimated.

Table 29g. System Planning Model results for summer steelhead (B's) in the Middle Fork Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:
Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 126,000 fish to allow SO-50 harvest by tribal and non-tribal fishers.'

Section objective: minimun 2,000 fish for harvest in subbasin. Table 29h also needs to be included in results consideration.

Biological Objective:
Optimum utilization of habitat. Min. spauning escapement of 19,000 for natural prod. Min. spauning escapement of 4,000 for hatchery prod. Adipose clip all hatchery fish. Total return above Louer Granite Dam of 25,260. Contrib. to 2X goal consistent uith policies, conserve genetic resources, maintain genetic fitness/diversity, ensure long-term viability. Attain average smolt-to-adult subbasin return rate of 2.5% for wild/natural (2.0% minimum) and of 2.0% for hatchery (1.5% minimum).

Section objective: minimum 7,475 spawners for natural production. Table 29h also needs to be included in results consideration.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	1,689 -C	4,686	6,495	5,992	0(1.00)
All Nat	2,013 -C	5,047	7,189	6,632	2,005(1.11)
1*	2,013 -C	5,047	7,189	6,632	2,005(1.11)

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Complete BPA and USFS funded habitat projects, and continue wild fish management. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spauning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spauning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spauning mortality equals total spawning return.

[4]Total return to the mouth of the subbasin.

[5]Includes ocean, estuary, and mainstem Columbia harvest.

[6]The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 29h. System Planning Model results for summer steelhead (B's) in the Bear Valley Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective: See Table 29g.

Biological Objective: See Table 29g.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	2 -N	234	243	224	0(1.00)
All Nat	93 -N	414	518	478	795(2.13)
1*	93 -N	414	518	478	795(2.13)

*Recommended strategy.

[1] Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Complete BPA and USFS funded habitat projects, and continue uild fish management. Post Mainstem Implementation.

[2] MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections uhere the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spauning escapement of less than 500 fish.

[3] Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4] Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northuest Pouer Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Panther Creek,

Biological Objective - minimum 58 spawners for natural production.

Utilization Objective - minimum 8,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

Most all strategies, hypotheses and assumptions are the same as those for summer chinook. Strategies assume rearing capacity could be developed at an existing facility, or at a new facility developed outside the basin because of temperature requirements.

STRATEGY 1: ACTION 1

1. Supplement 300,000 A-run smolts from Magic Valley Hatchery, as prescribed in the IDFG Anadromous Fisheries Management Plan, 1985-1990.

STRATEGY 2: ACTIONS l-4

1.

2. Implement hatchery effectiveness actions (Table 21).

3. Construct a brood stock collection and rearing facility, or use an existing facility for rearing an additional 700,000 smolts. Site has not been identified or proposed, but must meet temperature requirements for one year rearing.

4. Cooperatively with the Forest Service, provide passage in Napias Creek, if feasible, to allow drainage to be used.

STRATEGY 3: ACTIONS l-5

1.
2.
3.
4.

5. Implement a trap-and-haul program for adults and smolts, bypassing toxic sections of mainstem Panther Creek. Construct upstream and downstream weirs and traps.

STRATEGY 4: ACTIONS l-4, 6

1. -
2. -
3. -
4. -

6. **BPA** or appropriate agency fund completion of the final design of the feasibility study and subsequently fund restoration of Panther Creek. Negotiate reimbursement of funding agency from monies awarded to state if pending litigation is successful.

Table 29i. System Planning Model results for summer steelhead (A's) in the Panther Creek Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:

Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 126,000 fish to allow SO-50 harvest by tribal and non-tribal fishers.'

Section objective: minimum 8,000 fish for harvest in subbasin.

Biological Objective:

Optimum utilization of habitat. Min. spawning escapement of 19,000 for natural prod. Min. spawning escapement of 4,000 for hatchery prod. Adipose clip all hatchery fish. Total return above Lower Granite Dam of 25,260. Contrib. to 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness/diversity, ensure long-term viability. Attain average smolt-to-adult subbasin return rate of 2.5% for wild/natural (2.0% minimum) and of 2.0% for hatchery (1.5% minimum).

Section objective: minimun 58 spauners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spauning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	3,384 -N	825	4,230	1,437	0(1.00)
All Nat	297 -C	675	989	336	- 7,272(0.23)
1	3,655 -N	836	4,513	1.534	635(1.07)
2	14,139 -N	2,433	16,634	5,653	27,838(3.93)
3*	13,395 -N	3,627	17,173	5,836	29,047(4.06)
4*	13,090 -N	4,963	18,180	6,178	31,306(4.30)

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Supplement 300,000 A-run smolts from Magic Valley Hatchery. Post Mainstem Implementation.
2. Strategy 1 plus implement hatchery effectiveness actions, brood stock collection and rearing facility for 700,000 smolts. Post Mainstem Implementation.
3. Strategy 2 plus implement trap-and-haul program for adults and smolts to bypass toxic sections of creek mainstem, construct downstream and upstream traps and weirs. Post Mainstem Implementation.
4. Strategy 2 plus complete final design and implement restoration of creek. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spauning cunponent exceeds 500 fish. N = the model projection uhere sustainable yield is maximized for the naturally spauning component and is shoun when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4]Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northuest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 29ii. Estimated costs of alternative strategies for Panther Creek summer steelhead (A). Cost estimates represent neu or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Louer Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies			
	1	2	3*	4*
Hatchery Costs				
Capital[1]	0	3,225,000	3,225,000	3,225,000
O&M/yr[2]	0	350,000	350,000	350,000
Other Costs				
Capital[3]	0	0	121,500	6,020,000
O&M/yr[4]	0	0	31,900	200,000
Total Costs				
Capital	0	3,225,000	3,346,500	9,245,000
O&M/yr	0	350,000	381,900	550,000

* Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated with neu hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated uith new hatchery production. For consistency, O&M costs are based on 50 years.

Lemhi River

Biological Objective - minimum 686 spawners for natural production.

Utilization Objective - minimum 12,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Supplement at low levels and continue current land management practices.

Hypotheses: Improved juvenile migrant survival will enable this productive system to achieve optimum seeding and harvestable surplus. Fry supplementation will speed rebuilding process.

Assumptions: Low flows are not a production constraint, and further degradation of habitat quality does not occur. Angler access is available. Significant mortality is not occurring due to diversions. Mixed-stock harvest on **mainstem** Salmon can be developed without negatively impacting other populations.

ACTIONS: 1

1. Supplement with 500,000 fry from Pahsimeroi Hatchery, as prescribed in the IDFG Anadromous Fisheries Management Plan, 1985-1990.

STRATEGY 2: Improve passage and flows, and supplement at low levels.

Hypothesis: Dewatering, irrigation diversions and resultant channel alterations are significant constraints to production and must be rectified for population to rebuild and produce harvestable surplus.

Assumptions: Water is available for **instream** flows by purchase. Water can be made available by other methods, but costs were not estimated. Cooperative agreement can be reached with landowners concerning irrigation diversion improvements and reduction of channel alterations. costs will not be burdensome to property owner and no lessening of property rights or water usage and river access will be experienced.

ACTIONS: l-3, 6

1. -

2. Screen unscreened diversions and replace or repair existing screens.

3. Purchase water for minimum **instream** flows. Water rights can be obtained by purchasing water from the land to which it is appurtenant. However, the processes under which previously appropriated water could be returned to the stream (to support a minimum streamflow filing by the Water Resource Board) may require new legislation. Other actions could be taken such as constructing permanent and more efficient diversions, lining ditches, converting to sprinkler irrigation, and trapping and hauling around dewatered areas. Cost, however, were not estimated.

6. Continue supplementing as per supplementation research results, brood stock availability, and seeding levels.

STRATEGY 3: Increase hatchery production and supplementation, improve post-release survival of hatchery fish, and implement Strategy 2.

Hypothesis: To reach optimum seeding levels and produce harvestable surplus to meet needs, a combination of hatchery and natural production is needed.

Assumptions: Biological and physical requirements can be met for implementation of existing and/or new rearing facilities. Tributary brood stock is available to support hatchery and natural production, as well as harvestable surplus.

ACTIONS: 2-6

2. -
3. -

4. Develop a brood stock collection facility and a rearing facility to produce a total of 1 million smolts plus fry for supplementation. No sites have been proposed or developed, but must meet temperature requirements of one year rearing cycle.

5. Implement hatchery effectiveness actions (Table 21).

6. -

Table 29j. System Planning Model results for summer steelhead (A's) in the Lemhi Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:
Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 126,000 fish to allow 50-50 harvest by tribal and non-tribal fishers. .

Section objective: minimum 12,000 fish for harvest in s&basin.

Biological Objective:
Optimum utilization of habitat. Min. spawning escapement of 19,000 for natural prod. Min. spauning escapement of 4,000 for hatchery prod. Adipose clip all hatchery fish. Total return above Lover Granite Dam of 25,260. Contrib. to 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness/diversity, ensure long-term viability. Attain average smolt-to-adult subbasin return rate of 2.5% for wild/natural (2.0% minimum) and of 2.0% for hatchery (1.5% minimum).

Section objective: minimum 686 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spauning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	386 -N	669	1,072	364	0(1.00)
All Nat	573 -c	656	1,246	424	390(1.16)
1	449 -N	714	1,180	401	243(1.10)
2	573 -c	656	1,246	424	390(1.16)
3*	13,388 -N	4,586	18,091	6,148	38,193(16.87)

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy uas modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Supplement at low levels and continue current land management practices (500,000 smolts from Pahsimeroi Hatchery). Post Hainstem Implementation.
2. Strategy 1 plus improve passage and flous. Post Mainstem Implementation.
3. Strategy 2 plus increase supplementation to 1 million smolts and implement hatchery effectiveness actions. Post Hainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spauning component exceeds 500 fish. N = the model projection uhere sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spauning return.

[4]Total return to the mouth of the subbasin.

[5]Includes ocean, estuary, and mainstem Columbia harvest.

[6]The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the

Northuest Pouer Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 29jj. Estimated costs of alternative strategies for Lemhi summer steelhead (A). Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Louer Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1	2	3*
Hatchery Costs			
Capital[1]	0	0	4,600,000
O&M/yr[2]	0	0	500,000
Other Costs			
Capital[3]	0	2,096,760	2,096,760
O&M/yr[4]	0	150,000	150,000
Total Costs			
Capital	0	2,096,760	6,696,760
O&M/yr	0	150,000	650,000

* Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated uith neu hatchery production. For consistency, O&M costs are based on 50 years.

Pahsimeroi River

Biological Objective - minimum 209 spawners for natural production.

Utilization Objective - minimum 33,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

All strategies, hypotheses and assumptions are the same as those for summer chinook. Strategies assume rearing capacity could be developed at an existing facility or a new facility developed outside the basin because of temperature requirements.

STRATEGY 1: ACTIONS 3, 4

3. Release 700,000 smolts into drainage from Niagara Springs Hatchery.

4. Continue supplementing as per supplementation research results, brood stock availability, and seeding levels.

STRATEGY 2: ACTIONS l-5

1. Screen unscreened diversions and replace or repair existing screens.

2. Refer to Action 3, Lemhi River spring chinook. Improve instream flow for Morse, Little Morgan, Big, and Goldberg creeks and for mainstem Pahsimeroi from Goldberg to Doublespring Creek and Doublespring halfway to Burnt Creek.

3.
4.

5. Implement hatchery effectiveness actions (Table 21).

STRATEGY 3: ACTIONS l-6

1.
2.
3.
4.
5.

6. Develop rearing capacity for additional 700,000 A-run smolts at an existing facility or construct a new facility. Site has not been developed. Use existing facilities for brood stock collection. Temperature requirements for one year rearing cycle must be met.

Table 29k. System Planning Model results for summer steelhead (A's) in the Pahsimeroi Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:
Provide for range of mainstem 8 tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 126,000 fish to allow SO-50 harvest by tribal and non-tribal fishers.'

Section objective: minimun 33,000 fish for harvest in subbasin.

Biological Objective:
Optimum utilization of habitat. Min. spawning escapement of 19,000 for natural prod. Min. spawning escapement of 4,000 for hatchery prod. Adipose clip all hatchery fish. Total return above Louer Granite Dam of 25,260. Contrib. to 2X goal consistent uith policies, conserve genetic resources, maintain genetic fitness/diversity, ensure long-term viability. Attain average smolt-to-adult subbasin return rate of 2.5% for wild/natural (2.0% minimum) and of 2.0% for hatchery (1.5% minimum).

Section objective: minimun 209 spawners for natural production.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	6,011 -N	3,747	9,854	3,349	0(1.00)
All Nat	7,838 -N	4,299	12,248	4,163	5,372(1.24)
1	6,625 -N	3,793	10,515	3,573	1,484(1.07)
2	7,838 -N	4,299	12,248	4,163	5,372(1.24)
3*	17,881 -N	5,811	23,841	8,102	31,389(2.42)

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Release 700,000 smolts from Niagara Springs Hatchery and continue current supplementation program. Post Mainstem Implementation.
2. Strategy 1 plus repair/replace/install screens at irrigation diversions, improve instream flou (see also action 3 for Lemhi R. spring chinook. Post Mainstem Implementation.
3. Strategy 2 plus increase supplementation by an additional 700,000 A-run smolts and develop rearing capacity for these smolts. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C ❑ the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection uhere sustainable yield is maximized for the naturally spauning component and is shown when the combined MSY rate results in a natural spauning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4]Total return to the mouth of the subbasin.

[5]Includes ocean, estuary, and mainstem Columbia harvest.

[6]The increase in the total return to the mouth of the Colunbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 29kk. Estimated costs of alternative strategies for Pahsimeroi summer steelhead (A). Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1	2	3*
Hatchery Costs			
Capital[1]	0	0	3,225,000
O&M/yr[2]	0	0	350,000
Other Costs			
. tal[3]	0		
O&M,Capi[4]	0	501,310 35,000	501,310 35,000
Total Costs			
Capital	0	501,310	3,726,310
O&M/yr	0	35,000	385,000

* Recommended strategy.

I Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface-or well water is used and, if the latter, the nunber and depth of the wells.

2 Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

3 Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

4 Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Upper Salmon River - Headwaters (Middle Fork to headwaters)

Biological Objective - minimum 4,656 natural spawners.

Utilization Objective - minimum 33,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

All strategies and actions for both A-run and B-run steelhead are the same as those for spring chinook.

STRATEGY 1: ACTIONS 1-7

1. Complete Forest Service and Shoshone-Bannock projects including Challis, Twin, Basin, Valley Thompson, Squaw, Morgan, Beaver, and Alturas Lake creeks, Yankee Fork, East Fork, and the upper mainstem Salmon. Projects are funded by BPA and the Forest Service. They include passage improvements, erosion control, riparian revegetation and instream structures.

2. Resolve Alturas Lake Creek/upper Salmon River dewatering due to irrigation diversions operated by Busterback Ranch.

3. Develop minimum instream flows or provide enough water for productive spawning, rearing, and migration through water purchase or other methods for Squaw, Iron, Challis, Thompson, and Alturas Lake, Owl, Iron, Twelvemile, Colson, Dahlonega, Beaver, and Smiley creeks, and upper Salmon River. Many of these streams are managed by the USFS in the upper drainage and private landowners in the lower end and suffer dewatering. Water rights can be obtained by purchasing water from the land to which it is appurtenant. However, the processes under which previously appropriated water could be returned to the stream course (to support a minimum streamflow filing by the Water Resources Board) may require new legislation. Other actions could be taken such as constructing permanent and more efficient diversion, lining ditches, and converting to sprinkler irrigation. costs, however, were not estimated.

4. Produce 1 million hatchery B-run and 1 million hatchery A-run smolts at Hagerman National Fish Hatchery, of which 300,000 fish are slated for the upper Salmon area, as prescribed in the IDFG Anadromous Fisheries Management Plan, 1985-1990.

5. Continue supplementing as per supplementation research results, brood stock availability, and seeding levels. Capitalize on biotic potential of forestlands with juvenile supplementation in appropriate tributaries.

6. Screen unscreened diversions and replace or repair existing screens.

7. Reduce allotments in the Stanley Basin and/or implement alternative grazing strategies in those stream suffering from livestock degradation to provide optimum riparian area, upland area, and stream channel protection in allotments. No costs have been estimated.

STRATEGY 2: ACTIONS l-9

l-7. -

8. Fence and revegetate sections of the upper mainstem Salmon River not covered by current projects and where grazing has degraded the riparian area.

9. Implement hatchery effectiveness actions (Table 21).

STRATEGY 3: ACTIONS l-11

l-9. -

10. Complete additional rearing capacity at existing facility or develop new rearing facilities to produce an additional 2.5 million smolts, of which 1 million would be B-run, and of which 1 million A-run would be designated for the upper Salmon area (Middle Fork to Sawtooth/East Fork weirs). Develop cooperative Lower Snake River Compensation Plan agreements for additional production. Sites have not been developed.

11. Complete brood stock collection facility to collect tributary brood stock in the upper Salmon area. No sites have been developed.

Table 291. System Planning Model results for simmer steelhead (A's) in the upper mainstem Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:
Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 126,000 fish to allow 50-50 harvest by tribal and non-tribal fishers.'

Section objective: minimun 33,000 fish for harvest in subbasin. Tables 29m and 29n must also be included in results consideration.

Biological Objective:
Optimum utilization of habitat. Min. spawning escapement of 19,000 for natural prod. Min. spawning escapement of 4,000 for hatchery prod. Adipose clip all hatchery fish. Total return above Lower Granite Dam of 25,260. Contrib. to 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness/diversity, ensure long-term viability. Attain average smolt-to-adult subbasin return rate of 2.5% for wild/natural (2.0% minimum) and of 2.0% for hatchery (1.5% minimum).

Section objective: minimun 4,656 spawners for natural production. Tables 29m and 29n must also be included in results consideration.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution' To Council's Goal (Index)
Baseline	4,883 -C	3,308	8,276	2,812	0(1.00)
All Nat	6,142 -C	3,828	10,068	3,421	4,022(1.22)
1	5,495 -C	3,880	9,474	3,219	2,688(1.14)
2*	6,142 -C	3,828	10,068	3,421	4,022(1.22)
3	16,258 -C	3,963	20,323	6,906	27,034(2.46)

*Recommended strategy.

[1]Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Complete USFS habitat/passage projects, resolve Alturas Lake Creek dewatering, develop minimun instream flows, supplement with 300,000 Hagerman Hatchery smolts, continue existing supplementation program, fix/install screens, reduce grazing allotments. P
2. Strategy 1 plus additional habitat projects and implement hatchery effectiveness actions. Post Mainstem Implementation.
3. Strategy 2 plus increase rearing capacity by 2.5 million smolts for supplementation, and compete brood stock collection facility. Post Mainstem Implementation.

[2]MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3]Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4]Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Wildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 29m. System Planning Model results for summer steelheed (A's) in the headwaters Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-irrplementation.

Utilization Objective: See Table 291. Results should be combined with Tables 291 and 29n.

Biological Objective: See Table 291. Results should be combined with Tables 29l and 29n.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution[6] To Council's Goal (Index)
Baseline	11,654 -N	4,203	15,964	5,425	0(1.00)
All Nat	8,261 -N	3,619	11,973	4,069	- 8,958(0.75)
1	8,261 -N	3,619	11,973	4,069	- 8,958(0.75)
2*	9,491 -N	3,966	13,559	4,608	- 5,399(0.85)
3	20,462 -N	6,300	26,924	9,150	24,595(1.69)

*Recommended strategy.

'Strategy descriptions:

For comparison, an "all natural" strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Complete USFS habitat/passage projects, resolve Alturas Lake Creek dewatering, develop minimum instream flows, supplement with 300,000 Hagerman Hatchery smolts, continue existing supplementation program, fix/install screens, reduce grazing allotments. P
2. Strategy 1 plus additional habitat projects and implement hatchery effectiveness actions. Post Mainstem Implementation.
3. Strategy 2 plus increase rearing capacity by 2.5 million smolts for supplementation, and compete brood stock collection facility. Post Mainstem Implementation.

[2] MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3] Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4] Total return to the mouth of the subbasin.

'Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Uildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 29n. System Planning Model results for summer steelhead (B's) in the headwaters Salmon Subbasin. Baseline value is for pre-mainstem implementation, all other values are post-implementation.

Utilization Objective:

Provide for range of mainstem & tributary fishing opportunities for tribal and non-tribal fishers. Restore fishing opportunities in tribal and non-tribal historical areas. Develop and implement stair steps of opportunities and harvest that reflect increases in escapement, contingent on maintenance of viable, productive runs. Short-term achieve returns to allow tributary harvest of hatchery fish, Long-term achieve min. return of 126,000 fish to allow 50-50 harvest by tribal and non-tribal fishers.'

Section objective: See Table 291. Results should be combined with Tables 291 and 29m.

Biological Objective:

Optimum utilization of habitat. Min. spawning escapement of 19,000 for natural prod. Min. spawning escapement of 4,000 for hatchery prod. Adipose clip all hatchery fish. Total return above Lower Granite Dam of 25,260. Contrib. to 2X goal consistent with policies, conserve genetic resources, maintain genetic fitness/diversity, ensure long-term viability. Attain average smolt-to-adult subbasin return rate of 2.5% for wild/natural (2.0% minimum) and of 2.0% for hatchery (1.5% minimum).

Section objective: See Table 291. Results should be combined with Tables 291 and 29m.

Strategy[1]	Maximum[2] Sustainable Yield (MSY)	Total[3] Spawning Return	Total[4] Return to Subbasin	out of[5] Subbasin Harvest	Contribution' To Council's Goal (Index)
Basel ine	1,816 -N	953	2,794	2,578	0(1.00)
All Nat	6,932 -N	2,019	9,003	8,305	17,944(3.22)
1	6,932 -N	2,019	9,003	8,305	17,944(3.22)
2*	8,051 -N	2,214	10,322	9,523	21,758(3.69)
3	16,555 -N	3,543	20,189	18,623	50,273(7.23)

*Recommended strategy.

[1] Strategy descriptions:

For comparison, an "all natural@' strategy was modeled. It represents only the natural production (non-hatchery) components of the proposed strategies plus current management (which may include hatchery production). The all natural strategy may be equivalent to one of the alternative strategies below.

1. Complete USFS habitat/passage projects, resolve Alturas Lake Creek dewatering, develop minimun instream flows, supplement with 300,000 Hagerman Hatchery smolts, continue existing supplementation program, fix/install screens, reduce grazing allotments. P
2. Strategy 1 plus additional habitat projects and implement hatchery effectiveness actions. Post Mainstem Implementation.
3. Strategy 2 plus increase rearing capacity by 2.5 million smolts for supplementation, and compete brood stock collection facility. Post Mainstem Implementation.

[2] MSY is the number of fish in excess to those required to spawn and maintain the population size (see text). These yields should equal or exceed the utilization objective. C = the model projections where the sustainable yield is maximized for the natural and hatchery components combined and the natural spawning component exceeds 500 fish. N = the model projection where sustainable yield is maximized for the naturally spawning component and is shown when the combined MSY rate results in a natural spawning escapement of less than 500 fish.

[3] Total return to subbasin minus MSY minus pre-spawning mortality equals total spawning return.

[4] Total return to the mouth of the subbasin.

[5] Includes ocean, estuary, and mainstem Columbia harvest.

[6] The increase in the total return to the mouth of the Columbia plus prior ocean harvest (as defined by the Northwest Power Council's Fish and Uildlife Program), from the baseline scenario. The index () is the strategy's total production divided by the baseline's total production.

Table 29nn. Estimated costs of alternative strategies for upper Salmon-headwaters summer steelhead (A and B). Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies		
	1	2*	3
Hatchery Costs			
Capital[1]	0	0	11,500,000
O&M/yr[2]	0	0	1,250,000
Other Costs			
Capital[3]	2,732,590	2,822,964	2,882,964
O&M/yr[4]	190,000	191,900	191,000
Total Costs			
Capital	2,732,590	2,882,964	14,382,964
O&M/yr	190,000	191,900	1,441,000

* Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Recommended Strategies

Effective management of mixed-stock tributary and mainstem fisheries should be considered a critical component for all recommended strategies in the Salmon River Subbasin. Harvest research and methodology development must parallel production increases to meet utilization objectives to the greatest degree, as well as meet biological objectives.

Planners used a technique called the Simple! Multi-Attribute Rating Technique (SMART) as a decision-making tool. Refer to Appendix B for a list of the decision criteria and the analysis methodology.

A cost sheet that summarizes the cost of recommended strategies for all species is in Part V.

In many cases, subbasin numerical objectives were not met in terms of the SPM analyses. However, decisions should not rest on subbasin actions alone. Decisions must take into account benefits or impacts of system integration and potential implementation of system alternatives which, presumably, will have considerable impact on alternative and recommended strategy results. Thus, these are preliminary recommendations.

Lower Salmon River (mouth to French Creek, excluding Little Salmon River)

Biological Objective - minimum 664 spawners for natural production.

Utilization Objective - minimum 10,000 fish for non-tribal and tribal harvest. Includes fish that would be passing though the mainstem but produced in another area.

STRATEGY 1: Use current and planned hatchery production and supplementation to stock 700,000 B-run and 400,000 A-run steelhead; complete Forest Service habitat improvement projects; and improve post-release survival of hatchery fish. Although the strategy includes stocking both A- and B-run steelhead, model projections could only deal with one type, thus only B-run projections are displayed in Table 29b. Hatchery A-run smolts slated for this section were modeled under the Little Salmon and are included in the Little Salmon projections for all strategies.

Hypotheses: Addition of B-run fish would provide more diversity to anglers. These large fish are more desirable to anglers.

Assumptions: Clearwater stock would produce a viable population in Salmon Subbasin.

Index: The System Planning Model projected MSY to be 3,600 fish for the A-run component and 5,342 for the B-run. Total spawning return, including hatchery and natural fish, was projected to be 2,062 fish for the A-run component and 2,930 for the B-run. The contribution to the Power Planning Council's goal index was 1.07 for the A-run component and over 50 for the B-run. The index is the strategy's total production divided by the baseline's total production.

Rationale: This strategy would probably meet biological and utilization objectives without the increased hatchery production of Strategies 2 and 3. Also, although the return rate is not as high for B-run steelhead, there is public support for this steelhead component in the fishery. Habitat improvement is important to support fish for long-term genetic adaptation and fitness. This strategy also exhibited the highest SMART rating.

<u>Little Salmon River</u>

Biological Objective - minimum 832 spawners for natural production.

Utilization Objective - minimum 22,000 fish for non-tribal and tribal harvest to be utilized in Salmon Subbasin.

STRATEGY 3: Improve habitat, passage, and flow, increase hatchery production and supplementation to stock 1.6 million smolts, improve post-release survival of hatchery fish, and maintain the wild steelhead run into upper Rapid River above the weir.

Hypotheses: No significant resident fish impacts would occur with barrier removal: potential habitat should be utilized for natural production. Habitat improvement and tributary flow enhancement is needed to optimize available habitat for natural production and to assist juvenile migration. Increased hatchery production is needed to provide harvestable surplus to meet utilization objectives.

Assumptions: Cooperative agreements can be developed with private landowners for habitat improvement, and land management strategies are implemented that protect current and enhanced quality of habitat. Rearing capacity for additional production of steelhead smolts could be developed.

Index: The System Planning Model projected MSY to be 27,142 fish. Total spawning return, including hatchery and natural fish, was projected to be 8,357 fish. The contribution to the Power Planning Council's goal index was 2.52. The index is the strategy's total production divided by the baseline's total production.

Rationale: Of the four alternative strategies, Strategy 3 had the lowest SMART rating. This was due to subbasin planners' lowered confidence in meeting assumptions regarding habitat improvement and water availability. However, subbasin planners and regional System Planning Group members felt that the benefits of more hatchery production, as well as the extension of natural production capacity, fulfilled the objectives to a greater degree than other strategies. Habitat improvements and barrier removal would provide greater utilization opportunities as well as provide habitat conditions which would benefit production above and below the barrier. Extended natural production would better meet biological objectives and genetic maintenance for hatchery and natural brood stock.

<u>Mid-Mainstem Salmon River</u> (Salmon Canyon from French Creek to Middle Fork)

Biological Objective - minimum 1,306 natural spawners.

Utilization Objective - minimum 2,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Continue wild fish management.

Hypotheses: Protection of this wild stock is critical to the long-term vitality of potential hatchery and natural production in the basin. Increase in juvenile migrant survival due to full implementation of the Columbia River Basin Fish and Wildlife Program will promote rebuilding to a productive level and produce some harvestable surplus. Wild fish management is compatible with wilderness management. Fishers prefer wild fish qualities.

Assumptions: Migrant survival will increase expeditiously. Wild runs can be maintained in a potential mixed-stock harvest in the mainstem Salmon River. Pristine condition of habitat is maintained.

Index: The System Planning Model projected MSY to be 797 fish. Total spawning return was projected to be 1,215 fish. The contribution to the Power Planning Council's goal index was 1.10, The index is the strategy's total production divided by the baseline's total production,,

Rationale: Subbasin planners and regional System Planning Group members recommended this strategy because it exhibited the highest SMART rating and they considered wild fish management appropriate for this pristine environment. This strategy best meets biological objective of maintaining -wild fish genetics. Maximum consumptive utilization opportunities could be provided by other production units. Critical to this strategy is effective harvest management of a mixed-stock fishery in the mainstem corridor to meet utilization objectives.

South Fork Salmon River

Biological Objective - minimum 3,114 natural spawners.

Utilization Objective - minimum 4,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 2: Complete BPA- and Forest Service-funded habitat projects and the South Fork Initiative, and continue wild fish management.

Hypotheses: Increased migrant survival, along with increased natural capacity and early rearing survival, will rebuild population to produce optimum spawning escapement and harvestable surplus. Protection of wild stocks, because of their unique genetic fitness and diversity, is critical to the long-term vitality of this drainage. The full complement of basinwide SFI projects must be implemented to attain expected increases in juvenile survival and capacity, and to meet the Forest Service's interim objective of improving habitat to a condition capable of supporting fishable populations by 1997 and restoring the river to near full productive capability by 2007.

Assumptions: Habitat projects will provide expected increases in juvenile capacity and survival. Migrant survival will improve expeditiously. No land perturbations occur that would degrade the quality of spawning and rearing habitat. Land and mineral management strategies that protect riparian areas, stream channels, and water and substrate quality will be implemented. Harvest management will allow utilization of wild populations in the drainage and the mainstem Salmon, without negative impacts.

Index: The System Planning Model projected MSY to be 197 fish for the South Fork and 45 for the Secesh. Total spawning return was projected to be 1,940 fish for the South Fork and 394 for the Secesh. The contribution to the Power Planning Council's goal index was 1.65 for the South Fork and 1.10 for the Secesh. The index is the strategy's total production divided'by the baseline's total production.

Rationale: This strategy exhibited the midrange SMART rating, which resulted from lower confidence ratings concerning feasibility of habitat projects. Subbasin planners and regional System Planning Group members, however, felt that the benefits of extending natural production capacity and survival fulfilled the objectives to a greater degree than other strategies did. This strategy best meets the biological objective of maintaining wild fish genetics. Furthermore, improvement of degraded habitat is necessary to support biological and utilization objectives for naturally produced fish. The planners felt that habitat improvement aspects of the strategy were probably feasible. Critical to this strategy is development of accurate escapement estimates, and mainstem and tributary harvest monitoring.

Middle Fork Salmon River - Bear Valley

Biological Objective - minimum 7,475 natural spawners.

Utilization Objective - minimum 2,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 1: Continue wild fish management and complete habitat improvement and screening projects.

Hypotheses: Preservation of genetic fitness and diversity of this wild stock is important to long-term vitality of Salmon Subbasin summer steelhead. This stock is adapted to the Middle Fork drainage and exhibits better survival than other stocks or hatchery fish. Wild fish management is compatible with wilderness requirements. Fishers prefer wild fish qualities.

Assumptions: Improved juvenile and migrant survival will enable optimal seeding levels and production of a harvestable surplus. Habitat improvement will also add to rearing capacity to enhance natural'production. Harvest management will allow utilization of wild populations in the drainage and population. Wilderness designation is sufficient to ensure full production capability of habitat and that land management activities, such as grazing and mining, do not degrade current or enhanced habitat.

Index: The System Planning Model projected MSY to be 2,013 fish for the Middle Fork and 93 for Bear Valley. Total spawning return was projected to be 5,047 fish for the Middle Fork and 414 for Bear Valley. The contribution to the Power Planning Council's goal index was 1.11 for the. Middle Fork and 2.13 for Bear Valley. The index is the strategy's total production divided by the baseline's total production.

Rationale: This strategy exhibited the highest SMART rating and is compatible with strategies recommended for other species in the basin. This strategy best meets the biological objective of maintaining unique wild fish genetics and could still provide some utilization opportunities. Natural efforts to support rebuilding and increase survival such as screening are important to meet objectives. Critical to this strategy is development of accurate escapement estimates, and mainstem and tributary harvest monitoring.

Panther Creek

Biological Objective - minimum 58 spawners for natural production.

Utilization Objective - minimum 8,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

Because of the uncertainties associated with litigation and financial responsibilities for rehabilitation in this drainage, subbasin planners and regional System Planning Group members recommend a "short-term" and a "long-term" strategy. The short-term strategy is Strategy 3, which is compatible with and will build a framework for the long-term strategy, Strategy 4.

STRATEGY 3: Trap and haul adults and juveniles around the most toxic segment of stream (from Clear Creek to Blackbird Creek), collect tributary brood stock to produce 1 million smolts, and increase post-release survival rate of hatchery fish.

Hypotheses: Habitat is available and should be optimized for natural production along with hatchery production, particularly to produce a population more "fit" to the parameters of the drainage. Within a few cycles of smolt releases, a Panther Creek population capable of providing eggs for artificial rearing could be developed.

Assumptions: Additional hatchery rearing capacity can be developed. Large scale trapping and hauling of adults and juveniles is feasible and mortality due to handling is minimal. Adult return will support hatchery spawning needs, natural production needs, and harvestable surplus. Physical and biological requirements for brood stock collection can be met in the drainage and rearing capacity is available or can be developed elsewhere in the basin. Water quality is sufficient for artificial production. Future mining activities in the drainage will not negatively impact natural and artificial production. Toxicity is not a barrier to adult migration for brood stock collection.

STRATEGY 4: Rehabilitate Panther Creek, collect tributary brood stock to produce 1 million smolts, and increase post-release survival rate of hatchery fish.

Hypotheses: Full rehabilitation of toxic area, primarily to improve water quality, is needed for juvenile and adult survival to produce any level of spawning escapement (hatchery and natural) and harvestable surplus. BPA is already involved, but involvement has been delayed pending outcome of litigation.

Assumptions: Pending litigation is resolved, rehabilitation project research is completed, and project is deemed feasible. Multiple agency and industry agreements can be developed to implement rehabilitation plan.

Index: The System Planning Model projected MSY to be 13,395 fish for Strategy 3 and 13,090 for Strategy 4. Total spawning return, including hatchery and natural fish, was projected to be 3,627 fish for Strategy 3 and 4,963 for Strategy 4. The contribution to the Power Planning Council's goal index was 4.06 for Strategy 3 and 4.30 for Strategy 4. The index is the strategy's total production divided by the baseline's total production.

Rationale: Although Strategy 2 exhibited the highest SMART rating, **subbasin** planners and regional System Planning Group members recommend that rehabilitation of mining damage in this drainage is critical to long-term production of anadromous species and should not be ignored in lieu of short-term actions. Strategy 1 provides little in terms of utilization opportunities of spawners to maintain genetic fitness. While Strategy 2 provides utilization, no natural production to sustain genetic fitness would be provided. Because the litigation process has been lengthy and funding for rehabilitation has been linked to sale of the mine, planners recommended an'interim strategy to begin rebuilding populations and provide some harvestable surplus. The lower ratings for Strategies 3 and 4 are due to subbasin planners' lowered confidence in meeting assumptions.

Lemhi River

Biological Objective - minimum 686 spawners for natural production.

Utilization Objective - minimum 12,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 3: Increase hatchery production and supplementation to stock 1 million smolts, improve post-release survival of hatchery fish, and improve passage and flows.

Hypotheses: To reach optimum seeding levels and produce harvestable surplus to meet needs, a combination of hatchery and natural production is needed. Dewatering, irrigation diversions and resultant channel alterations are significant constraints to production and must be rectified for natural population to rebuild and produce harvestable surplus.

Assumptions: Biological and physical requirements can be met for implementation of existing and/or new rearing facilities. Tributary brood stock is available to support hatchery and natural production as well as harvestable surplus. Water is available for instream flows by purchase or by other methods. Cooperative agreements can be reached with landowners concerning irrigation diversion improvements and reduction of channel alterations.

Index: The System Planning Model projected MSY to be 13,338 fish. Total spawning return, including hatchery and natural fish, was projected to be 4,586 fish. The contribution to the Power Planning Council's goal index was 16.87. The index is the strategy's total production divided by the baseline's total production.

Rationale: Strategies 1 and 2 were not felt to be aggressive enough in terms of rebuilding natural populations and meeting utilization objectives. A combination of hatchery and natural actions is needed to support both objectives. Lemhi passage and flow improvement is needed to prevent losses of hatchery and natural fish, and to promote rebuilding of natural populations to sustain genetic fitness. This strategy also exhibited the highest SMART rating. Critical to this strategy is water management and landowner cooperation in this system, where demand for water generally exceeds the supply.

Pahsimeroi River

Biological Objective - minimum 209 spawners for natural production.

Utilization Objective - minimum 33,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 3: Increase hatchery production and supplementation to produce 1.4 million smolts, improve flows and passage, and improve post-release survival rate of hatchery fish.

Hypotheses: Increased hatchery production is needed to produce harvestable surplus to meet utilization objectives. Drainage is fairly productive and major limitation is water.

Assumptions: Water can be obtained for instream flow in addition to legislated instream flow. Current habitat is not degraded further by agricultural and grazing practices. Angler access can be developed through purchase and cooperative agreements. Capacity for additional rearing exists or can be developed. Cooperative agreements for additional production can be developed under existing programs. Angler access can be developed through purchase and cooperative agreements.

Index: The System Planning Model projected MSY to be 17,881 fish. Total spawning return, including hatchery and natural fish, was projected to be 5,811 fish. The contribution to the Power Planning Council's goal index was 2.42. The index is the strategy's total production divided by the baseline's total production.

Rationale: This strategy exhibited a midrange SMART rating. Lower confidence in meeting requirements for additional rearing capacity and water resulted in the lower rating. However, a major aspect of this strategy would be additional hatchery production to provide more utilization benefits than Strategies 1 or 2. Improved Pahsimeroi flows and passage would provide additional natural production and improved survival to ensure genetic fitness. Subbasin planners and regional System Planning Group members feel that although additional hatchery production would benefit utilization objectives, sites for additional rearing capacity will be a major constraint. Thus,, Strategy 2 (which contains all aspects of Strategy 3 except increased

hatchery production) would be the alternative recommendation if a rearing site **could not** be identified.

<u>Upper Salmon River - Headwaters</u> (Middle Fork to headwaters, excluding Panther Creek, Lemhi, and Pahsimeroi rivers)

Biological Objective - minimum 4,656 spawners for natural production.

Utilization Objective - minimum 33,000 fish for non-tribal and tribal harvest in the Salmon Subbasin.

STRATEGY 2: Improve post-release survival of hatchery fish, improve habitat and passage, and use current hatchery production and supplementation to stock 800,000 A-run steelhead and 1 million B-run steelhead.

Hypothesis: Harvestable surplus and spawning escapements are constrained by survival of hatchery fish, system constraints, and dewatering in upper Salmon. Additional habitat improvements will enhance natural production.

Assumptions: Hatchery effectiveness measures will improve post-release survival. Dewatering issues are resolved. Brood stock can be obtained to rebuild natural populations, support hatchery program, and meet utilization needs.

Index: The System Planning Model projected1 MSY to be 6,142 fish for upper Salmon **A's,** 9,491 fish for Hieadwater **A's,** and 8,051 for Headwater **B's.** Total spawning return, including hatchery and natural fish, was projected to be 3,828 fish for Upper Salmon **A's,** 3,966 for Headwater **A's,** and 2,214 for Headwater **B's.** The contribution to the Power Planning Council's goal index was 1.22 for upper Salmon **A's,** 0.85 for Headwater **A's,** and 3.69 for Headwater **B's.** The index is the strategy's total production divided by the baseline's total production.

Rationale: This strategy exhibited the highest SMART rating for B-run steelhead and a midrange rating for A-run steelhead. **Subbasin** planners and regional System Planning Group members felt that this strategy would meet biological and utilization needs as well as increase natural production. A benefit over Strategy 1 is that this strategy would optimize current hatchery production with increased hatchery effectiveness, modeled as improved post release survival. Habitat and passage improvements are important to sustain natural production for genetic fitness and meet biological objectives.

SOCKEYE SALMON

Fisheries Resource

Sockeye salmon destined for the Salmon River pass Bonneville Dam from June 1 to July-31 each year and Lower Granite Dam from June 25 to August 30, on their 850-mile migration to the spawning grounds of the upper Salmon River. Sockeye populations have been declining since the late 1800s when the U.S. Fish Commission first sent researchers to the Salmon River Subbasin. Evermann (1895) stated, "The investigations show undoubtedly that very important spawning-grounds of the chinook salmon, redfish, and steelhead are found in Idaho, and that it is upon these grounds that we must depend in large measure for the natural increase necessary to the continuance of the salmon industry of Columbia River."

Historically sockeye were an important food source for early settlers. In 1881 a prospector harvested 2,600 pounds of sockeye from Alturas Lake to sell to miners in the region (Evermann 1895). The sockeye run to the Sawtooth region was cut off from 1914 to 1934 when the Sunbeam Dam was erected to produce power for the mining communities of the Yankee Fork area. Parkhurst (1950) speculated that the sockeye stock in the upper Salmon River is probably not identical to the indigenous stocks because of Sunbeam Dam. The first account of sockeye back into the lakes of the upper Salmon was in 1942 when 200 fish were seen in Redfish Lake (Hauck 1955). In 1954, researchers counted 998 sockeye at a weir on Redfish Lake Creek (Hauck 1955). Hauck (1955) suggested five theories for the return of the sockeye above the Sunbeam Dam site. The two in which he put the most credence were reestablishment of the run by fish spawning below the Sunbeam Dam during operation years, and the possible seaward drift of kokanee (resident forms of sockeye).

By 1964, 45 adults were found in Alturas Lake (Bjornn et al. 1968). By 1986, only Redfish Lake continued to support a natural population. The run size that year was down to 29 fish, seven males and 22 females (Warren 1988). Of these fish, a 45 percent pre-spawning mortality reduced the spawning population to three males and 13 females.

Sockeye travel approximately 400 miles from the mouth of the Salmon River up to the lakes of the upper Salmon River. Using Hauck's (1955) migration estimates of 13 miles per day and recognizing that fish are trapped at Redfish Lake from July 23 through September 1 (Evermann 1896), fish would be entering the Salmon River from June 22 to July 31.

The run size for the past few years has been less than 100 fish per year (Table 31). This is evident not in weir counts on **Redfish** Lake, but in sockeye counts over Lower Granite Dam. Most, if not all, of the sockeye migrating over Lower Granite Dam are destined for **Redfish** Lake.

Table 31. Fish counts for sockeye passing Lower Granite Dam (U.S. Army Engineer District 1984).

Year	Count	Year	Count
1975	209	1982	211
1976	531	1983	122
1977	458	1984	47
1978	123	1985	35
1979	25	1986	15
1980	96	1987	29
1981	218	1988	22

In 1986 a trap operated on **Redfish** Lake Creek from July 7 to September 17. Managers found 29 fish in the trap from July 26 to August 26 (Warren 1988). In comparing the trap count with the Lower Granite Dam count, it is apparent that fish hold over between the dam and the trap, that dam counts reflect trends and not exact numbers, or that some of the fish caught in the trap were kokanee moving from the Little **Redfish** Lake or from the Salmon River.

Of 24 fish collected in a 1953 survey, 19 had lived in fresh water two years and in salt water two years (Hauck 1955). One fish had spent one year in the ocean and two years in freshwater, three fish had spent three years in the ocean and two in fresh water, and one fish had spent two years in the ocean and three years in fresh water.

After 13 years trapping fish (Table 32), Bjornn et al. (1968), found a l-to-l sex ratio for sockeye. **This** appears to be quite different from the l-to-3 ratio Warren (1988) found in 1986. Bjornn et al. (1968) also recorded length data by sex from the salmon trapped (Table 33).

Table 32. Run size, females, estimated egg deposition and smolts produced by year from Bjornn et al. (1968).

Year Class	Adults Counted	Female Spawners	Estimated Egg Deposition	Number of smolts Age 1	Age II	Total	Percent Survival
1953						25,023	
1954	998	434	1,258,600	13,006	26,065	39,071	3.10
1955	4,316	1,999	5,797,100	38,935	40,139	79,074	1.36
1956	1,381	595	1,725,500	861	9,854	10,715	0.62
1957	523	275	797,500	3,146	1,442	4,588	0.58
1958	55	25	72,500	691	626	1,317	1.82
1959	290	130	377,000	20,974	1,978	22,952	6.09
1960	75	34	98,600	21,022	466	21,488	21.79
1961	11	6	17,400	22,854	2,175	25,029	143.84
1962	39	18	52,200	4,317	10,222	14,539	27.85
1963	395	202	585,800	8,778	3,627	12,405	2.12
1964	335	192	556,800	11,873			
1965	17						
1966	61						

Table 33. Length-frequency distribution of adultt sockeye salmon sampled at the **Redfish** Lake Creek weir 1953-1965 and 1986 (Bjornn et. al 1968 and Warren 1988).

Fork Length (centimeters)	Males	Females	Total .	(Warren 1988)
431-444	1		1	
445-456	1		1	
457-569	1		1	
470-482	1	1	2	
483-494	1	7	8	
495-507	2	12	14	
508-520	8	29	37	
521-532	16	59	75	
533-545	28	106	134	
546-558	47	118	165	
559-571	80	76	156	
572-583	107	441	513	
584-596	88	20	108	
597-609	47	4	51	
610-621	31	1	32	3
622-634	8		8	1
635-644	9		9	
645-660	1	1	2	

In 1986, managers spawned 13 sockeye from September 24 to October 24, producing 31,594 eggs for an average fecundity of 2,430 eggs per female (Warren 1988). This is over double what Evermann (1896) counted from a 610 mm spawner in 1896.

Fry emerge in early spring and begin migrating to the ocean from late April through early May (Bjornn et al. 1968). Young sockeye may spend up to three years in fresh water (Hauck 1955).

Bjornn et al. (1968) estimated egg-to-smolt survival rates ranged from 1.36 percent to 21.79 percent under high and low fry densities, respectively. This is similar to Meeham (1966) and Foerster (1968) survival estimates for sockeye in other systems. Smolt-to-adult survival rates for fish leaving Redfish Lake ranged from 0.07 percent to 1.83 percent (Bjornn et al. 1968). During periods of intense downriver harvest, 1956 to 1959, survival rates ranged from 0.08 percent to 0.45 percent. During low and non-harvest years, survival was considerably better.

Biologists assume natural habitat production is limited by rearing capacity of the lakes of the upper Salmon River. The main production constraint for sockeye is the dewatering of streams leading from the rearing lakes (Bowles and Cochnauer 1984), mortality of smolts as they pass through the dams, and availability of a suitable donor stock. Many of these migration paths have been obstructed because of irrigation needs. Bowles and Cochnauer's (1984) production estimate for lakes was used to determine production potential for all of the sockeye production lakes in the Stanley Basin (Table 34). Warm Lake in the South Fork Salmon River drainage is also included, though no sea-run sockeye have been documented there.

Although an attempt was made in 1986 to trap and raise sockeye in the Sawtooth Hatchery, no long-term hatchery program has been established. If this species is to survive, managers will need to instigate hatchery programs and natural enhancement efforts.

In June 1981, managers stocked 173,880 sockeye fry into Stanley Lake. These fry were from eggs taken from the Fulton River in Canada (Parrish 1983). In 1982, managers stocked 260,393 sockeye fry into Stanley Lake, also from the Fulton River (Table 35).

Table 34. Sockeye salmon production estimated for the Salmon River Subbesin.

Area	Lake	Surface Area (HA)	Smolt Production[a]	Area Production
South Fork Salmon River				282,310
	Warm Lake	259	282,310	
Upper Salmon River				1,345,060
	Alturas Lake	334	364,060	
	Pettit Lake	148	161,320	
	Redfish Lake	610	664,900	
	Stanley Lake	73	79,570	
	Yellow Belly Lake	69	75,210	
		Total production		1,627,370

[a] Smolt production estimate made by multiplying surface area by 1,090 smolts per ha (Bowles and Cochnauer 1984).

Table 35. Sockeye fry stocked in the lakes of the upper Salmon River Subbasin (Howell et al. 1985).

Brood Year	Eyed Eggs	Fry Stocked	Stocking Date	Location Stocked	Rearing Hatchery
1980	536,000	173,880	1981	Stanley Lake	American Falls
1981	604,350	260,393	1982	Stanley Lake	American Falls
1982	752,000	150,015	1983	Stanley Lake	Mackay
1983	259,356	63,000	1984	Alturas Lake	Mackay
	147,000		1984	Stanley Lake	Mackay

Specific Considerations

(See chinook and steelhead production plans.)

- Population size is probably below maintenance level. A high priority of the Shoshone-Bannock Tribes is to discover why runs are so depressed and investigate opportunities to rejuvenate.
- Attempts to supplement were not successful due to very low population levels.
- Stock transfers have not been successful. Limited stock is available that is genetically similar to the endemic stock.
- Many sockeye stocks are very susceptible to infectious hematopoietic necrosis (IHN).
- Inbasin water management problems, primarily upper mainstem Salmon dewatering, constrain production in Alturas Lake.
- Mainstem hydroelectric system mortality will challenge any rebuilding effort.
- Sawtooth National Forest Plan calls for recovery to historical escapement levels.

Objectives

Biological Objectives

(Numbers are not additive. For example, hatchery spawners includes brood needs also included in the Lower Snake River Compensation Plan mitigation goal.)

1. Provide a minimum of 6,000 sockeye spawners to the Salmon Subbasin to maintain the unique biological characteristics and productivity of its naturally reproducing populations, and to rebuild populations to provide sustainable yield.
2. Restore sockeye populations to historical range.
3. Contribute to the Northwest Power Planning Council's doubling goal, consistent with council policies.
4. Conserve and protect genetic resources represented by wild and natural stocks.

Utilization Objectives

1. In the long term, achieve and maintain a minimum of 1,000 sockeye, as identified by the public advisory committees, for non-tribal harvest in the subbasin once rebuilding is achieved. Nez Perce and Shoshone-Bannock tribes would expect to harvest equal numbers as non-tribal fishers harvest, for a total of 2,000 fish.

2. Restore fishing opportunities in tribal and non-tribal historical areas.

3. Emphasize public viewing and nonconsumptive use until run can produce harvestable surplus.

Alternative Strateffies

In general, sockeye strategies followed a sequence of actions beginning with utilization of existing hatchery production (if any), and methods to enhance natural production (such as an "all natural" strategy), followed by levels of increased artificial production in addition to the natural actions found in the first strategy. Modeling results are not available: the strategies for sockeye were not modeled.

Estimated costs of the alternative strategies below are summarized in Table 36. Standardized cost sheets were developed for each sockeye strategy and are grouped in Appendix C. These should be referred to for estimated, relative costs.

STRATEGY 1: Continue current management. Improve passage to Stanley Basin lakes to enhance inbasin migration survival.

Hypotheses: Some populations of other anadromous species are slowly rebuilding and continued efforts to improve inbasin and out-of-basin survival may result in increased numbers of adults returning to the area.

Assumptions: Numbers are not so low now that without some intervention the population may go extinct.

ACTIONS: 1, 7

1. Maintain minimum flows in the headwaters for adult passage into Stanley and Alturas lakes and for juvenile migration out of the lakes.

7. Resolve Alturas Lake Creek/upper Salmon dewatering due to irrigation diversions operated by Busterback Ranch.

STRATEGY 2: Seek federal help in protecting the **Redfish** Lake sockeye.

Hypotheses: Listing as a threatened or endangered species would afford sockeye federal protection including outside the **subbasin** where interested parties now have no jurisdiction.

Assumptions: Sockeye meet requirements of Endangered Species Act for listing. Production and harvest of other species would not be negatively impacted due to this action.

ACTIONS: 1, 3

1. -

3. Petition the U.S. Fish and Wildlife Service to list sockeye as a threatened and endangered species.

STRATEGY 3: Rebuild the population by supplementing with indigenous stock in Stanley Basin lakes. Investigate feasibility of expanding to Warm Lake.

Hypotheses: Indigenous population will support both hatchery and natural production. Additional hatchery production is needed to prevent run from extinction.

Assumptions: Brood stock collection and rearing methods are successful. Rearing capacity exists at Sawtooth Hatchery, another facility, or a new facility can be developed.

ACTIONS: 1, 2, 4, 5

1. -

2. Supplement Stanley and Alturas lakes in the upper Salmon River area with indigenous brood stock and, if feasible, Warm Lake in the South Fork.

4. Improve culture methods and knowledge of the species.

5. Develop additional rearing capacity if capacity does not exist at current facility.

STRATEGY 4: Rebuild the population by supplementing with an out-of-subbasin donor stock into Stanley Basin lakes and, if feasible, Warm Lake.

Hypotheses: Indigenous population is too low to support collection for hatchery brood stock. Investigate feasibility of expanding to Warm Lake.

Assumptions: An acceptable donor stock, with regards to ecology, disease, and other factors, could be found and upon transfer, would produce a viable run without negatively impacting other fish species. The genetic resource of the indigenous population could be conserved.

ACTIONS: 1, 4, 5, 6

1. -
4. -
5. -

6. supplement with a mid-Columbia River stock of sockeye.

Table 36. Estimated costs of alternative strategies for Salmon River sockeye. Cost estimates represent new or additional costs to the 1987 Columbia River Basin Fish and Wildlife Program; they do not represent projects funded under other programs, such as the Lower Snake River Compensation Plan or a public utility district settlement agreement. (For itemized costs, see Appendix C.)

	Proposed Strategies				
	1	2	3	4	5*
Hatchery Costs					
Capital[1]	0	0	1,300,000	14,700,000	1,300,000-14,700,000
O&M/yr[2]	0	0	30,000	320,000	30,000-320,000
Other Costs					
		0			
Capital[3]	20,000 800	0	20,000 800	20,000 800	20,000 800
Total Costs					
Capital	20,000	0	1,320,000	14,720,000	1,320,000-14,720,000
O&M/yr	800	0	30,800	320,800	30,800-320,800

* Recommended strategy.

[1] Estimated capital costs of constructing a new, modern fish hatchery. In some subbasins, costs may be reduced by expanding existing facilities. For consistency, estimate is based on $23/pound of fish produced. Note that actual costs can vary greatly, especially depending on whether surface or well water is used and, if the latter, the number and depth of the wells.

[2] Estimated operation and maintenance costs per year directly associated with new hatchery production. Estimates are based on $2.50/pound of fish produced. For consistency, O&M costs are based on 50 years.

[3] Capital costs of projects (other than direct hatchery costs) proposed under a particular strategy, such as enhancing habitat, screening diversions, removing passage barriers, and installing net pens (see text for specific actions).

[4] Estimated operation and maintenance costs per year of projects other than those directly associated with new hatchery production. For consistency, O&M costs are based on 50 years.

Recommended Stratecries

Effective management of mixed-stock tributary and **mainstem** fisheries should be considered a critical component for all recommended strategies in the Salmon River Subbasin. Harvest research and methodology development must parallel production increases to meet utilization objectives to the greatest degree, as well as to meet biological objectives.

Subbasin planners and regional System Planning Group members recommend a new strategy that combines elements of Strategies 3 and 4.

STRATEGY 5, Step 1: Rebuild the population by supplementing with indigenous stock of sockeye in Stanley Basin lakes. This would include genetic and behavioral identification of kokanee that might exhibit anadromous tendencies, and attempts to use that strain as brood stock. Enhance lake productivity through fertilization and implement smolt monitoring. Investigate feasibility of expanding population to Warm Lake.

Step 2: If sockeye recovery is not possible with Stanley Basin fish, identify an out-of-basin brood stock that could be used to supplement the indigenous stock. Consider **out-**of-basin brood stock program for Warm Lake and monitor prior to stocking the Stanley Basin lakes. Ensure that **out-of-**basin brood stock is acceptable regarding fish ecology and disease transfer, and would not negatively impact existing fish populations.

Hypotheses: To increase sockeye, a recovery program and increased knowledge about this population is required. The link, if any, between the kokanee population in the Stanley Basin lakes and the few returning sockeye should be explored and utilized, if possible; the current sockeye population is too small to support hatchery production and a previous **out-**of-basin brood stock transfer was not successful. Potential natural production should be enhanced by various methods to increase numbers. Successful artificial production methodology will also be critical to a recovery program.

Assumptions: Brood stock collection and rearing methods are successful. Anadromous tendencies in kokanee can be identified and optimized. Rearing capacity exists at Sawtooth Hatchery or another facility, or new facility can be developed. Juvenile migration behavior is conducive to the Snake River hydroelectric project passage program for chinook and steelhead.

Index: This species **has not** been modeled.

Rationale: **Subbasin** planners and regional System Planning Group members felt that although Strategy 1 had the highest SMART rating, it did not meet biological or utilization objectives to any degree. Because of the precipitous status of this population; planners felt that an aggressive recovery program should be instigated that optimizes the genetic material that has sustained this population, albeit at low numbers, through time, and consider stock transfers as a second alternative.

FALL CHINOOK SALMON

Fisheries managers'believe that fall chinook salmon once inhabited the South Fork Salmon River drainage, however they are now apparently extinct. Diaries and long-time residents indicated that fall chinook were found in the lower portion of the drainage in the Elk Creek vicinity. A Forest Service fisheries biologist at Krassel observed chinook spawning in early November in the early 1980s, but only one observation was made. Extinction was probably the result of the cumulative impacts of habitat alteration in the South Fork prior to the 1950s, subsequent severe sedimentation in the 1960s, downstream hydroelectric development, and overfishing. Effects in the lower South Fork Salmon River prior to the 1950s were primarily related to mining in the Secesh River and East Fork Salmon River basins (USFS 1988).

To date, managers have not identified objectives or strategies for fall chinook salmon in the Salmon River Subbasin.

PART V. SUMMARY AND IMPLEMENTATION

Objectives and Recommended Strategies

The Salmon River Subbasin Plan identifies and recommends a mix of methods to achieve production and ultimately utilization objectives. Strategies incorporate a wide range of actions, and use the full range of artificial, natural, and wild stock management options for spring and summer chinook salmon, steelhead, and sockeye salmon. Recommended strategies consider and result in production increases balanced with subbasin management needs for short- and long-term harvest opportunities and stock viability.

Collectively, the recommended strategies for the subbasin are anticipated to result in substantial subbasin benefit. While hatchery supported populations in the subbasin are expected to increase the most, wild stocks are expected to benefit as well. All populations will benefit from improved migration passage and flows. Eventual harvest opportunity for all stocks except sockeye is anticipated. Spring chinook are expected to increase approximately 324 percent of pre-implementation baseline according to System Planning Model projections of the recommended strategies. Summer chinook and steelhead are expected to increase approximately 272 percent and 215 percent of pre-implementation baseline, respectively.

Appendix C lists the costs for each alternative strategy. These cost figures represent additional costs for the strategy to be implemented and do not include the cost of any currently funded project, regardless of the source of funds. Major uncertainties with these cost estimates are the likelihood of land and water developments and reality of artificial production sites. Due to the implementation of these actions in the subbasin historically, obvious and optimum options have been recommended. Options remaining are either uncertain or have not been identified.

The estimated cost of implementing all of the recommended strategies in the Salmon River Subbasin is $17,717,784, with an annual operation and maintenance cost of $673,222 (Table 37). Artificial production costs are not included in this figure and would substantially increase the overall cost. The total number of smolts required in the recommended strategies is 16.2 million. Also not included is the cost of water acquisition, which will not be incorporated into this estimated cost. These figures are preliminary and provide a general estimate of the potential cost to implement the recommended strategies.

Table 37. Cost of recommended strategies in the Salmon River Subbasin (life expectancy 50 years).

Subbasin	Species	Strategy	Cost-capital (O&M)	Water acquisition	Fish needed to stock
Lower Main	SPCH	2	3,297,508 (31,380)		0
	STHD	1	0		0
Little Salmon	SPCH	3	3,004,746 (172,962)	Y	1,000,000
	SUCH	1	0		0
	STHD	3	3,700,000 (400,000)*	Y	800,000
Mid-Main	SPCH	1	0		0
	STHD	1	0		0
South Fork	SUCH	3	2,317,146 (151,330)		1,000,000
	STHD	2	*		0
Middle Fork	SPCH	1	115,850 (8,750)		0
	SUCH	1	0		0
	STHD	1	*		0
Panther Creek	SUCH	3,4	7,401,500 (316,380)		1,000,000
	STHD	3,4	3,245,000 (350,000)*		700,000
Lemhi	SPCH	3	3,396,760 (300,000)	Y	1,000,000
	STHD	3	4,600,000 (500,000)*	Y	1,000,000
Pahsimeroi	SUCH	3	1,801,310 (185,000)	Y	1,000,000
	STHD	3	3,225,000 (350,000)*	Y	700,000
Upper Salmon-Headwater	SPCH	3	6,482,964 (591,900)	Y	2,800,000
	SUCH	5	1,300,000 (150,000)*	Y	1,000,000
	STHD	2	*	Y	0
	SOCK	5	1,320,000 (30,800)		
			14,720,000 (320,800)	Y	1.0-11.5 mil.
Total			45,207,784 (3,538,502)		
			58,607,784 (3,828,502)		13.0-23.5 mil.

* Cost, if any, for hatchery production: cost of other actions under chinook, spring chinook in upper Salmon-headwaters.

Implementation

In the summer of 1990, the Columbia Basin Fish and Wildlife Authority submitted to the Northwest Power Planning Council the Integrated System Plan for salmon and steelhead in the Columbia Basin, which includes all 31 **subbasin** plans. The system plan attempts to integrate this **subbasin** plan with the 30 others in the Columbia River Basin, prioritizing fish enhancement projects and critical uncertainties that need to be addressed.

From here, the Northwest Power Planning Council will begin its own public review process, which will eventually lead to amending its Columbia River Basin Fish and Wildlife Program. The actual implementation schedule of specific projects or measures proposed in the system plan will materialize as the council's adoption process unfolds.

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APPENDIX A
NORTHWEST POWER PLANNING COUNCIL
SYSTEM POLICIES

In Section 204 of the 1987 Columbia River Basin Fish and Wildlife Program, the Northwest Power Planning Council describes seven policies to guide the systemwide effort in doubling the salmon and steelhead runs. Pursuant to the council's plan, the basin's fisheries agencies and Indian tribes have used these policies, and others of their own, to guide the system planning process. The seven policies are paraphrased below.

1) The area above Bonneville Dam is accorded priority.

Efforts to increase salmon and steelhead runs above Bonneville Dam will take precedence over those in subbasins below Bonneville Dam. In the past, most of the mitigation for fish losses has taken the form of hatcheries in the lower Columbia Basin. According to the council's fish and wildlife program, however, the vast majority of salmon and steelhead losses have occurred in the upper Columbia and Snake river areas. System planners turned their attention first to the 22 major subbasins above Bonneville Dam, and then to the nine below.

2) Genetic risks must be assessed.

Because of the importance of maintaining genetic diversity among the various salmon and steelhead populations in the Columbia River Basin, each project or strategy designed to increase fish numbers must be evaluated for its risks to genetic diversity. Over millions of years, each fish run has evolved a set of characteristics that makes it the best suited run for that particular stream, the key to surviving and reproducing year after year. System planners were to exercise caution in their selection of production strategies so that the genetic integrity of existing fish populations is not jeopardized.

3) Mainstem survival must be improved expeditiously.

Ensuring safe passage through the reservoirs and past the dams on the Columbia and Snake River mainstems is crucial to the success of many efforts that will increase fish numbers, particularly the upriver runs. Juvenile fish mortality in the reservoirs and at the dams is a major cause of salmon and steelhead losses. According to estimates, an average of 15 percent to 30 percent of downstream migrants perish at each dam, while 5 percent to 10 percent of the adult fish traveling upstream perish. Projects to rebuild runs in the tributaries have and will represent major expenditures by the region's ratepayers -- expenditures and long-term projects that should be protected in the mainstem.

4) Increased production will result from a mix of methods.

To rebuild the basin's salmon and steelhead runs, fisheries managers are to use a mixture of wild, natural and hatchery production. Because many questions still exist as to whether wild and natural stocks can coexist with significant numbers of hatchery fish, no one method of production will be solely responsible for increasing fish numbers. System planners were to take extra precaution when considering outplanting hatchery fish into natural areas that still produce wild fish. The council is relying on the fish and wildlife agencies and tribes to balance artificial production with wild and natural production.

5) Harvest management must support rebuilding.

Like improved mainstem passage, effective harvest management is critical to the success of rebuilding efforts. A variety of fisheries management entities from Alaska to California manage harvest of the Columbia Basin's salmon and steelhead runs. The council is calling on those entities to regulate harvest, especially in mixed-stock fisheries, in ways that support the basin's efforts to double its runs.

6) System integration will be necessary to assure consistency.

The Northwest Power Planning Council intends to evaluate efforts to protect and rebuild Columbia River Basin salmon and steelhead from a systemwide perspective. Doubling the runs will require improvements in mainstem passage, fish production and harvest management -- three extremely interdependent components. System planners from all parts of the basin are to coordinate their efforts so, for example, activities in the lower Columbia are consistent with and complement the activities 800 miles upstream in Idaho's Salmon River. The fisheries management organizations and their plans vary from subbasin to subbasin, but the council is calling upon the agencies and tribes to help resolve conflicts that arise.

7) Adaptive management should guide action and improve knowledge.

System planners were to design projects so that information can be collected to improve future management decisions. By designing projects that test quantitative hypotheses and lend themselves to monitoring and evaluation, managers can learn from their efforts. This learning by doing is called "adaptive management." Using such an approach, managers can move ahead with plans to rebuild the Columbia Basin's salmon and steelhead runs, despite many unanswered questions about how best to accomplish their goal. With time, the useful information revealed by these "experiments" can guide future projects.

APPENDIX B
SMART ANALYSIS

To help select the preferred strategies for each subbasin, planners used a decision-making tool known as Simple Multi-Attribute Rating Technique (SMART). SMART examined each proposed strategy according to the following five criteria. In all cases, SMART assumed that all of the Columbia River mainstem passage improvements would be implemented on schedule.

1) Extent the subbasin objectives were met

2) Change in maximum sustainable yield

3) Impact on genetics

4) Technological and biological feasibility

5) Public support

Once SMART assigned a rating for each criteria, it multiplied each rating by a specific weight applied to each criteria to get the "utility" value (see following tables). Because the criteria were given equal weights, utility values were proportional to ratings. The confidence in assigning the ratings was taken into consideration by adjusting the weighted values, (multiplying the utility value by the confidence level) to get the "discount utility." SMART then totaled the utility values and discount utility values for all five criteria, obtaining a "total value" and a "discount value" for each strategy.

System planners used these utility and discount values to determine which strategy for a particular fish stock rated highest across all five criteria. If more than one of the proposed strategies shared the same or similar discount value, system planners considered other factors, such as cost, in the selection process. Some special cases arose where the planners' preferred strategy did not correspond with the SMART results. In those cases, the planners provide the rationale for their selection.

SUBBASIN: Salmon, Lower Main

STOCK : Spring Chinook

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	6	0.6	1	6	3.6
2	5	0.9	1	5	4.5
3	5	0.6	1	5	3
4	8	0.6	1	8	4.8
5	6	0.6	1	6	3.6

TOTAL VALUE 30

DISCOUNT VALUE 19.5

CONFIDENCE VALUE 0.65

SUBBASIN: Salmon, Lower Main

STOCK: Spring Chinook

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	9	0.6	1	9	5.4
2	10	0.9	1	10	9
3	5	0.6	1	5	3
4	7	0.6	1	7	4.2
5	8	0.6	1	a	4.8

TOTAL VALUE 39

DISCOUNT VALUE , 26.4

CONFIDENCE VALUE 0.67692307

SUBBASIN: Salmon, Lower Main

STOCK: Spring Chinook

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1					
2	10 10	0.9	1	10	6
3	4	0.3	1	10	9
4	6	0.3	1	4	1.2
			1	6	1.8
5	8	0.6	1	8	4.8

TOTAL, VALUE 30

DISCOUNT VALUE 22.8

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Lower Main

STOCK : Summer Steelhead A (&B)

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	8	0.9	1	8	7.2
2	9	0.6	1	9	5.4
3	2	0.6	1	2	1.2
4	8	0.6	1	8	4.8
5	8	0.9	1	8	7.2

TOTAL VALUE 35

DISCOUNT VALUE 25.8

CONFIDENCE VALUE 0.73714285

SUBBASIN: Salmon, Lower Main

STOCK: Summer Steelhead A (&B)

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1					
2	10 10	0.6	1 1	10	6
		0.6		10	6
3	5	0.6	1	5	3
4	6	0.6	1	6	3.6
5	8		1	8	4.8

TOTAL VALUE 39

DISCOUNT VALUE 23.4

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Lower Main

STOCK: Summer Steelhead A (&B)

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
2		0.6			
3	10 10 4	0.6	1	10	6 6
	6	0.6			
4	8	0.3	1	6	2.4
5			1	8	1.8
		0.6	1		4.8

TOTAL, VALUE 38

DISCOUNT VALUE 21

CONFIDENCE VALUE 0.55263157

SUBBASIN: Salmon, Little Salmon

STOCK : Spring Chinook

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	6	0.6	1	6	3.6
2	6	0.6	1	6	3.6
3	4	0.6	1	4	2.4
4	8	0.6	1	8	4.8
5	5	0.6	1	5	3

TOTAL VALUE 29

DISCOUNT VALUE 17.4

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Little Salmon

STOCK: Spring Chinook

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	6	0.6	1	6	3.6
2	6	0.6	1	6	3.6
3	4	0.6	1	4	2.4
4	a	0.6	1	8	4.8
5	8	0.9	1	a	7.2

TOTAL VALUE 32

DISCOUNT VALUE 21.6

CONFIDENCE VALUE 0.675

SUBBASIN: Salmon, Little Salmon

STOCK: Spring Chinook

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	7	0.6	1	7	4.2
2	6	0.6	1	6	3.6
3	4	0.3	1	4	1.2
4	9	0.3	1	9	2.7
5	6	0.6	1	6	3.6

TOTAL VALUE 32

DISCOUNT VALUE 15.3

CONFIDENCE VALUE 0.478125

SUBBASIN: Salmon, Little Salmon

STOCK: Spring Chinook

STRATEGY: 4

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	6	0.6	1	6	3.6
2	6	0.6	1	6	3.6
3	3	0.3	1	3	0.9
4	9	0.6	1	9	5.4
5	8	0.9	1	8	7.2

TOTAL VALUE 32

DISCOUNT VALUE 20.7

CONFIDENCE VALUE 0.646075

SUBBASIN: Salmon, Little Salmon

STOCK: Summer Chinook

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	3	0.6	1	3	1.8
2	3	0.6	1	3	1.8
3	8	0.9	1	8	7.2
4	7	0.6	1	7	4.2
5	5	0.6	1	5	3

TOTAL VALUE 26

DISCOUNT VALUE 18

CONFIDENCE VALUE 0.69230769

SUBBASIN: Salmon, Little Salmon

STOCX : Sumner Steelhead A

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	6	0.6	1	6	3.6
2	6	0.6	1	6	3.6
3	5	0.9	1	5	4.5
4	8	0.6	1	8	4.0
5	5	0.6	1	5	3

TOTAL VALUE 30

DISCOUNT VALUE 19.5

CONFIDENCE VALUE 0.65

SUBBASIN: Salmon, Little Salmon

STOCX: Summer Steelhead A

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	6	0.6	1	6	3.6
2	6	0.6	1	6	3.6
3	4	0.6	1	4	2.4
4	8	0.6	1	8	4.8
5	8	0.9	1	8	7.2

TOTAL VALUE 32

DISCOUNT VALUE 21.6

CONFIDENCE VALUE 0.675

SUBBASIN: Salmon, Little Salmon

STOCX: Summer Steelhead A

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	8	0.6	22		
2	8	0.6	18	144	105.6 86.4
3	4	0.6	28	112	67.2
4	7	0.6	20	140	84
5	6	0.6	12	72	43.2

TOTAL VALUE 644

DISCOUNT VALUE 386.4

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon. Little Salmon

STOCX : Summer Steelhead A

STRATEGY: 4

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1			1	8	
2	8	0.6	1	8	4.6 4.0
3	3	0.6	1	3	0.9
4	7	0.9	1	7	4.2
5	8			8	7.2

TOTAL VALUE 34

DISCOUNT VALUE 21.9

CONFIDENCE VALUE 0.64411764

SUBBASIN: Salmon, Mid-Mainstem

STOCK: Spring Chinook

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	4	0.9	1	4	3.6
2	3	0.9	1	3	2.7
3	10	0.9	1	10	9
4	10	0.9	1	10	9
5	10	0.9	1	10	9

TOTAL VALUE 37

DISCOUNT VALUE 33.3

CONFIDENCE VALUE 0.9

SUBBASIN: Salmon, Mid-Mainstem

STOCK: Spring Chinook

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	8	0.6	1	8	4.8
2	10	0.9	1	10	9
3	3	0.6	1	3	1.8
4	7	0.3	1	7	2.1
5	7	0.3	1	7	2.1

TOTAL VALUE 35

DISCOUNT VALUE 19.8

CONFIDENCE VALUE 0.56571428

SUBBASIN: Salmon, Mid-Mainstem

STOCK: Spring Chinook

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	8	0.6	1	8	4.8
2	10	0.9	1	10	9
3	7	0.3	1	7	2.1
4	5	0.3	1	5	1.5
5	5	0.3	1	5	1.5

TOTAL VALUE 35

DISCOUNT VALUE 18.9

CONFIDENCE VALUE 0.54

SUBBASIN: Salmon, Mid-Malnstem

STOCK: Summer Steelhead A

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1 2	4	0.9	1	4	
3	10 3	0.6	1	3	3.6 1.8
		0.9	1	10	9
		0.9	1	10	9
5 4	10	0.9	1	5	4.5

TOTAL VALUE 32

DISCOUNT VALUE 27.9

CONFIDENCE VALUE 0.871875

SUBBASIN: Salmon,, Mid-Mainstem

STOCK: Summer Steelhead A

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1					
2	10 10	0.6	1	10	6
3	3	0.6	1	10	6
4	7	0.3	1	3	1.8
			-	7	2.1
5	7	0.6	1	7	4.2

TOTAL VALUE 37

DISCOUNT VALUE 20.1

CONFIDENCE VALUE 0.54324324

SUBBASIN: Salmon, Mid-Mainstem

STOCK: Summer Steelhead A

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1		0.6	1		6
2	10 10	0.6	1	10 10	6
3	5	0.3	1	5	2.1
4	9	0.3	1	9	1.5
5		0.6	1		5.4

TOTAL VALUE 41

DISCOUNT VALUE 21

CONFIDENCE VALUE 0.51219512

SUBBASIN: Salmon," South Fork - Secesh

STOCK: Summer Chinook

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	6	0.6	1	6	3.6
2	6	0.6	1	6	3.6
3	5	0.9	1	5	4.5
4	8	0.9	1	a	7.2
5	a	0.9	1	a	7.2

TOTAL VALUE 33

DISCOUNT VALUE 26.1

CONFIDENCE VALUE 0.79090909

SUBBASIN: Salmon, South Fork - Secesh

STOCK: Summer Chinook

STRATEGY: 2

CRITERIA'	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT.
	7	0.6	1	7	4.2
a	6	0.6	1	6	3.6
3	6	0.6	1	6	3.6
4	8	0.3	1	a	2.4
5	10	0.6	1	10	6

TOTAL VALUE 37

DISCOUNT VALUE 19.8

CONFIDENCE VALUE 0.53513513

SUBBASIN: Salmon, South Fork - Secesh

STOCK: Summer Chinook

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1					
2	7a	0.6 0.6	11	a7	4.8
					4.2
3	7	0.6	1	7	
4	9	0.6	1	9	4.2;
5		0.6	1		5.4

TOTAL VALUE 36

DISCOUNT VALUE 21.6

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, South Fork - Secesh

STOCK: Summer Steelhead B

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1		0.6		6	3.6
2	6	0.6	1	6	3.6
3	10			10	9
	8	0.9	1	8	7.2
5	8	0.9	1	8	7.2

TOTAL VALUE 38

DISCOUNT VALUE 30.6

CONFIDENCE VALUE 0.80526315

SUBBASIN: Salmon, South Fork - Secesh

STOCK: Summer Steelhead B

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1		0.6			
2	7	0.6	1	7	4.2
			1	6	3.6
3	10	0.9	1	10	9
4	8	0.3	1	8	2.4
5	10	0.6	1	10	6

TOTAL VALUE 41

DISCOUNT VALUE 25.2

CONFIDENCE VALUE 0.61463414

SUBBASIN: Salmon, South Fork - Secesh

STOCK: Summer Steelhead B

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	9	0.6	1	9	5.4
2	10	0.6	1	10	6
3	5	0.3	1	5	1.5
4	8	0.6	1	8	4.8
5	3	0.6	1	3	1.8

TOTAL VALUE 35

DISCOUNT VALUE 19.5

CONFIDENCE VALUE 0.55714285

SUBBASIN: **Salmon,** Middle Fork-Bear Valley

STOCK: Spring Chinook'

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	5	0.9	1	5	4.5
2	5	0.9	1	5	4.5
3	10	0.9	1	10	9
4	10	0.9	1	10	9
5	a	0.9	1	8	7.2

TOTAL VALUE 38

DISCOUNT VALUE 34.2

CONFIDENCE VALUE 0.9

SUBBASIN: Salmon, Middle Fork-Bear Valley

STOCK: Spring Chinook

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	5	0.9	1	5	4.5
2	5	0.9	1	5	4.5
3		0.3	1	5	1.5
	6	0.6	1	6	3.6
4 5	2	0.6	1	2	1.2

TOTAL VALUE 23

DISCOUNT VALUE 15.3

CONFIDENCE VALUE 0.66521739

SUBBASIN: Salmon, Middle Fork-Bear Valley

STOCX: Spring Chinook

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
2	6	0.6	1	6	3.6
3	6	0.6	1	6	3.6
	6	0.6	1	4	1.2
4	2	0.6	1	6	3.6
5			1	2	1.2

TOTAL VALUE 24

DISCOUNT VALUE 13.2

CONFIDENCE VALUE 0.55

SUBBASIN: Salmon, Middle Fork - Bear Valley

STOCK: Summer Chinook

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	3	0.9	1	3	2.7
2	3	0.9	1	3	2.7
3	10	0.9	1	10	9
4	10	0.9	1	10	9
5	7	0.6	1	7	4.2

TOTAL VALUE 33

DISCOUNT VALUE 27.6

CONFIDENCE VALUE 0.83636363

SUBBASIN: Salmon, Middle Fork - Bear Valley

STOCK: Summer Steelhead B

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	5	0.9	1	5	4.5
2	5	0.9	1	5	4.5
3	10	0.9	1	10	9
4	10	0.9	1	10	9
5	10	0.9	1	10	9

TOTAL VALUE	40
DISCOUNT VALUE	36
CONFIDENCE VALUE	0.9

SUBBASIN: Salmon, Panther creek

STOCK: Summer Chinook

STRATEGY: 1 '

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
2	10	0.6	1	10	6
3	10 4	0.6	1	10 4	2.4 6
		0.6	1		
4	3	0.6	1	3	1.8
5	7		1	7	4.2

TOTAL VALUE 34

DISCOUNT VALUE 20.4

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Panther Creek

STOCK: Sumner Chinook

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	10	0.6	1	10	6
2	10	0.6	1	10	6
3	4	0.6	1	4	2.4
4	6	0.6	1	6	3.6
5	7	0.6	1	7	4.2

TOTAL VALUE 37

DISCOUNT VALUE 22.2

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Panther Creek

STOCK: Summer Chinook

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	10	0.6	1	10	6
2	10	0.6	1	10	6
3	4	0.6	1	4	2.4
4	6	0.6	1	6	3.6
5	8	0.6	1	8	4.0

TOTAL VALUE 38

DISCOUNT VALUE 22.8

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Panther Creek

STOCK: Summer Chinook

STRATEGY: 4

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	10	0.6	1	10	6
2	10	0.6	1	10	6
3	4	0.6	1	4	2.4
4	3	0.6	1	3	1.8
5	9	0.6	1	9	5.4

TOTAL VALUE 36

DISCOUNT VALUE 21.6

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Panther Creek

STOCK : Summer Steelhead A

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	4	0 . 6	1	4	2.4
2	3	0.6	1	3	1.9
3	4	0.6	1	4	2.4
4	10	0.9	1	10	9
5	7	0.6	1	7	4.2

TOTAL VALUE 28

DISCOUNT VALUE 19.8

CONFIDENCE VALUE 0.70714285

SUBBASIN: Salmon, Panther Creek

STOCK: Sumner Steelhead A

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	10	0.6	1	10	6
2	10	0.6	1	10	6
	4	0.6	1	4	2.4
a	7	0.6	1	7	4.2
5	7	0.6	1	7	4.2

TOTAL VALUE 38

DISCOWT VALUE 22.8

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Panther Creek

STOCK : Summer Steelhead A

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	10	0.6	1	10	6
2	10	0.6	1	10	6
3	4	0.6	1	4	2.4
4	5	0.6	1	5	3
5	8	0.6	1	8	4.8

TOTAL VALUE 37

DISCOUNT VALUE 22.2

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Panther Creek

STOCK: Sumner Steelhead A

STRATEGY: 4

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1				10	6
2	10 10	0.6 0.6	1	10	6
3	3	0.6	1	5	3
4	9	0.6	1	3	1.8
5				9	5.4

TOTAL VALUE 37

DISCOUNT VALUE 22.2

CONFIDENCE VALUE 0.6,

SUBBASIN: Salmon, Lemhi

STOCK: Spring Chinook

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
2					
3	4 3	0.9	1	4 3	2.7 3.6
	7	0.0	1		
4	10	0.9	1	7	4.2
5	4		1	10	9
		0.6	1	4	2.4

TOTAL VALUE 28

DISCOUNT VALUE 21.9

CONFIDENCE VALUE 0.78214285

SUBBASIN: Salmon, Lemhi

STOCK: Spring Chinook

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	4	0.9	1	4	3.6
2	4	0.6	1	4	2.4
3	7	0.9	1	7	4.2
4	7	0.6	1	7	6.3
5	6		1	6	3.6

TOTAL VALUE 28

DISCOUNT VALUE 20.1

CONFIDENCE VALUE 0.71785714

SUBBASIN: Salmon, Lemhi

STOCK: Spring Chinook

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	9	0.9	1	9	8.1
2	10	0.6	1	10	6
3	4	0.6	1	4	2.4
4	6	0.6	1	6	3.6
5	6	0.6	1	6	3.6

TOTAL VALUE 35

DISCOUNT VALUE 23.7

CONFIDENCE VALUE 0.67714285

SUBBASIN: Salmon, Lemhi

STOCK: Summer Steelhead A

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	4	0.9	1	4	3.6
2	3	0.6	1	3	1.8
3	5	0.6	1	5	3
4	10	0.9	1	10	9
5	4	0.6	1	4	2.4

TOTAL VALUE 26

DISCOUNT VALUE 19.8

CONFIDENCE VALUE 0.76153846

SUBBASIN: Salmon, Lemhi

STOCK: Summer Steelhead A

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	4	0.9			
2	4	0.6	1	4	3.6
		...	1	4	2.4
3	7	0.9	1	5	3
4	6	0.6	1	7	6.3
5			1	6	3.6

TOTAL VALUE 26

DISCOUNT VALUE 18.9

CONFIDENCE VALUE 0.72692307

SUBBASIN: Salmon, Lemhi

STOCK: Summer Steelhead A

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1					
2	10 10	0.9	1	10	9
3	5	0.6	1	15	6
4	8	0.6	1	8	3
5	6	0.6	1		4.8
				6	3.6

TOTAL VALUE 39

DISCOUNT VALUE 26.4

CONFIDENCE VALUE 0.67692307

SUBBASIN: Salmon, Pahsimeroi

STOCK: Summer Chinook

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	4	0.6	1	5	2.4
2	5	0.6	1	5	3
3	10	0.9	1		4.5
4		0.9		10	9
5	4	0.6	1	4	2.4

TOTAL VALUE 28

DISCOUNT VALUE 21.3

CONFIDENCE VALUE 0.76071428

SUBBASIN: Salmon, Pahsimeroi

STOCK: Summer Chinook

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	6	0.6			
2	6	0.6	1	6	3.6
				6	3.6
3	6	0.6	1	6	3.6
4	6	0.6	1	6	3.6
5	7	0.6	1	7	4.2

TOTAL VALUE 31

DISCOUNT VALUE 18.6

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Pahsimeroi

STOCK: Summer Chinook

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	8				
2	9	0.6	1	8	4.8
3		0.6	1	9	5.4
4	"7 4	0.6	1	4	2.4
				" 7	4.2
5	7	0.6	1	7	4.2

TOTAL VALUE 35

DISCOUNT VALUE 21

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Pahsimeroi

STOCK: Summer Steelhead A

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	4	0.9	1	4	3.6
2	3	0.6	1	3	1.8
3	6	0.9	1	6	5.4
4	10	0.9	1	10	9
5	4	0.9	1	4	3.6

TOTAL VALUE 27

DISCOUNT VALUE 23.4

CONFIDENCE VALUE 0.86666666

SUBBASIN: Salmon, Pahsimeroi

STOCK: Summer Steelhead A

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	4	0.6	1	4	2.4
2	4	0.6	1	4	2.4
3	6	0.9	1	6	5.4
4	5	0.6	1	5	3
5	7	0.6	1	7	4.2

TOTAL VALUE 26

DISCOUNT VALUE 17.4

CONFIDENCE VALUE 0.66923076

SUBBASIN: Salmon, Pahsimeroi

STOCK: Sumner Steelhead A

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	7		1	7	
2	9	0.6	1	9	4.2
		0.6			5.4
3	6	0.6	1	6	3.6
4	7	0.6	1	7	4.2
5	7		1	7	4.2

TOTAL VALUE 36

DISCOUNT VALUE 21.6

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Upper Salmon-Headwaters

STOCK: Spring Chinook

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	6	0.6	1	6	3.6
2	6	0.9	1	6	3.6
3	5	.		5	4.5
4	7	0.9	1	7	6.3
5	4	0.6	1	4	2.4

TOTAL VALUE 28

DISCOUNT VALUE 20.4

CONFIDENCE VALUE 0.72857142

SUBBASIN: Salmon, Upper Salmon-Headwaters

STOCK: Spring Chinook

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	7	0.6	1	7	4.2
2	6	0.6	1	6	3.6
3	5	0.6	1	5	3
4	8	0.9	1	8	7.2
5	6	0.9	1	6	5.4

TOTAL VALUE 32

DISCOUNT VALUE 23.4

CONFIDENCE VALUE 0.73125

SUBBASIN: Salmon, Upper Salmon-Headwaters

STOCK: Spring Chinook

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
		0.6			
1	9	0.6	1	8	4.8
3	3	0.3	1	3	5.4
4	7	0.6	1	7	0.9
5	8		1		4.2
		0.6	1	8	4.8

TOTAL VALUE 35

DISCOUNT VALUE 20.1

CONFIDENCE VALUE 0.57428571

SUBBASIN: Salmon, Upper Salmon

STOCX: **Summer** Chinook

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1		0.6	1		
2	5 6		1	6	3.6
		0.6		5	3
3	5	0.6	1	5	3
4	9	0.6	1	9	5.4
5	5	0.6	1	5	3

TOTAL VALUE 30

DISCOUNT VALUE 18

CONFIDENCE VALUE 0.6

SUBBASIN: salmon, Upper salmon

STOCK : **Summer** Chinook

STRATEGY: 2

CRITERIA	**RATING**	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT **UT**
1	6	0.6	1	6	3.6
2	6	0.6	1	6	3.6
3	5	0.6	1	5	3
4	8	0.6	1	8	4.8
5	7	0.6	1	7	4.2

TOTAL VALUE 32

DISCOUNT **VALUE** 19.2

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Upper Salmon

STOCK: **Summer** Chinook

STRATEGY: 3

CRITERIA	**RATING**	**CONFIDENCE**	**WEIGHT**	**UTILITY**	**DISCOUNT UT**
1	8	0.6	1	8	4.8
2	7	0.6	1	7	4.2
3	4	0.6	1	4	2.4
4	7	0.3	1	7	2.1
5	8	0.6	1	8	4.8

TOTAL **VALUE** 33

DISCOUNT VALUE 18.3

CONFIDENCE VALUE 0.53823529

SUBBASIN: Salmon, Upper Salmon

STOCK: Summer Chinook

STRATEGY : 4

CRITERIA	**RATING**	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1		0.9	1	4	3.6
2	a	0.6	1	4	2.4
3	10	0.9	1	10	9
4	10	0.9	1	10	9
5	3	0.9	1	3	2.7

TOTAL VALUE 31

DISCOUNT **VALUE** 26.7

CONFIDENCE VALUE 0.86129032

SUBBASIN: Salmon, Upper Salmon-Headwaters

STOCK: Summer Steelhead A

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	4	0.6	1	4	2.4
2	5		1	5	3
3	9	0.6	1	5	4.5
4	5	0.9	1	9	8.1
5		0.6	1	5	3

TOTAL VALUE 28

DISCOUNT VALUE 21

CONFIDENCE VALUE 0.75

SUBBASIN: Salmon, Upper Salmon-Headwaters

STOCK: Summer Steelhead A

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	5	0.6	1	5	3
2	5	0.6	1	5	3
3	5	0.6	1	5	3
4	8	0.9	1	8	7.2
5	6	0.6	1	6	3.6

TOTAL VALUE 29

DISCOUNT VALUE 19.8

CONFIDENCE VALUE 0.68275862

SUBBASIN: Salmon, Upper Salmon-Headwaters

STOCK: Summer Steelhead A

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1					
2	7	0.6	1	7	4.2
		0.6			4.2
3	4	0.3	1	4	1.2
		0.6	1		4.8
5	7	0.6	1	7	4.2

TOTAL VALUE 33

DISCOUNT VALUE 18.6

CONFIDENCE VALUE 0.56363636

SUBBASIN: Salmon, Headwaters

STOCK: Summer Steelhead B

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	10	0.6	1	10	6
	9	0.6	1	9	5.4
3	3	0.6	1	3	1.8
4	9	0.6	1	9	5.4
5	9	0.6	1	9	5.4

TOTAL VALUE 40

DISCOUNT VALUE 24

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon, Headwaters

STOCK: Summer Steelhead B

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1		0.6			
3	13	0.6	1	19	6
4	8		1	3	5.4
		0.6	1		1.8
		0.9	1	8	7.2
5	9	0.6	1	9	5.4

TOTAL VALUE 39

DISCOUNT VALUE 25.8

CONFIDENCE VALUE 0.66153846

SUBBASIN: Salmon, Headwaters

STOCK : Summer Steelhead B

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	10	0.6	1	10	6
2	10	0.6	1	10	6
3	3	0.3	1	3	0.9
4	8	0.6	1	8	4.8
5	9	0.6	1	9	5.4

TOTAL VALUE 40

DISCOUNT VALUE 23.1

CONFIDENCE VALUE 0.5775

SUBBASIN: Salmon

STOCK: Sockeye

STRATEGY: 1

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	3	0.6	1	3	1.8
2	2	0.6	1	2	1.2
3	9	0.6	1	9	5.4
4	9	0.9	1	9	8.1
5	3	0.6	1	3	1.8

TOTAL VALUE 26

DISCOUNT VALUE 18.3

CONFIDENCE VALUE 0.70384615

SUBBASIN: Salmon

STOCK: Sockeye

STRATEGY: 2

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	3	0.3	1	3	0.9
2	2	0.6	1	2	1.2
3	9	0.6	1	9	5.4
4	7	0.6	1	7	4.2
5	2	0.6	1	2	1.2

TOTAL VALUE 23

DISCOUNT VALUE 12.9

CONFIDENCE VALUE 0.56086956

SUBBASIN: Salmon

STOCK: Sockeye

STRATEGY: 3

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	4	0.6	1	4	2.4
2	4	0.6	1	4	2.4
3	6	0.6	1	6	3.6
4	5	0.6	1	5	
5	7	0.6	1	7	4.:

TOTAL VALUE 26

DISCOUNT VALUE 15.6

CONFIDENCE VALUE 0.6

SUBBASIN: Salmon

STOCK: Sockeye

STRATEGY: 4

CRITERIA	RATING	CONFIDENCE	WEIGHT	UTILITY	DISCOUNT UT
1	5	0.3	1	5	1.5
2	4	0.6	1	4	2.4
3	3	0.6	1	3	1.8
4	3	0.6	1	3	1.8
5	7	0.6	1	7	4.2

TOTAL VALUE 22

DISCOUNT VALVE 11.7

CONFIDENCE VALUE 0.53181818

APPENDIX C
SUMMARY OF COST ESTIMATES

The cost estimates provided in the following summary tables represent new or additional costs necessary to implement the alternative strategies.' Although many strategies involve projects already planned or being implemented under the Columbia River Basin Fish and Wildlife Program or other programs, such as the Lower Snake River Compensation Plan, the associated costs and hatchery production do not appear in the following tables.

In many cases, the following costs are no more than approximations based on familiarity with general costs of similar projects constructed elsewhere. Although the costs are very general, they can be used to evaluate relative, rather than absolute, costs of alternative strategies within a subbasin.

Particular actions are frequently included in strategies for more than one species or race of anadromous fish. In these cases, the same costs appear in several tables, but would only be incurred once, to the benefit of some, if not all, of the species and races of salmon and steelhead in the subbasin.

Subbasin planners used standardized costs for actions "universal" to the Columbia River system, such as costs for installing instream structures, improving riparian areas, and screening water diversions (see the Preliminary System Analysis Report, March 1989). For other actions, including the removal of instream barriers, subbasin planners developed their own cost estimates in consultation with resident experts.

Planners also standardized costs for all new hatchery production basinwide. To account for the variability in fish stocking sizes, estimates were based upon the cost per pound of fish produced. For consistency, estimated capital costs of constructing a new, modern fish hatchery were based on $23 per pound of fish produced. Estimated operation and maintenance costs per year were based on $2.50 per pound of fish produced.

All actions have a life expectancy, a period of time in which benefits are realized. Because of the variation in life expectancy among actions, total costs were standardized to a 50-year period. Some actions had life expectancies of 50 years or greater and thus costs were added as shown. Other actions (such as instream habitat enhancements) are expected to be long term, but may only have life expectancies of 25 years. Thus the action would have to be repeated (and its cost doubled) to meet the 50-year standard. Still other actions (such as a study or a short-term supplementation program) may have life expectancies of 10 years after which no further action would be taken. In this case, operation and maintenance costs were amortized over 50 years to develop the total O&M per year estimate. Capital costs, being up-front, one-time expenditures, were added directly.

Subbasin planners have estimated all direct costs of alternative strategies except for the purchase of water rights. No cost estimates have been or will be made for actions that involve purchasing water. Indirect costs, such as changes in water flows or changes in hydroelectric system operations, are not addressed.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Lower Mainstem Stock: Spring chinook
Subbasin Objective: 20,000 natural escapement; 6,000 hatchery escapement: 94.000 harvest
Section Objective: 661 minimum natural escapement: 6.000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1	2#	3	4	5	6
Habitat Enhancement	Capital		3,234,408	3,234,408			
	O&M/yr		28,880	28,880			
	Life		50	50			
Screening	Capital		33.100	33.100			
	O&M/yr		2.500	2,500			
	Life		50	50			
Barrier Removal	Capital		30.000	30,000			
	O&M/yr						
	Life		indef	indef			
Misc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital			1.300.000			
	O&M/yr			150.000			
	Life			50			
Total Cost	Capital	0	3,297,508	4,597,508			
	O&M/yr	0	31,380	181,380			
Water Acquisition**		N	N	N			
Fish to stock	number			1,000,000			
	size***			S. 18/lb			
	years			50			

* Life expectancy in years.
\# Recommended strategy.
** Y = yes, the strategy includes water acquisition: N = no, water aquisition is not a part of the strategy.
*** E = eggs; F = fry; J = juvenile, fingerling, parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Little Salmon River Stock: Spring chinook
Subbasin Objective: 20,000 natural escapement: 6.000 hatchery escapement; 94,000 harvest
Section Objective: 805 minimum natural escapement; see hatchery escapement above; 10.000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1	2	3#	4	5	6
Habitat Enhancement	Capital			11575,926			
	O&M/yr			14,212			
	Life			50			
Screening	Capital	118.820		118,820			
	O&M/yr	8.750		8,750			
	Life	50		50			
Barrier Removal	Capital			10.000			
	O&M/yr						
	Life			indef			
Misc. projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital			1.300.000	1,300,000		
	O&M/yr			150,000	150.000		
	Life			50	50		
Total Cost	Capital	118.820	0	3,004,746	1,300,000		
	O&M/yr	8,750	0	172.962	150,000		
Water Acquisition**		Y	Y	Y	Y		
Fish to stock	number			1,000,000	1,000,000		
	size***			S,18/lb	S,18/lb		
	years			50	50		

* Life expectancy in years.
\# Recommended strategy.
** Y = yes, the strategy Includes water acquisition: N = no, water aquisition is not a part of the strategy.
*** E = eggs; F = fry; J = juvenile, fingerling, Parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Mid-Main Stock: Spring chinook
Subbasin Objective: 20,000 natural escapement: 6.000 hatchery escapement; 94.000 harvest
Section Objective: 1.398 minimum natural escapement; 12.000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1#	2	3	4	5	6
Habitat Enhancement	Capital						
	O&M/yr						
	Life						
Screening	Capital						
	O&M/yr						
	Life						
Barrier Removal	Capital						
	O&M/yr						
	Life						
Misc. projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital		1,300,000	1.300.000			
	O&M/yr		150.000	150,000			
	Life		50	50			
Total Cost	Capital	8	1,300,000	1,300,000			
	O&M/yr		150,000	150,000			
Water Acquisition**		N	N	N			
Fish to stock	number		1.000.000	1,000,000			
	size***		S,18/lb	S,18/lb			
	years		50	50			

* Life expectancy in years.
# Recommended strategy.
** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.
*** E = eggs; F = fry; J = juvenile. fingerling, parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Middle Fork - Bear Valley Creek   Stock: Spring chinook
Subbasin Objective: 20,000 natural escapement: 6,000 hatchery escapement; 94,000 harvest
Section Objective: 9,004 minimum natural escapement: 16,000 minimum hatchery

Action	Costs and life expectancy*	Proposed Strategies 1#	2	3	4	5	6
Habitat Enhancement	Capital						
	O&M/yr						
	Life						
Screening	Capital	115.850	115.850	115,850			
	O&M/y						
	Life	8.750 50	8,750 50	B. 750 50			
Barrier Removal	Capital						
	O&M/yr						
	Life						
Mi sc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Product1 on	Capital		650.000	1.300.000			
	O&M/yr		75,000	150.000			
	Life		50	50			
Total Cost	Capital	115.850	765.850	1,415,850			
	O&M/yr	8,750	83,750	158.750			
Water Acquisition**		N	N	N			
Fish to stock	number		500,000	1.000.000			
	size***		S,18/lb	S,18/lb			
	years		50	50			

* Life expectancy in years.
\# Recommended strategy.
** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.
*** E = eggs: F = fry: J = juvenile, fingerling, parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Lemhi River Stock: Spring chinook

Subbasin Objective: 20,000 natural escapement: 6.000 hatchery escapement: 94.000 harvest

Section Objective: 1.978 minimum natural escapement: 10.000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1	2	3#	4	5	6
Habitat Enhancement	Capital						
	O&M/yr						
	Life						
Screen1 ng	Capital		2,096,760	2.096.760			
	O&M/yr		150.000	150,000			
	Life		50	50			
Barrier Removal	Capital						
	O&M/yr						
	Life						
Misc. Projects	Capital						
	O&M/y						
	Life						
Hatchery Production	Capital			1,300,000			
	O&M/y			150.000			
	Life			50			
Total Cost	Capital	0	2.096.760	3,396,760			
	O&M/yr	0	150,000	300,000			
Water Acquisition**		N	Y	Y			
Fish to stock	number			1,000,000			
	size***			S,18/lb			
	years			50			

* Life expectancy in years.

\# Recommended strategy.

** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.

*** E = eggs; F = fry; J = juvenile, fingerling, parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Upper Salmon - Headwaters Stock: Spring chinook
Subbasin Objective: 20,000 natural escapement; 6,000 hatchery escapement: 94.000 harvest
Section Objective: 6.036 minimum natural escapement: see hatchery escapement above: 30,000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1	2	3#	4	5	6
Habitat Enhancement	Capital		150,374	150.374			
	O&M/yr		1,900	1,900			
	Life		50	50			
Screen1 ng	Capital	2,732,590	2,732,590	2,732,590			
	O&M/yr	190.000	190.000	190,000			
	Life	50	50	50			
Barrier Removal	Capital						
	O&M/yr						
	Life						
Misc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital			3,600,000			
	O&M/yr			400.000			
	Life			50			
Total Cost	Capital	2,732,590	2.882.964	6.482.964			
	O&M/yr	190,000	191,900	591,900			
Water Acquisition**		Y	Y	Y			
Fish to stock	number			2.800.000			
	size***			S,18/lb			
	years			50			

* Life expectancy in years.
\# Recommended strategy.
** Y = yes, the strategy includes water acquisition: N = no, water aquisition is not a part of the strategy.
*** E = eggs; F = fry; J = juvenile, fingerling. parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Little Salmon River Stock: Sumner chinook
Subbasin Objective: 11.000 natural escapement: 3,000 hatchery escapement: 112.000 harvest
Section Objective: 399 minimum natural escapement: 2,000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1#	2	3	4	5	6
Habitat Enhancement	Capital						
	O&M/yr						
	Life						
Screening	Capital						
	O&M/yr						
	Life						
Barrier Removal	Capital						
	O&M/yr						
	Life						
Misc. projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital						
	O&M/yr						
	Life						
Total Cost	Capital	0					
	O&M/yr	0					
Water Acquisition**		N					
Fish to stock	number						
	sire***						
	years						

* Life expectancy in years.
# Recommended strategy.
** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.
*** E = eggs; F = fry; J = juvenile, fingerling, parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: South Fork - Secesh River

Stock: Sumner chinook

Subbasin Objective: 11,000 natural escapement; 3.000 hatchery escapement: 112.000 harvest

Section Objective: 5,760 minimum natural escapement: see hatchery escapement above; 18,000 minimum harvest

Action	Costs and life expectancy*	Proposed Strateoies 1	2	3#	4	5	6
Habitat Enhancement	Capital	137.146	137,146	137.146			
	O&M/yr	1.330	1.330	1.330			
	Life	50	50	50			
Screening	Capital						
	O&M/yr						
	Life						
Barrier Removal	Capital						
	O&M/yr						
	Life						
Misc. Projects	Capital	8430,000	880.000	680,000			
	O&M/yr						
	Life	50	50	50			
Hatchery Production	Capital			1,300,000			
	O&M/yr			150,000			
	Life			50			
Total Cost	Capital	1.017.146	1,017,146	2.317.146			
	O&M/yr	1,330	1,330	151,330			
Water Acquisition**		N	N	N			
Fish to stock	number			1.000.000			
	size***			S,18/lb			
	years			50			

* Life expectancy in years.

\# Recommended strategy.

** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.

*** E = eggs: F = fry; J = juvenile, fingerling, parr, subsmolt: S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Middle Fork - Sear Valley Creek   Stock: Sumner chinook

Subbasin Objective: 11,000 natural escapement: 3,000 hatchery escapement: 112,000 harvest

Section Objective: 1.326 minimum natural escapement: 10.000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1#	2	3	4	5	6
Habitat Enhancement	Capital						
	O&M/yr						
	Life						
Screen1 ng	Capital						
	O&M/yr						
	Life						
Barrier Removal	Capital						
	O&M/yr						
	Life						
Misc. Projects	Capital						
	O&M/y						
	Life						
Hatchery Production	Capital						
	O&M/yr						
	Life						
Total Cost	Capital	0					
	O&M/yr	0					
Water Acquisition**		N					
Fish to stock	number						
	size***						
	years						

* Life expectancy in years.

\# Recommended strategy.

** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.

*** E = eggs; F = fry; 3 = juvenile, fingerling, parr, subsmolt; S = smolt; A = Adult.

lmon River subbasin alternative strategies.

Stock: Summer chinook

ral escapement; 3,000 hatchery escapement; 112,000 harvest

natural escapement; 4,000 minimum harvest

		Proposed	Strategies
		3#	4#
		101 . 500	6,000,000
		31,900	200.000
		50	50
	1,300,000	1.300.000	1,300,000
	150.000	150.000	150,000
	50	50	50
0	1.300.000	1.401.500	7.300.000
0	150.000	181,900	350,000
	1,000,000	1,000,000	1,000,000
	S,18/1b	S,18/1b	S,18/1b
	50	50	50

es water acquisition: N = no, water aquisition is not a part of the strategy.
ile, fingerling, parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasi n: Pahsimeroi River Stock: Sumner chinook

Subbasin Objective: 11,000 natural escapement: 3.000 hatchery escapement; 112.000 harvest

Section Objective: 709 minimum natural escapement; see hatchery escapement above; 7,000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1	2	3#	4	5	6
Habitat Enhancement	Capital						
	O&M/yr						
	Life						
Screening	Capital		501.310	501,310			
	O&M/yr		35,000	35.000			
	Life		50	50			
Barrier Removal	Capital						
	O&M/yr						
	Life						
Misc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital			1.300.000			
	O&M/y			150.000			
	Life			50			
Total Cost	Capital	0	501,310	1.801.310			
	O&M/yr	0	35,000	185.000			
Water Acquisition**		N	Y	Y			
Fish to stock	number			1,000,000			
	size***			S,18/lb			
	years			50			

* Life expectancy in years.

\# Recommended strategy.

** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.

*** E = eggs; F = fry; J = juvenile, fingerling, parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Upper Salmon - Headwaters Stock: Sumner chinook
Subbasin Objective: 11.000 natural escapement: 3.000 hatchery escapement: 112.000 harvest
Section Objective: 2.688 minimum natural escapement: 15.000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1	2	3	4	5#	6
Habitat Enhancement	Capital						
	O&M/yr						
	Life						
Screening	Capital	2,732,590	2,732,590	2,732,590	2,732,590	2,732,590	
	O&M/yr	190.000	190.000	190.000	190.000	190,000	
	Life	50	50	50	50	50	
Barrier Removal	Capital						
	O&M/yr						
	Life						
Misc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital			1,300,000		1,300,000	
	O&M/yr			150.000		150,000	
	Life			50		50	
Total Cost	Capital	2,732,590	2,732,590	4.032.590	2.732.590	4,032,590	
	O&M/yr	190.000	190.000	340,000	190.000	340,000	
Water Acquisition**		Y	Y	Y	Y	Y	
Fish to stock	number			1,000,000		1.000.000	
	size***			S,18/lb		S,18/lb	
	years			50		50	

* Life expectancy in years.
# Recommended strategy.
** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.
*** E = eggs; F = fry; J = juvenile, fingerling. parr, subsmolt; S = smolt; A = Adult.

Table Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Lower Mainstem Stock: Summer steelhead (A & B)
Subbasin Objective: 19,000 natural escapement; 4,000 hatchery escapement; 126,000 harvest
Section Objective: 664 minimum natural escapement: 10,000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1#	2	3	4	5	6
Habitat Enhancement	Capital		3,234,408	3,234,408			
	O&M/yr						
	Life		28,880 50	28,880 50			
Screening	Capital		33,100	33,100			
	O&M/yr		2,500	2,500			
	Life		50	50			
Barrier Removal	Capital		30,000	30,000			
	O&M/yr						
	Life		indef	indef			
Misc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital			5,980,000			
	O&M/yr			650,000			
	Life			50			
Total Cost	Capital	0	3,297,508	9,277,508			
	O&M/yr	0	31,380	681,380			
Water Acquisition**		N	N	N			
Fish to stock	number			1,300,000			
	size***			S,5/lb			
	years			50			

* Life expectancy in years.
\# Recommended strategy.
** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.
*** E = eggs; F = fry; J = juvenile, fingerling, parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Little Salmon River Stock: Sumner steelhead (A)

Subbasin Objective: 19,000 natural escapement; 4,000 hatchery escapement; 126.000 harvest

Section Objective: 832 minimum natural escapement: 22.000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1	2	3#	4	5	6
Habitat Enhancement	Capital			1,575,926			
	O&M/y						
	Life			14.212 50			
Screen1 ng	Capital	118,820		118.820			
	O&M/yr	8,750		8,750			
	Life	50		50			
Barrier Removal	Capital			10.000			
	O&M/yr						
	Life			i ndef			
Misc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital			3.700.000	3,700,000		
	O&M/y						
	Life			400.000 50	400,000 50		
Total Cost	Capital	118.820	0	5,404,746	3,700,000		
	O&M/yr	8,750	0	422,962	400.000		
Water Acquisition**		Y	Y	Y	Y		
Fish to stock	number			800.000	800,000		
	size***			S,5/lb	S,5/lb		
	years			50	50		

* Life expectancy in years.

\# Recommended strategy.

** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.

*** E = eggs; F = fry; J = juvenile, fingerling, parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Mid-Main　　　Stock: Sumner steelhead (A)

Subbasin Objective: 19.000 natural escapement; 4,000 hatchery escapement: 126.000 harvest

Section Objective: 1.306 minimum natural escapement: 2.000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1#	2	3	4	5	6
Habitat Enhancement	Capital						
	O&M/yr						
	Life						
Screen1 ng	Capital						
	O&M/yr						
	Life						
Barrier Removal	Capital						
	O&M/yr						
	Life						
Misc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital		4.600.000	4.600.000			
	O&M/yr		500.000	500,000			
	Life		50	50			
Total Cost	Capital	0	4.600.000	4.600.000			
	O&M/yr	0	500,000	500,000			
Water Acquisition**		N	N	N			
Fish to stock	number		1,000,000	1,000,000			
	size***		S,5/lb	S,5/lb			
	years		50	50			

* Life expectancy in years.

\# Recommended strategy.

** Y = yes, the strategy includes water acquisition: N = no, water aquisition is not a part of the strategy.

*** E = eggs; F = fry; J = juvenile, fingerling, parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: South Fork - Secesh River   Stock: Summer steelhead (B)
Subbasin Objective: lg.000 natural escapement: 4.000 hatchery escapement: 126.000 harvest
Section Objective: 3.114 minimum natural escapement: 4.000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1	2#	3	4	5	6
Habitat Enhancement	Capital	137.146	137.146	137.146			
	O&M/yr	1.330	1.330	1,330			
	Life	50	50	50			
Screening	Capital						
	O&M/y						
	Life						
Barrier Removal	Capital						
	O&M/yr						
	Life						
Mi sc. Projects	Capital	880.000	880.000	880.000			
	O&M/yr						
	Life	50	50	50			
Hatchery Production	Capital			2.300.000			
	O&M/yr			250.000			
	Life			50			
Total Cost	Capital	1.017.146	1.017.146	3,317,146			
	O&M/yr	1,330	1,330	251,330			
Water Acquisition**		N	N	N			
Fish to stock	number			500,000			
	size***			S,5/lb			
	years			50			

* Life expectancy in years.
\# Recommended stragegy.
** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.
*** E = eggs; F = fry; J = juvenile, fingerling, parr, subsmolt; S = smoit; A = Aduit.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Middle Fork - Bear Valley Creek

Stock: Sumner steelhead (B)

Subbasin Objective: 19.000 natural escapement: 4,000 hatchery escapement; 126.000 harvest

Section Objective: 7,475 minimum natural escapement: 2,000 minimum harvest

Action	Costs and life expectancy*	Proposed Strateqies 1#	2	3	4	5	6
Habitat Enhancement	Capital						
	O&M/yr						
	Life						
Screening	Capital	115.850					
	O&M/yr	8,750					
	Life	50					
Barrier Removal	Capital						
	O&M/yr						
	Life						
Misc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital						
	O&M/yr						
	Life						
Total Cost	Capital	115.850					
	O&M/yr	8.750					
Water Acquisition**		N					
Fish to stock	number						
	size***						
	years						

* Life expectancy in years.

\# Recommended strategy.

** Y = yes, the strategy includes water acquisition; N = no, water aquisition 'is not a part of the strategy.

*** E = eggs; F = fry;J=juvenile,fingerling,p a r r , subsmolt; S = smolt; A = Adult.

Table Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Panther Creek | Stock: Summer steelhead (A)
Subbasin Objective: 19,000 natural escapement; 4,000 hatchery escapement; 126,000 harvest
Section Objective: 58 minimum natural escapement; 8,000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1	2	3#	4#	5	6
Habitat Enhancement	Capital						
	O&M/yr						
	Life						
Screening	Capital						
	O&M/yr						
	Life						
Barrier Removal	Capital			20,000	20,000		
	O&M/yr						
	Life			indef	indef		
Misc. Projects	Capital			101,500	6,000,000		
	O&M/yr			31,900	200,000		
	Life			50	50		
Hatchery Production	Capital		3,225,000	3,225,000	3,225,000		
	O&M/yr		350,000	350,000	350,000		
	Life		50	50	50		
Total Cost	Capital	0	3,225,000	3,346,500	9,245,000		
	O&M/yr	0	350,000	381,900	550,000		
Water Acquisition**		N	N	N	N		
Fish to stock	number		700,000	700,000	700,000		
	size***		S,5/lb	S,5/lb	S,5/lb		
	years		50	50	50		

* Life expectancy in years.
\# Recommended strategy.
** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.
*** E = eggs; F = fry; J = juvenile, fingerling, parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Lemhi River

Stock: Sumner steelhead (A)

Subbasin Objective: 19.000 natural escapement: 4.000 hatchery escapement: 126,000 harvest

Section Objective: 686 minimum natural escapement: 12,000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1	2	3#	4	5	6
Habitat Enhancement	Capital						
	O&M/yr						
	Life						
Screening	Capital		2,096,760	2,096,760			
	O&M/yr		150.000	150,000			
	Life		50	50			
Barrier Removal	Capital						
	O&M/yr						
	Life						
Misc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital			4.600.000			
	O&M/yr			500,000			
	Life			50			
Total Cost	Capital	0	2,096,760	6,696,760			
	O&M/yr	0	150.000	650,000			
Water Acquisition**		N	Y	Y			
Fish to stock	number			1.000.000			
	size***			S,5/lb			
	years			50			

* Life expectancy in years.

\# Recommended strategy.

** Y = yes, the strategy includes water acquisition; N = no. water aquisition is not a part of the strategy.

*** E = eggs; F = fry; J = juvenile, fingerling. parr, subsmolt: S = smolt; A = Adult.

Table Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Pahsimeroi River Stock: Summer steelhead (A)
Subbasin Objective: 19,000 natural escapement; 4,000 hatchery escapement; 126,000 harvest
Section Objective: 209 min. natural escapement; see hatchery component of subbasin objective; 33,000 min. harvest

Action	Costs and life expectancy*	Proposed Strategies 1	2	3#	4	5	6
Habitat Enhancement	Capital						
	O&M/yr						
	Life						
Screening	Capital		501,310	501,310			
	O&M/yr		35,000	35,000			
	Life		50	50			
Barrier Removal	Capital						
	O&M/yr						
	Life						
Misc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital			3,225,000			
	O&M/yr			350,000			
	Life			50			
Total Cost	Capital	0	501,310	3,726,310			
	O&M/yr	0	35,000	385,000			
Water Acquisition**		N	Y	Y			
Fish to stock	number			700,000			
	size***			S,5/lb			
	years			50			

* Life expectancy in years.
\# Recommended strategy.
** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.
*** E = eggs; F = fry; J = juvenile, fingerling, parr, subsmolt; S = smolt; A = Adult.

Table . Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Upper Salmon - Headwaters

Stock: Sumner steelhead (A & B)

Subbasin Objective: 19.000 natural escapement: 4.000 hatchery escapement: 126.000 harvest

Section Objective: 4.656 minimum natural escapement: see hatchery escapement above: 33.000 minimum harvest

Action	Costs and life expectancy*	Proposed Strategies 1	2#	3	4	5	6
Habitat Enhancement	Capital		150,374	150.374			
	O&M/yr		1.900	1.900			
	Life		50	50			
Screening	Capital	2.732.590	2,732,590	2,732,590			
	O&M/yr	190,000	190.000	190.000			
	Life	50	50	50			
Barrier Remova1	Capital						
	O&M/yr						
	Life						
Misc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital			11.500.000			
	O&M/yr			1.250.000			
	Life			50			
Total Cost	Capital	2,732,590	2,882,964	14,382,964			
	O&M/yr	190,000	191,900	1.441.000			
Water Acquisition**		Y	Y	Y			
Fish to stock	number			2,500,000			
	sire***			S,5/lb			
	years			50			

* Life expectancy in years.

Recommended strategy.

** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.

*** E = eggs; F = fry; J = juvenile, finger1 ing, parr, subsmolt; S = smolt; A = Adult.

Table Estimated costs for Salmon River subbasin alternative strategies.

Subbasin: Salmon River | Stock: Sockeye

Subbasin Objective: 6,000 natural escapement; 2,000 harvest

Section Objective: same as subbasin objective

Action	Costs and life expectancy*	Proposed Strategies 1	2	3	4	5#	6
Habitat Enhancement	Capital	5,000		5,000	5,000	5,000	
	O&M/yr	4,000		4,000	4,000	4,000	
	Life	10		10	10	10	
Screening	Capital						
	O&M/yr						
	Life						
Barrier Removal	Capital	15,000		15,000	15,000	15,000	
	O&M/yr	--		--	--	--	
	Life	indef		indef	indef	indef	
Misc. Projects	Capital						
	O&M/yr						
	Life						
Hatchery Production	Capital			1,300,000	14,700,000	1,300,000-14,700,000	
	O&M/yr			150,000	1,600,000	150,000-1,600,000	
	Life			10	10	10	
Total Cost	Capital	20,000	@	1,320,000	14,720,000	1,320,000-14,720,000	
	O&M/yr	800		30,800	320,800	30,800-320,800	
Water Acquisition**		Y	N	Y	Y	Y	
Fish to stock	number			1,000,000	11,500,000	1,000,000-11,500,000	
	size***			S,18/lb	S,18/lb	S,18/lb	
	years			10	10	10	

* Life expectancy in years.
\# Recommended strategy.
** Y = yes, the strategy includes water acquisition; N = no, water aquisition is not a part of the strategy.
*** E = eggs; F = fry; J = juvenile, fingerling, parr, subsmolt; S = smolt; A = Adult.
@ Costs would be incurred but are unknown.

APPENDIX D
HATCHERY PRODUCTION AND SUPPLEMENTATION

Table 1. Release of hatchery fish into the headwaters area of the Salmon River, (IOFG Data Base, R. Roseberg, USFWS-FAO, pers. commun., IDFG 1977-87).

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
STHD	HW	smolt	1977	HST	A	48100	Salmon River	P	
	HW	F-F	1977	HC	B	80000	East Fork	DNFH	
	HW	F-F	1978	M	B	93873	Alturas Lake Cr.	DNFH	fall release
	HW	F-F	1978	M	B	192560	East Fork	DNFH	fall release
	HW	F-F	1978	M	B	24070	Pole Creek	DNFH	fall release
	HW	F-F	1978	HS	A	193450	East Fork	P	
	HW	F-F	1978	HST	A	112500	Salmon River	P	
	HW	adult	1978	P	A	625	Sawtooth	P	
	HW	F-F	1978	M	B	178118	Sawtooth	DNFH	
	HW	F-F	1979	HS	?	98920	Alturas Lake Cr.	?	
	HW	F-F	1980	HNFH	A	191400	East Fork	P	
	HW	F-F	1981	P	A	80598	Alturas Lake Cr.	P	
	HW	smolt	1981	HNFH	A	317433	Sawtooth	P	
	HW	F-F'	1981	P	A	99008	East Fork	P	
	HW	smolt	1981	HNFH	A	177123	East Fork	P	
	HW	F-F	1982	P	B	82560	East Fork	P	
	HW	F-F	1982	P	B	104576	Pole Creek	P	
	HW	smolt	1982	HNFH	A	359772	Sawtooth	P	
	HW	smolt	1982	HNFH	B	58384	East Fork	P	
	Hw	smolt	1983	Mv	B	49140	East Fork	P	
	HW	F-F	1983	P	B	218000	East Fork	P	
	HW	smolt	1983	HNFH	A	81121	Sawtooth	P	
	HW	smolt	1983	HNFH	B	26173	Sawtooth	P	
	HW	smolt	1983	HNFH	B	201587	East Fork	P	
	HW	smolt	1983	HNFH	A	31348	East Fork	P	
	HW	smolt	1983	NS	B	46250	East Fork	P	
	Hw	F-F	1983	P	B	240000	Herd Creek	P	
	HW	smolt	1984	Mv	A	181720	Sawtooth	P	
	HW	smolt	1984	HST	A	19600	Sawtooth	P	
	HW	adult	1984	P	A	2324	Sawtooth	P	
	HW	F-F	1984	P	A	317500	Pole Creek	P	
	HW	smolt	1984	HNFH	A	477164	Sawtooth	P	
	HW	smolt	1984	HNFH	B	393452	East Fork	P	

Table 1 continued

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
STHD	HW	smolt	1985	HNFH	A	786096	Sawtooth	P	
	HW	smolt	1985	HNFH	B	270208	East Fork	P	
	HW	F-F	1985	S	A	488437	Pole Creek	S	
	HW	F-F	1985	S	A	503170	Salmon River	S	
	HW	F-F	1985	S	A	181420	Alturas Lake Cr.	S	
	HW	F-F	1985	S	A	103474	Frenchman Creek	S	
	Hw	F-F	1985	S	B	18822	East Fork	EF,P	
	HW	F-F	1986	S	A	532781	Salmon River	S	
	HW	F-F	1986	S	A	349017	Pole Creek	S	
	HW	F-F	1986	S	A	299633	Alturas Lake Cr.	S	
	HW	F-F	1986	S	B	229075	East Fork	P	
	HW	adult	1986	S	A	1056	Sawtooth	S	
	HW	adult	1986	S	B	243	East Fork	EF,P	
	HW	smolt	1986	HNFH	A	1652921	Sawtooth	S	
	HW	smolt	1986	HNFH	B	525316	East Fork	EF,P	
	HW	F-F	1986	P	B	449100	East Fork	P	
	HW	adult	1986	P	B	200	East Fork	P	
	HW	adult	1987	P	B	54	East Fork	P	
	HW	smolt	1987	HNFH	A	687634	Sawtooth	S	
	HW	smolt	1987	HNFH	B	485078	East Fork	EF	
	HW	F-F	1987	S	A	174580	Alturas Lake Cr.	S	
	Hw	F-F	1987	S	A	188500	Pole Creek	S	

Table 1 continued

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
SPCH	HW	F-F	1977	M	RR	250200	Salmon River	RR	fall release
	HW	F-F	1977	RR	RR	100170	East Fork	RR	
	HW	smolt	1978	M	RR	985400	Salmon River	RR	
	HW	F-F	1978	M	RR	607750	Salmon River	RR	fall release
	HW	smolt	1978	P	RR	23200	Sawtooth	RR	
	HW	smolt	1979	M	RR	1011297	Salmon River	RR	
	HW	smolt	1983	MC	S	167895	Salmon River	S	
	HW	smolt	1984	MC	S	230550	Salmon River	S	
	HW	smolt	1985	MC	S	420060	Sawtooth	S	
	HW	adult	1985	S	S	19	Upper Salmon River	S	
	HW	smolt	1986	S	S	347481	Sawtooth	S	
	HW	smolt	1986	S	S	108690	East Fork	EFT	
	HW	smolt	1987	S	S	1185080	Sawtooth	S	
	HW	smolt	1987	S	S	195100	East Fork	EFT	
	HW	smolt	1987	S	S	12	Frenchman Creek	S	

DNFH = Dworshak National Fish Hatchery
EF = East Fork
EFT = East Fork Trap
F-F = Fry-Finger1 ing
HNFH = Hagerman National Fish Hatchery
HS = Hayspur Hatchery
HST = Hagerman State Hatchery
HW = Salmon River headwaters area
M = Mackay Hatchery
MC = McCall Hatchery
MV = Magic Valley Hatchery
P = Pahsimeroi Hatchery
RR = Rapid River Hatchery
S = Sawtooth Hatchery

Table 2. Release of hatchery fish into the upper Salmon River area, (IDFG Data Base, R. Roseberg, USFWS-FAO, pet-s. commun., IDFG 1977-87).

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
STHD	US	smolt	1977	HST	A	39165	Valley Creek	P	
	us	adult	1978	P	A	374	Valley Creek	P	
	us	F-F	1978	HC	B	106000	Indian Creek	DNFH	
	us	F-F	1978	Hc	B	50000	Owl Creek	DNFH	
	us	F-F	1978	HC	B	55000	North Fork	DNFH	
	us	F-F	1978	Hc	B	75000	Hughes Creek	DNFH	
	us	F-F	1978	HC	B	20000	Sheep Creek	DNFH	
	us	F-F	1978	HC	B	61000	Pine Creek	DNFH	
	us	F-F	1978	M	B	255142	Yankee Fork	DNFH	
	us	F-F	1978	M	B	52954	Bain Creek	DNFH	
	us	F-F	1978	M	B	48140	Thompson Creek	DNFH	
	us	F-F	1978	M	B	48140	Squaw Creek	DNFH	
	us	F-F	1978	M	B	154711	Yankee Fk., W. Fk.	DNFH	
	us	F-F	1978	M	B	50547	Slate Creek	DNFH	
	us	F-F	1978	M	B	48140	Herd Creek	DNFH	
	US	F-F	1978	M	B	38512	Morgan Creek	DNFH	
	us	F-F	1978	M	B	50547	Warm Springs Cr.	DNFH	
	us	F-F	1978	M	B	38512	Iron Creek	DNFH	
	us	F-F	1979	HC	A	208800	Yankee Fork	P	
	us	F-F	1979	Hc	A	100080	Yankee Fk., W. Fk.	P	
	us	F-F	1979	HC	B	71720	Indian Creek	DNFH	
	us	F-F	1979	HC	B	90759	Iron Creek	DNFH	
	us	F-F	1979	HC	B	120620	North Fork	DNFH	
	us	F-F	1979	HC	B	48900	Sheep Creek	DNFH	
	us	F-F	1979	HC	B	32600	Hughes Creek	DNFH	
	us	F-F	1979	HC	B	17604	Owl Creek	DNFH	
	us	F-F	1979	HC	B	39120	Pine Creek	DNFH	
	us	adult	1979	P	A	199	North Fork	P	
	us	F-F	1979	HS	B	114070	Basin Creek	DNFH	
	us	F-F	1979	HS	a	80000	Slate Creek	DNFH	
	us	F-F	1979	HS	B	100000	Squaw Creek	DNFH	
	us	F-F	1979	HS	B	60000	Thompson Creek	DNFH	
	us	F-F	1979	HS	B	120780	Valley Creek	DNFH	
	us	adult	1979	P	A	205	Valley Creek	P	
	us	F-F	1981	P	A	110200	Indian Creek	P	
	us	F-F	1981	P	A	194250	North Fork	P	
	us	F-F	1981	P	A	79800	Hughes Creek	P	
	us	F-F	1981	P	A	96600	Sheep Creek	P	
	us	F-F	1981	P	A	96600	Pine Creek	P	
	us	F-F	1981	P	A	46464	Iron Creek	P	
	us	F-F	1981	P	A	254600	Yankee Fork	P	
	us	F-F	1981	P	A	297024	Yankee Fk., W. Fk.	P	
	US	F-F	1981	P	A	80598	Valley Creek	P	

Table 2 continued.

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
STHD	us	F-F	1981	P	A	46464	Morgan Creek	P	
	us	F-F	1981	P	A	45600	Slate Creek	P	
	us	F-F	1981	P	A	45600	Thompson Creek	P	
	us	F-F	1981	P	A	129200	Squaw Creek	P	
	us	F-F	1981	P	A	148200	Basin Creek	P	
	us	F-F	1982	P	A	156696	North Fork	P	
	us	F-F	1982	P	A	69120	Hughes Creek	P	
	us	F-F	1982	P	A	24000	Moose Creek	P	
	us	F-F	1982	P	A	106624	Sheep Creek	P	
	us	F-F	1982	P	A	72576	Spring Creek	P	
	us	F-F	1982	P	A	62208	Pine Creek	P	
	us	F-F	1982	P	A	31968	Owl Creek	P	
	us	F-F	1982	P	A	118048	Indian Creek	P	
	us	F-F	1982	P	B	211904	Herd Creek	P	
	us	F-F	1982	P	B	82560	Iron Creek	P	
	us	adult	1983	P	A	200	North Fork	P	
	us	adult	1983	P	A	400	Sheep Creek	P	
	us	F-F	1983	P	B	24000	Sheep Creek	P?	
	us	F-F	1983	P	B	26000	Hughes Creek	P?	
	us	F-F	1983	P	B	240000	Herd Creek	P?	
	us	F-F	1983	P	B	50000	Indian Creek	P?	
	us	F-F	1983	P	B	30000	Pine Creek	P?	
	us	F-F	1983	P	B	20000	Owl Creek	P?	
	us	adult	1983	P	A	513	Yankee Fork	P	
	us	F-F	1983	P	A	57720	Yankee Fk., W. Fk.	P	
	us	F-F	1983	P	B	100000	Yankee Fk., W. Fk.	P?	
	us	F-F	1983	P	A	156250	Iron Creek	P	
	us	F-F	1983	P	A	20703	Basin Creek	P	
	us	F-F	1983	P	A	25000	Slate Creek	P	
	us	F-F	1983	P	A	112500	Morgan Creek	P	
	US	F-F	1983	P	A	85000	Squaw Creek	P	
	us	adult	1983	P	A	150	Valley Creek	P	
	us	F-F	1984	P	A	140450	Yankee Fork	P	
	us	adult	1984	P	A	1700	Yankee Fork	P	
	US	F-F	1984	P	A	30000	Yankee Fk., W. Fk.	P	
	us	F-F	1984	P	A	108750	North Fork	P	
	us	F-F	1984	P	A	36250	Sheep Creek	P	
	us	F-F	1984	P	A	36250	Hughes Creek	P	
	us	F-F	1984	P	A	215000	Valley Cr	P	

Table 2 continued.

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
STHD	us	F-F	1987	S	A	214206	Yankee Fk., W. Fk.	S	
	us	F-F	1987	P	A	45000	Indian Creek	P	
	US	adult	1987	P	A	120	Indian Creek	P	
	us	F-F	1987	P	A	75000	North Fork	P	
	us	adult	1987	P	A	120	North Fork	P	
	us	F-F	1987	P	A	20000	Hughes Creek	P	
	us	F-F	1987	P	A	75000	Sheep Creek	P	
	us	adult	1987	P	A	120	Sheep Creek	P	
	us	F-F	1987	P	A	33041	Squaw Creek	P	
	us	adult	1987	P	A	120	Squaw Creek	P	
	us	F-F	1987	P	A	33744	Thompson Creek	P	
	us	adult	1987	P	A	120	Thompson Creek	P	
	us	adult	1987	P	A	360	Yankee Fork	P	
	us	F-F	1987	P	A	95462	Yankee Fk., W. Fk.	P	
	us	F-F	1987	P	A	141746	Valley Creek	P	
	us	F-F	1987	P	A	102500	Morgan Creek	P	
SPCH	US	F-F	1977	M	RR	45360	North Fork	RR	
	us	F-F	1977	M	RR	56700	Yankee Fk., W. Fk.	RR	
	us	F-F	1978	M	RR	75036	Yankee Fork	RR	
	us	F-F	1978	M	RR	102934	Valley Fork	RR	
	us	F-F	1978	Hc	RR	50400	Indian Fork	RR	
	us	adult	1985	S	S	61	Yankee Fork	S	
	us	adult	1985	P	RR	659	Yankee Fork	P	
	us	adult	1986	S	S	61	Yankee Fork	S	
	us	adult	1986	P	RR	1505	Yankee Fork	P	
	us	F-F	1986	P	RR	386348	Yankee Fork	P	
	us	F-F	1987	S	RR	157877	Yankee Fork	P	
	us	adult	1987	P	RR	600	Yankee Fork	P	

DNFH = Dworshak National Fish Hatchery
F-F = Fry-Fingerling
HC = Hayden Creek Hatchery
HNFH = Hager-man National Fish Hatchery
HS = Hayspur Hatchery
HST = Hagerman State Hatchery
M = Mackay Hatchery
P = Pahsimeroi Hatchery
RR = Rapid River Hatchery
S = Sawtooth Hatchery
US = Upper Salmon River area

Table 3. Release of hatchery fish in the Salmon River subbasin, lower Salmon through Pahsimeroi River, (R. Roseberg, USFWS-FAO pers. commun., IDFG 1977-87).

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
STHD	PAH	smolt	1977	NS	A	1418974	Pahsimeroi River	P	
	PAH	sniolt	1978	NS	A	1309525	Pahsimroi River	P	
	PAH	F-F	1978	P	A	185000	Pahsimeroi River	P	
	PAH	smolt	1978	P	A	39	Pahsimeroi River	P	
	PAH	snwlt	1978	DNFH	B	34246	Pahsitmeroi River	DNFH	
	PAH	smolt	1979	NS	A	1371954	Pahsimeroi River	P	
	PAH	F-F	1979	P	A	10800	Pahsimeroi River	P	
	PAH	adult	1979	P	A	384	Pahsimeroi River	P	
	PAH	smolt	1979	HNFH	B	154276	Pahsitmeroi River	DNFH	
	PAH	smolt	1980	NS	A	1110810	Pahsimeroi River	P	
	PAH	smolt	1980	HNFH	B	199303	Pahsimeroi River	DNFH	
	PAH	smolt	1981	NS	A	860944	Pahsimeroi River	P	
	PAH	F-F	1981	P	A	21120	Pahsimeroi River	P	
	PAH	smolt	1981	HNFH	A	62038	Pahsimeroi River	P	
	PAH	F-F	1981	P	B	6880	Pahsimeroi River	P	
	PAH	sniolt	1981	HNFH	B	35886	Pahsimeroi River	DNFH	
	PAH	smolt	1982	HNFH	A	60784	Pahsimeroi River	P	
	PAH	smolt	1982	HNFH	B	67025	Pahsimeroi River	P	
	PAH	F-F	1982	P	A	399872	Pahsimeroi River	P	
	PAH	smolt	1982	NS	A	995205	Pahsimeroi River	P	
	PAH	adult	1982	P	A	425	Pahsimeroi River	P	
	PAH	smolt	1983	NS	A	496140	Pahsimeroi River	P	
	PAH	F-F	1983	NS	A	228800	Pahsimeroi River	P	fall release
	PAH	F-F	1983	P	A	167500	Pahsimeroi River	P	
	PAH	adult	1983	P	A	200	Pahsimeroi River	P	
	PAH	adult	1983	P	A	125	Spring Creak	P	
	PAH	smolt	1983	HNFH	A	84194	Pahsimeroi River	P	
	PAH	smolt	1983	Mv	A	40681	Pahsimeroi River	P	
	PAH	adult	1984	P	A	780	Pahsimeroi River	P	
	PAH	adult	1984	P	A	825	Spring Creek	P	
	PAH	smolt	1984	NS	A	752195	Pahsimeroi River	P	
	PAH	F-F	1985	P	A	253950	Pahsimeroi River	P	
	PAH	adult	1985	P	A	543	Pahsimaroi River	P	
	PAH	adult	1985	P	A	300	Spring Creek	P	
	PAH	smolt	1985	NS	A	878530	Pahsimeroi River	P	
	PAH	smolt	1985	NS	A	156742	E. Fork Pahsimeroi	P	

Table 3 continued.

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
STHD	PAH	smolt	1986	NS	A	614038	Pahsimeroi River	P	
	PAH	F-F	1986	P	A	115900	Pahsimeroi River	P	
	PAH	adult	1986	P	A	BOO	Pahsimeroi River	P	
	PAH	smolt	1987	NS	A	712200	Pahsimeroi River	P	
	PAH	adult	1987	P	A	1573	Pahsimeroi River	P	
	PAH	F-F	1987	P	A	268950	Pahsimeroi River	P	
SPCH	PAH	F-F	1979	P	co	72090	Warm Creek	co	
	PAH	smolt	1983	P	RR	437300	Pahsimeroi River	RR	
	PAH	smolt	1984	P	RR	1143029	Pahsimeroi River	RR,HC	
	PAH	smolt	1985	P	RR	170769	Pahsimeroi River	HC	
	PAH	smolt	1986	P	RR	80948	Pahsimeroi River	P,HC	
SUCH	PAH	smolt	1978	M	P	289900	Pahsimeroi River	P	
	PAH	smolt	1978	P	P	218202	Pahsimeroi River	P	
	PAH	adult	1978	P	P	205	Pahsimeroi River	P	
	PAH	smolt	1984	P	P	55803	Pahsimeroi River	P	
	PAH	smolt	1986	P	P	12095	Pahsimeroi River	P	
	PAH	smolt	1987	P	Mix	258600	Pahsimeroi River	P,SFSR	
STHD	LEMHI	smolt	1977	HC	Washougal	222404	Hayden Creek	Washougal	
	LEMHI	adult	1978	P	A	60	Lemhi River	P	
	LEMHI	F-F	1978	Hc	Mix	32956	Hayden Creek	WASH/DNFH	
	LEMHI	smolt	1978	HC	Mix	236845	Hayden Creek	WASH/DNFH	
	LEMHI	F-F	1978	Hc	A	499730	Hayden Creek	P	
	LEMHI	smolt	1978	DNFH	B	119300	Hayden Creek	DNFH	
	LEMHI	adult	1979	P	A	130	Lemhi River	P	
	LEMHI	smolt	1979	Hc	Skamania	59292	Hayden Creek	WASH	
	LEMHI	F-F	1979	HC	A/B	50400	Hayden Creek	Mix	
	LEMHI	F-F	1979	HC	A/B	112050	Bear Valley Creek	Mix	
	LEMHI	smolt	1979	HNFH	B	294684	Lemhi River	DNFH	
	LEMHI	F-F	1979	HC	A/B	149960	Lemhi River	Mix	

Table 3 continued.

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
STHD	LEMHI	smolt	1980	HNFH	B	17780	Lemhi River	ONFH	
	LEMHI	F-F	1981	P	A	109200	Lemhi River	P	
	LEMHI	F-F	1981	P	B	63392	Big Springs Creek	P	
	LEMHI	F-F	1981	HC	A/B	57000	Bear Valley Creek	Mix	
	LEMHI	F-F	1981	HC	A/B	366477	Lemhi River	Mix	
	LEMHI	F-F	1981	P	B	57392	Big Springs Creek	P	
	LEMHI	F-F	1981	HC	A/B	218481	Big Springs Creek	Mix	
	LEMHI	F-F	1981	UI	B	700	Big Springs Creek	DNFH	
	LEMHI	adult	1982	P	A	173	Lemhi River	P	
	LEMHI	F-F	1982	HC	A	164853	Lemhi River	HC,P	
	LEMHI	F-F	1982	Hc	A	91545	Bear Valley Creek	HC,P	
	LEMHI	F-F	1982	HC	A	285007	Big Springs Creek	HC,P	
	LEMHI	F-F	1983	P	A	305000	Big Springs Creek	P	
	LEMHI	adult	1983	P	A	557	Lemhi River	P	
	LEMHI	adult	1983	P	A	162	Big Springs Creek	P	
	LEMHI	F-F	1984	P	A	270000	Lemhi River	P	
	LEMHI	adult	1984	P	A	2553	Lemhi River	P	
	LEMHI	adult	1984	P	A	501	Big Springs Creek	P	
	LEMHI	F-F	1985	P	A	822680	Lemhi River	P	
	LEMHI	adult	1985	P	A	721	Lemhi River	P	
	LEMHI	F-F	1986	P	A	612500	Lemhi River	P	
	LEMHI	adult	1986	P	A	682	Lemhi River	P	
	LEMHI	F-F	1986	P	A	105000	Hayden Creek	P	
	LEMHI	F-F	1987	P	A	87500	Lemhi River	P	
	LEMHI	F-F	1987	P	A	185000	Hayden Creek	P	
	LEMHI	adult	1987	P	A	959	Hayden Creek	P	
	LEMHI	adult	1987	P	A	50	Bear Valley Creek	P	
SPCH	LEMHI	F-F	1977	HC	RR	32960	Hayden Creek	RR	
	LEMHI	yearling	1977	Hc	RR	260581	Hayden Creek	RR,HC	
	LEMHI	smolt	1978	Hc	RR	16500	Hayden Creek	RR	
	LEMHI	smolt	1979	HC	RR	176528	Hayden Creek	RR	
	LEMHI	smolt	1981	HC	RR,HC	606000	Hayden Creek	RR,HC	
	LEMHI	smolt	1982	HC	RR,HC	16922	Hayden Creek	RR,HC	
	LEMHI	smolt	1986	HC	RR	528	Hayden Creek	P	
	LEMHI	adult	1986	Hc	RR	24	Hayden Creek	P	

Table 3 continued.

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
STHD	PAN	F-F	1978	HC	B	25000	Clear Creek	DNFH	
	PAN	F-F	1982	P	A	118048	Panther Creek	P	
	PAN	adult	1983	P	A	379	Panther Creek	P	
	PAN	F-F	1984	P	A	265000	Panther Creek	P	
	PAN	adult	1984	P	A	677	Panther Creek	P	
	PAN	F-F	1984	P	A	40000	Musgrove Creek	P	
	PAN	F-F	1985	NS	A	120	Panther Creek	P	
	PAN	smolt	1985	NS	A	237909	Panther Creek	P	
	PAN	F-F	1985	P	A	310000	Panther Creek	P	
	PAN	adult	1985	P	A	150	Panther Creek	P	
	PAN	F-F	1985	P	A	175000	Moyer Creek	P	
	PAN	smolt	1986	NS	A	246320	Panther Creek	P	
	PAN	F-F	1986	P	A	177500	Panther Creek	P	
	PAN	adult	1986	P	A	121	Panther Creek	P	
	PAN	F-F	1986	P	A	265000	Musgrove Creek	P	
	PAN	F-F	1986	P	A	182500	Moyer Creek	P	
	PAN	smolt	1987	NS	A	299700	Panther Creek	P	
	PAN	F-F	1987	P	A	172500	Panther Creek	P	
	PAN	F-F	1987	P	A	102500	Moyer Creek	P	
	PAN	F-F	1987	P	A	102500	Musgrove Creek	P	
SPCH	PAN	F-F	1977	M	RR	46305	Panther Creek	RR	
	PAN	adult	1986	P	RR	3383	Panther Creek	RR	
STHD	SFSR	F-F	1977	DNFH	B	300000	Johnson Creek	DNFH	
	SFSR	F-F	1977	DNFH	B	300000	South Fork	ONFH	
	SFSR	F-F	1978	HS	B	96735	Johnson Creek	DNFH	
	SFSR	F-F	1978	HS	B	193450	South Fork	DNFH	
	SFSR	smolt	1980	HNFH	B	246472	South Fork	DNFH	
	SFSR	smolt	1981	HNFH	B	6500	South Fork	ONFH	

Table 3 continued.

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
SUCH	SFSR	smolt	1977	MC	Mix	247445	South Fork	LTGO	
	SFSR	smolt	1978	MC	Mix	79300	South Fork	LTGO	
	SFSR	sllwlt	1979	M	Mix	23670	South Fork	LTGO	
	SFSR	smolt	1980	MC	Mix	124800	South Fork	LTGO	
	SFSR	smolt	1981	MC	Mix	248296	South Fork	LG	
	SFSR	smolt	1982	MC	Mix	122247	South Fork	LG,SFTR	
	SFSR	F-F	1982	MC	Mix	1000	South Fork	LG,SFTR	
	SFSR	smolt	1983	MC	SFSR	183896	South Fork	SFTR	
	SFSR	smolt	1984	MC	SFSR	269880	South Fork	SFTR	
	SFSR	F-F	1984	MC	SFSR	30990	South Fork	SFTR	
	SFSR	smolt	1985	MC	SFSR	564405	South Fork	SFTR	
	SFSR	F-F	1985	MC	SFSR	50149	South Fork	SFTR	
	SFSR	F-F	1985	MC	SFSR	50744	Johnson Creek	SFTR	
	SFSR	smolt	1986	MC	SFSR	970348	South Fork	SFTR	
	SFSR	F-F	1986	MC	SFSR	177606	Johnson Creek	SFTR	
	SFSR	smolt	1987	MC	SFSR	958300	South Fork	SFTR	
	SFSR	E. EGGS	1987	MC	SFSR	3000	South Fork	SFTR	
	SFSR	F-F	1987	MC	SFSR	6178	Rock Creek	SFTR	
	SFSR	F-F	1987	MC	SFSR	22246	Sand Creek	SFTR	
STHD	LS	smolt	1983	DNFH	B	171	Slate Creek	DNFH	
	LS	smolt	1983	MV	B	11340	Allison Creek	P	
	LS	smolt	1983	Mv	B	32700	Slate Creek	P	
	LS	F-F	1983	ox	A	395720	Boulder Creek	HCT	
	LS	F-F	1983	ox	A	230463	Hazard Creek	HCT	
	LS	F-F	1984	ox	A	149366	Boulder Creek	HCT	
	LS	F-F	1984	ox	A	216263	Hazard Creek	HCT	
	LS	smolt	1984	HNFH	B	95624	Hazard Creek	P	
	LS	smolt	1984	HNFH	A	96425	Hazard Creek	P	
	LS	F-F	1984	P	A	25000	Slate Creek	P	

Table 3 continued.

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
STHD	LS	F-F	1985	OX	A	140736	Hazard Creek	HCT	
	LS	smolt	1985	HNFH	A	308103	Hazard Creek	P	
	LS	F-F	1985	HNFH	A	91688	Little Salmon R.	P	
	LS	smolt	1986	HNFH	A	125587	Hazard Creek	S	
	LS	smolt	1986	HNFH	A	302303	Hazard Creek	S	
	LS	F-F	1986	ox	A	94700	Hazard Creek	HCT	
	LS	F-F	1986	HNFH	A	27431	Boulder Creek	S	
	LS	smolt	1987	HNFH	B	49740	Slate Creek	EFT	
	LS	smolt	1987	HNFH	A	299098	Hazard Creek	S	
	LS	smolt	1987	HNFH	A	13801	Salmon River	S	Deer Creek bridge
SPCH	LS	smolt	1977	RR	RR	3170922	Rapid River	RR	
	LS	adult	1977	RR	RR	861	Little Salmon R.	RR	
	LS	smolt	1978	RR	RR	2413678	Rapid River	RR	
	LS	smolt	1979	RR	RR	2866993	Rapid River	RR	
	LS	smolt	1980	RR	RR	2811593	Rapid River	RR	
	LS	smolt	7987	RR	RR	2372607	Rapid River	RR	
	LS	smolt	1982	RR	RR	1473733	Rapid River	RR	
	LS	smolt	1983	RR	RR	2998103	Rapid River	RR	
	LS	smolt	1984	RR	RR	3246197	Rapid River	RR	
	LS	smolt	1985	RR	RR	2491238	Rapid River	RR	
	LS	smolt	1986	RR	RR	1594688	Rapid River	RR	
	LS	F-F	1986	RR	RR	100590	Boulder Creek	RR	

Table 3 continued,

RACE	SUBAREA	SIZE	RELEASE YEAR	HATCHERY	STOCK	NUMBER	LOCATION	ADULT SITE	COMMENTS
SPCH	LS	smolt	1987	RR	RR	2836400	Rapid River	RR	

CO = Cowlitz
DNFH = Dworshak National Fish Hatchery
EFT = East Fork Trap
E. EGGS = Eyed Eggs
F-F = Fry-Fingerling
HC = Hayden Creek Hatchery
HCT = Hells Canyon Trap
HNFH = Hagerman National Fish Hatchery
HS = Hayspur Hatchery
LG = Lower Granite Dam
LTGO = Little Goose Dam
LS = Lower Salmon River area
M = Mackay Hatchery
MC = McCall Hatchery
MV = Magic Valley Hatchery
NS = Niagara Springs Hatchery
OX = Oxbow Hatchery
P = Pahsimeroi Hatchery
PAH = Pahsimeroi River drainage
PAN = Panther Creek drainage
RR = Rapid River Hatchery
S = Sawtooth Hatchery
SFSR = South Fork Salmon River drainage
SFTR = South Fork Trap
UI = University of Idaho
WASH = Washington

APPENDIX E
PRODUCTION CONSTRAINTS

Table 1. Major habitat constraints for spring chinook production in the Salmon River subbasin (IDFG, NPT, SBT, USFS, BLM, pers. commun.).

LOCATION	Sediment	Low flow	Uater quality	Migration barriers	Habitat	Riparian degradation	Channel/bank instability	Other[†]
MOUTH TO FRENCH CREEK EXCLUDING LITTLE SALMON								
Little Whitebird								
Cold Spring				X				
Asbestos				X				
N.F. Whitebird								
Skookmchuck	X			X				
Slate	X							
Van Buren	X							
John Day				X				
LITTLE SALMON RIVER	xupper			X RM 21		X		
Emery								
Boulder				X RM 4				
Hard				X RM 0.5				
SOUTH FORK SALMON RIVER	X				X			
Secesh R.	X							
E.F. S.F. Salmom R.								
Johnson				X				
Goat				X CULVERT				
FRENCH CREEK TO PAHSIMEROI RIVER								
Warren	X			X	X	X		M, G
Fivemile								G
Trout								G
Chamberlain	X	X		X				D
Horse								G
Panther			X chem					M
Moyer			x chem	x spch				
Musgrove			x chem	x spch				
Porphyry			x chem	x spch				
N.F. Salmon R.	X				X	X	X	M, L, R, A
Dahlonega		X						
Twin				ximpeded				
Iron		X						G
MIDDLE FORK OF THE SALMON RIVER								
Monunental	X					X		M, G, L
Camas	X					X		M, G, L
Loon	X					X		M, G, L
Bear Valley	X					X		M, G, L
Bearskin								
Porter	X							
Marsh	X					X		M, G, L
Swamp		X		X		x		
Knapp								G
LEMHI RIVER		X				X	X	D, G, C
Kirtley		X		X				D
Hayden								
Basin		X		ximpeded				

Table 1 continued.

LOCATION	Sediment	Lou flow	Uater quality	Migration barriers	Habitat	Riparian degradation	Channel/bank instability	Other[1]
PAHSIMEROI RIVER		X				X	X	D
Burnt								
PAHSIMEROI RIVER TO HEADWTERS								
Road	X					x		
Corral Basin		X						
Horse Basin	X					x		G
Misquito	X					x		G
Herd	X					x		G
East Fork						x		G
Yest Fork						x		G
East Pass	X					x		G
Taylor								G
Big Lake								G
West Pass								G
Spud								
Kinnikinic								G
Squaw	X							
Cash				X		x		G
Cinnibar	X							
Thompson					pool2ri			
Slate	X		x chem			x		
Uarm Springs				X				
Yankee Fork	X		X				X	C, G
Ramey								G
Lightning								G
Jordan	X		x chem			x		G
Fivemile	X							G
Eithtmile								G
Elevenmile								G
Twelvemile								G
McKay								G
Basin	X				gravel		X	B
Big Casino	X		x chem					
Valley	X					X		B
Iron	X					x		
Crooked	X							
Stanley Lake	X					x		
Elk	X							
Trap	X							
Red Fish Lake	X							
Gold		X		X				D
Uilliams								D

[1] A = Agriculture, B = Grazing, C = Channelization, D = Diversions, G = Gradient, I = Irrigation diversion, L = Logging, M = mining, R = Road construction.

Table 2. Major habitat constraints for summer chinook production in the Salmon River subbasin (IDFG, NPT, SBT, USFS, BLM, pers. commun.).

LOCATION	Sediment problems	LOU flow	Water quality	Migration barriers	Habitat	Riparian degradation	Channel/bank instability	Other†
MOUTH TO FRENCH CREEK								
Uhitebird								
Little Whitebird								G
Cold Spring				X				
Asbestos				X				
LITTLE SALMON RIVER								
Emery								G
Rapid R.								
U.F. Rapid R.								G
Boulder				X RM 4				
SOUTH FORK SALMON RIVER	X				X			
Porphyry								
Sheep								
Secesh R.	X							
Ruby								
Summit	X							
Lake	X							
Threemile	X							
Willow	X							
E.F. S.F. Salmom R.								
Johnson				X				
Goat				X CULVERT				
FRENCH CREEK TO THE PAHSIMEROI RIVER								
N.F. Salmon R.	X				X	X	X	M, 'L, R, A
MIDDLE FORK SALMON RIVER								
Monunental	X					X		M, B, L
Camas	X					X		M, B, L
Loon	X					X		M, B, L
Bear Valley	X					X		M, B, I.
Bearskin								
Marsh	X					X		M, B, L
LEMHI RIVER		X				X	X	D, G, C
Hayden								
Bear Valley								G
PAHSIMEROI RIVER		X				X	X	D
Morgan		X		X			X	D
Patterson		X		X				D
Falls		X		X				D
Meadow				X				
Big Creek		X		X				D
Goldsburg		X		X				D
Burnt								
Short		X		X				D
Long		X		X				D

Table 2 continued.

LOCATION	Sediment problems	Low flow	Water quality	Migration barriers	Habitat	Riparian degradation	Channel/bank instability	Other'
PAHSIMEROI RIVER TO HEADUATERS								
Morgan		x		X				D
Challis		X					X	D, C
E.F. Salmon R.	X	X				X	X	D, B, C
Big Boulder			x chem	x impeded				D
Meadow					pool2riffle			
Gold		X		X				D
Alturas Lake		X		X	X			D

1 A = Agriculture, B = Grazing, C = Channelization, D = Diversions, G = Gradient, I = Irrigation diversion, L = Logging, M = mining, R = Road construction.

Table 3. Major habitat constraints for summer steelhead production in the Salmon River subbasin (IDFG, NPT, SBT, USFS, BLM, pers. commun.).

LOCATION	Sediment	Lou flow	Water quality	Migration barriers	Habitat	Riparian degradation	Channel/bank instability	Other'
MOUTH TO FRENCH CREEK EXCLUDING LITTLE SALMON								
cottonwood				X				
Burnt				X				
Rice				X				
S.F. Uhitebird				X				
Little Whitebird								G
Cold Spring				X				
Asbestos				X				
N.F. Uhitebird								G
Sotin		X						D
Deer								G
Skookunchuck				X				
Mckinzie								G
Slate								G
Van Buren								
John Day				X				
Allison				X				
French								G
LITTLE SALMON RIVER	xupper			X RM 21		x		G
Squaw		X						D
Emery								G
Rapid R.								
U.F. Rapid R.								G
Sheep				X				
Rattlesnake				X				
Lockwood	X							
Elk				X				
Boulder				X RM 4				
Hard				X RM 0.5				
SOUTH FORK SALMON RIVER	X				X			
Porphyry								
Sheep								
Secesh R.	X							
Ruby								
Summit	X							
Lake	X							
Threemile	X							
Uillou	X							
E.F. S.F. Salmom R.								
Johnson				X				
Goat				X CULVERT				

Table 3 continued.

LOCATION	Sediment	Low flow	Uater quality	Migration barriers	Habitat	Riparian degradation	Channel/bank instability	Other'
FROM FRENCH CREEK TO THE PAHSIMEROI RIVER								
Carey	X					x		
Rabbit				X				G
Indian				X				G
Uarren	X			X	X	X		G, M
Fivemile								G
Trout								G
Big Mallard				X				G
Chamberlain	X	X		X				D
Horse								G
Colson	X							
Owl	X	X						
East Fork				X				
Panther			chem					M
Trail			chem					
Napais			chem	X				
Deep			chem					
Little Deep			chem					
Spring	X							
Uoodtick			chem					
Moyer			chem	X				
Musgrove			chem					
Porphyry			chem					
Moose				X				
N.F. Salmon R.	X				X	X	X	M, L, R, A
Warm Spring								G
Iron		X						G
Poison								G
cow						x		
MIDDLE FORK OF THE SALMON RIVER								
Honunental	X					X		M, L, B
Carnas	X					X		M, L, B
Loon	X					X		M, L, B
Bear Valley	X					X		M, L, B
Poker					gravel			
Bearskin								
Elk	X							
Porter	X							
Marsh	X					X		M, L, B
LEMHI RIVER		X				X	X	D, G, C
Kirtley		X		x				D
Hayden								
Basin		X		x impeded				

Table 3 continued.

LOCATION	Sediment	Low flow	Uater quality	Migration barriers	Habitat	Riparian degradation	Channel/bank instability	Other'
PAHSIMEROI RIVER		X				X	X	D
Morgan		X		X			X	D
Patterson		X		X				D
Falls		X		X				D
Meadow				X				
Big Creek		X		X				D
Goldsburg		X		X				D
Burnt								
Short		X		X				D
Long		X		X				D
PAHSIMEROI RIVER TO HEADUATERS								
Morgan		X		X				D
Challis		X					X	D, C
Bayhorse		X						G
E.F. Salmon R.	X	X				X	X	D, B, C
Road	X					X		
Corral Basin		X						
Horse Basin	X					X		G
Misquito	X					X		G
Herd	X					X		G
East Fork						X		G
West Fork						X		G
East Pass	X					X		G
Taylor								G
Big Boulder			chem	ximpeded				D
West Pass								G
Spud								
Squaw	X							
Cash				X		X		G
Cinnibar	X							
Thompson					pool2ri			
Slate	X		chem			X		
Yankee Fork	X		chem				X	C, S, G
Ramey								G
Jordan	X		chem			X		G
Fivemile	X							G
Eithtmile								G
Big Casino	X		chem					
Valley	X					X		B
Meadow					pool2ri			
Iron	X					X		
Crooked	X							
Stanley Lake	X					X		
Elk	X							
Trap	X							

Table 3 continued.

LOCATION	Sediment	LOW flow	Uater quality	Migration barriers	Habitat	Riparian degradation	Channel/bank instability	Other
Red Fish Lake	X							
Gold		x		X				D
Huckleberry								G
Fisher		X						
Fourth of July		X						G
Alturas Lake		X		X	X			D
Alpine		X		X				
Pole		X						G
Beaver		X						G
Smiley		X						G
Frenchman		X		X				G

[1] A = Agriculture, B = Grazing, C = Channelization, D = Diversions, G = Gradient, I = Irrigation diversion, L = Logging, M = mining, R = Road construction.

APPENDIX F
HATCHERY BROOD STOCK INFORMATION
AND LIFE HISTORY

Table 1. Spring chinook run information from Rapid River Hatchery (T. Levendofske, Idaho Dep. Fish and Game, pers. commun.).

Year	Total Return To Rack	Number Released Upstream (%)	Total Ponded (%)	Number of Females Ponded	Female Prespawn Mortality (%)	Females Spawned (%)
1977	8181	1170 (14) a	7011 (86)	4308	563 (13)	3745 (87)
1978	5769	0 (0)	5735 (99) b	3183	833 (26)	2350 (74)
1979	3404	N/A	N/A	N/A	N/A	N/A
1980	1960	0 (0)	1528 (78) c	832	289 (35)	543 (65)
1981	3263	0 (0)	3263 (100)	1812	146 (8)	1666 (92)
1982	3676	0 (0)	3676 (100)	2120	237 (11)	1883 (89)
1983	1958	0 (0)	1958 (100)	1044	185 (18)	859 (82)
1984	2356	0 (0)	2356 (100)	896	75 (8)	821 (92)
1985	6727	0 (0)	6727 (100)	3346	384 (11)	2962 (89)
1986	6723	0 (0)	6723 (100) d	3734	1283 (34)	2451 (66)
1987	3808	0 (0)	3808 (100)	1791	658 (37)	1133 (63)

(a) fish released in Little Salmon River and South Fork Clearwater River

(b) 34 fish unaccounted for

(c) 432 jacks given to Nez Perce Tribe

(d) includes 177 jacks

Table 2. Sex and average fecundity for spring chinook from the Rapid River Hatchery, near Riggins, Idaho, by run year with ocean age identified (T. Levendofske, IDFG, pers. commun.).

	Ocean age[a]						
	1	2	3	Sex		Sex ratio	Fecundity[b]
Year	M	Total	Total	M[c]	F	(M/F)	(eggs/female)
1977	437	7110	634				3745
1978	34	3890	1845				4266
1979	350	598	2413				4950
1980	432	1482	46	1128	832	1.35	3235
1981	176	3068	146	1451	1812	0.80	3675
1982	30	3089	557	1556	2120	0.73	3973
1983	94	838	1026	914	1044	0.87	4016
1984	651	1349	356	1460	896	1.63	3807
1985	351	6177	199	3030	3346	0.90	3741
1986	177	5591	955	2989	3734	0.80	3629
1987	210	2443	1155	1807	1791	1.01	3996

[a] Ocean age was determined using fork length distribution

Age class	Fork length in inches
1	less than or equal to 21
2	22 to 32
3	greater than 32

[b] Average fecundity for only females spawned.

[c] Includes jacks

Table 3. Spring chinook run information from Sawtooth Hatchery (T. Rogers, Idaho Dep. Fish and Game, pers. commun.).

Year	Total Return To Rack	Number Released Upstream (%)	Total Ponded (%)	Number of Females Ponded	Female Prespawn Mortality (%)	Females Spawned (%)
1981 b	829	500 (60) a	300 (36) a	194	34 (18)	160 (87)
1982 b	262	N/A	N/A	99	17 (17)	82 (83)
1983 b	366	97 (27)	269 (73)	161	33 (20)	128 (80)
1984	406	205 (50)	201 (50)	125	25 (20)	100 (80)
1985	1639	625 (38)	881 (54) c	377	64 (17)	313 (83)
1986	1769	876 (50)	893 (50)	478	115 (24)	360 (75)
1987	1344	506 (38)	838 (62)	448	18 (4)	426 (95)

(a) estimated

(b) temporary trap - not in service during entire run

(c) excludes 133 jacks given to Shoshone-Bannock tribal members ho, Table 4. Sex and average fecundity for spring chinook from the Sawtooth Hatchery, near Stanley, Ida by run year with ocean age identified (T. Rogers, IDFG, pers. commun.).

	Ocean age*										
	1	2			3			Sex		Sex ratio	Fecundity[b]
Year	M	M	F	Total	M	F	Total	M	F	(M/F)	(eggs/female)
1981"	23							380	449	0.85	4,047
1982[e]	16							151	111	1.36	5,511
1983[c,d,e]	17			9			243	187	179	1.04	5,080
1984[c]	49			66			291	218	187	1.17	6,017
1985	296	722	456	1,178	64	101	165	1,082	557	1.94	4,533
1986[c]	51			922			796	1,043	726	1.44	5,156
1987	17	330	122	452	297	578	875	644	700	0.92	5,399

[a] Ocean age was determined using fork length distribution

Age class	Fork length in inches
1	less than 22
2	22 to 32
3	greater than 32

[b] Average fecundity for only females spawned.

[c] Fish were not sexed by ocean age.

[d] Ninty seven fish were released without being measured.

[e] Not all fish were trapped. A portable trap was used.

Table 5. Spring chinook run information from Sawtooth Hatchery (T. Rogers, Idaho Dep. Fish and Game, pers. commun.).

Year	Total Return To Rack	Number Released Upstream (%)	Total Ponded (%)	Number of Females Ponded	Female Prespawn Mortality (%)	Females Spawned (%)
1984	139	65 (47)	52 (37)	28	3 (11)	25 (89)
1985	303	142 (47)	161 (53)	45	0 (0)	45 (100)
1986	194	126 (65)	68 (35)	54	6 (11)	48 (89)
1987	272	98 (36)	174 (64)	76	7 (9)	66 (87)

Table 6. Sex and average fecundity for spring chinook from the East Fork trap of the Sawtooth Hatchery, near Stanley, Idaho, by run year with ocean age identified (T. Rogers, IDFG, pers. commun.).

Year	Ocean age[a] 1	Ocean age[a] 2			Ocean age[a] 3			Sex		Sex ratio	Fecundity[b]
	M	M	F	Total	M	F	Total	M	F	(M/F)	(eggs/female)
1984	22			26			69	82	34	2.41	6,852
1985	50	165	29	194	25	34	59	190	63	3.02	5,570
1986	5			87			102	115	79	1.46	5,904
1987	1	65	122	187	93	88	181	158	210	0.75	5,606

[a] Ocean age was determined using fork length distribution

Age class	Fork length in inches
1	less than 22
2	22 to 32
3	greater than 32

[b] Average fecundity for only females spawned.

[c] Fish were not sexed by ocean age.

Table 7. Steelhead run information from Sawtooth Hatchery (T. Rogers, Idaho Dep. Fish and Game, pers. commun.).

Year	Total Return To Rack	Number Released Upstream (%)	Total Ponded (%)	Number of Females Ponded	Female Prespawn Mortality (%)	Females Spawned (%)
1985	526	206 (39) a	N/A	287	0	287 (100)
1986	2212	1056 (48)	1156 (52)	619	0	619 (100)
1987	2187	979 (45)	1208 (55)	730	8 (1)	722 (99)

(a) includes males spawned and released

Table 8. Sex and average fecundity for A run summer steelhead from the Sawtooth Hatchery, near Stanley, Idaho, by run year with ocean age identified (T. Rogers, IDFG, pers. commun.).

	Ocean age[a]												
	1			2			3			Sex		Sex ratio	Fecundity[b]
Year	M	F	Total	M	F	Total	M	F	Total	M	F	(M/F)	(eggs/female)
1985[c]			77			390			59	149	377	0.40	5,640
1986	1,258	821	2,079	12	104	116	1	16	17	1,271	941	1.35	4,468
1987	978	699	1,677	89	405	494	7	39	46	1,074	1,143	0.94	4,854

[a] Ocean age was determined using total length distribution in inches

Age class	Male	Female
1	less than 27	less than 25
2	27 - 32	25 - 31
3	reater than 32	greater than 31

[b] Average fecundity for only females spawned.

[c] Fish were not sexed by ocean age.

Table 9. Steelhead run information from East Fork Trap (T. Rogers, Idaho Dep. Fish and Game, pers. commun.).

Year	Total Return To Rack	Number Released Upsteam (%)	Total Ponded (%)	Number of Females Ponded	Female Prespawn Mortality (%)	Females Spawned (%)
1984	40	40 (100)	N/A	N/A	N/A	N/A
1985	77	0 (0)	77 (100)	30	10 (33)	20 (67)
1986	720 a	465 (65) b	255 (35)	215	0 (0)	215 (100)
1987	224	111 (50)	113 (50)	87	0 (0)	87 (100)

(a) includes 277 Pahsimeroi B's hauled to East Fork Salmon River

(b) includes A adults outplanted into Yankee Fork

Table 10. Sex and average fecundity for B run summer steelhead from the East Fork Trap, near Stanley, Idaho, by run year with ocean age identified (T. Rogers, IDFG, pers. commun.).

Year	Ocean age* 1 M	1 F	1 Total	2 M	2 F	2 Total	3 M	3 F	3 Total	Sex M	Sex F	Sex ratio (M/F)	Fecundity- (eggs/female)
1986[c]	166	19	185	67		24				47	30	1.57	6,487
1987	33	19	52	25	77	144	33	81	114	266	177	1.50	6,792
					60	85	30	57	87	88	126	0.70	5,119

[a] Ocean age was determined using total length distribution in inches

Age class	Male	Female
1	less than 27	less than 25
2	27 - 32	25 - 31
3	greater than 32	greater than 31

[b] Average fecundity for only females spawned.

[c] Fish were not sexed by ocean age.

Table 11. Summer chinook run information from McCall Hatchery (T. Frew, Idaho Dep. Fish and Game, pers. commun.).

Year	Total Return To Rack	Number Released Upstream (%)	Total Ponded (%)	Number of Females Ponded	Female Prespawn Mortality (%)	Females Spawned (%)
1980	380	230 (61)	150 (39)	25	0 (0)	25 (100)
1981	524	227 (43)	297 (57)	134	10 (7)	124 (93)
1982	550	158 (29)	392 (71)	151	4 (3)	147 (97)
1983	937	216 (23)	721 (77)	185	5 (3)	180 (97)
1984	1529	337 (22)	1192 (78)	379	26 (7)	353 (93)
1985	2238	651 (29)	1587 (71) a	568	91 (16)	477 (84)
1986	2690	566 (21)	2124 (79) b	499	71 (15)	428 (88)
1987	2705	866 (32)	1839 (68) c	798	136 (17)	662 (83)

(a) includes 450 unspawned jacks and 7 adults given to the Shoshone-Bannock Tribes

(b) includes 1060 unspawned jacks given to agencies, tribes, public

(c) includes 196 unspawned jacks given to public

Table 12. Sex and average fecundity for summer chinook from the McCall Hatchery, McCall, Idaho, by run year with ocean age identified (T. Frew, IDFG, pers. commun.).

Year	Ocean age[a] 1	Ocean age[a] 2			Ocean age[a] 3			Sex		Sex ratio	Fecundity[b]
	M	M	F	Total	M	F	Total	M	F	(M/F)	(eggs/female)
1980	92	50	24	74	2	1	3	144	25	5.76	3,851
1981	124	171	135	306	31	63	94	326	198	1.65	3,895
1982	48	294	168	462	12	28	40	354	196	1.81	4,412
1983	504	108	164	272	85	76	161	697	240	2.90	4,170
1984	595	296	417	713	135	86	221	1,026	503	2.04	4,571
1985	828	467	792	1,259	47	104	151	1,342	896	1.50	4,347
1986	1,222	722	543	1,265	70	133	203	2,014	676	2.98	5,020
1987	386	1,158	959	2,117	82	120	202	1,626	1,079	1.51	4,792

[a] Ocean age was determined using fork length distribution

Age class	Fork length in inches
1	less than 26
2	26 to 34
3	greater than 34

[b] Average fecundity for only females spawned.

Table 13. Summer chinook run information from Pahsimeroi Hatchery (B. Moore, Idaho Dep. Fish and Game, pers. commun.).

Year	Total Return To Rack	Number Released Upstream (%)	Total Ponded (%)	Number of Females Ponded	Female Prespawn Mortality (%)	Females Spawned (%)
1980	46	46 (100)	N/A	N/A	N/A	N/A
1981	35	0 (0)	35 (100)	5	1 (20)	4 (80)
1982	39	0 (0)	39 (100)	15	2 (13)	13 (87)
1983	109	0 (0)	109 (100)	57	11 (19)	45 (79)
1984	37	0 (0)	37 (100)	8	4 (50)	4 (50)
1985	110	0 (0)	110 (100)	30	6 (20)	24 (80)
1986	345	100 (29)	245 (71)	138	32 (23)	106 (77)
1987	473	228 (48)	245 (52)	151	29 (19)	122 (81)

Table 14. Sex and average fecundity for summer chinook from the Pahsimeroi Hatchery, Ellis, Idaho, by run year with ocean age identified (B. Moore, IDFG, pers. commun.).

	Ocean age[a]							Sex		Sex ratio	Fecundity[b]
	1	2			3						
Year	M	M	F	Total	M	F	Total	M	F	(M/F)	(eggs/female)
1980	13[c]	26	4	30[c]	1		1[c]	40	4	10.00	
1981	4[c]	17	1	18[c]	9	4	13[c]	30	5	6.00	5693
1982	4[c]	9	8	17[c]	11	7	18[c]	24	15	1.60	5800
1983	8[c]	2	1	3[c]	34	56	90[c]	44	57	0.77	5804
1984	13	11	3	14[c]	5	5	10[c]	29	8	3.63	6000
1985	27	46	26	72	7	4	11[c]	80	30	2.67	5,305
1986	37	120	158	278	13	30	43	170	188	0.90	3,831
1987	13	216	193	409	25	27	52	254	220	1.15	5,705

a Ocean age was determined using fork length distribution

1980-86 Age class	Fork length in inches 1980-86	1987 Male	1987 Female
1	less than 22	less than 32	
2	22 to 32	32 to 36	35 or less
3	greater than 32	greater than 36	greater than 35

b Average fecundity for only females spawned.

c Wild fish.

Table 15. Spring chinook run information from Pahsimeroi Hatchery (B. Moore, Idaho Dep. Fish Game, pers. commun.).

Year	Total Return To Rack	Number Released Upstream (%)	Total Ponded (%)	Number of Females Ponded	Female Prespawn Mortality (%)	Females Spawned (%)
1982	107 a	N/A	107 (100)	34	7 (21)	27 (79)
1983	232 a	N/A	232 (100)	100	25 (25)	75 (75)
1984	209 b	N/A	209 (100)	47	15 (32)	32 (68)
1985						
1986	6518	4889 (75) c	1629 (25)	742	363 (49) d	379 (51)
1987	2175	600 (28) e	1575 (72)	1039	576 (55) d	463 (46)

(a) fish trapped at Hayden Creek Trap near Lemhi, Idaho

(b) 97 fish were jacks trapped at Pahsimeroi, rest were trapped at Hayden Creek

(c) outplanted adults to Panther Creek and Yankee Fork

(d) mainly due to kidney disease

(e) outplanted adults to Yankee Fork

Table 16. Sex and average fecundity for spring chinook from the Pahsimeroi Hatchery, Ellis, Idaho, by run year with ocean age identified (B. Moore, IDFG, pers. commun.).

	Ocean age[a]										
	1	2			3			Sex		Sex ratio	Fecundity[b]
Year	M	M	F	Total	M	F	Total	M	F	(M/F)	(eggs/female)
1984	97							97	0		
1985	480	730	838	1,568				1,210	838	1.44	4,211
1986	101	2,563	3,456	6,019	261	137	398	2,925	3,593	0.81	3,928
1987	35	311	366	677	665	798	1,463	1,011	1,164	0.87	4,598

[a] Ocean age was determined using fork length distribution

Age class	Fork length in inches
1	less than 22
2	22 to 32
3	greater than 32

[b] Average fecundity for only females spawned.

Table 17. Steelhead A & B run information from Pahsimeroi Hatchery (B. Moore, Idaho Dep. Fish and Game, pers. commun.).

Year	Total Return To Rack	Number Released Upstream (%)	Total Ponded (%)	Number of Females Ponded	Female Prespawn Mortality (%)	Females Spawned (%)
1977	1504	0 (0)	1504 (100)	756	4 (1)	752 (99)
1978	2803 a	2090 (75)	713 (25)	554	0 (0)	554 (100)
1979	2501	1600 (64)	901 (36)	673	11 (2)	662 (98)
1980	1620	36 (2)	1585 (98)	902	5 (1)	897 (99)
1981	3491 b	266 (8)	3225 (92)	1736	101 (6)	1635 (94)
1982	3444 c	702 (20) d	2742 (80)	1674	172 (10)	1502 (90)
1983	5008 e	2486 (50) d	2522 (50)	1820	5 (0)	1815 (100)
1984	13883 f	10928 (79) d	2955 (21)	1892	143 (8)	1749 (92)
1985	4944 g	3028 (61) d	1916 (39)	1539	8 (1)	1531 (99)
1986	4505 h	2963 (66) d	1542 (34)	1017	6 (1)	1011 (99)
1987	5033 i	3600 (72) d	1433 (28)	1216	6 (0)	1210 (100)
1988	1981	484 (24)	1497 (76)	989	2 (0)	983 (100) j

(a) 29 Clearwater B stock

(b) 83 Clearwater B stock

(c) 352 Clearwater B stock

(d) includes outplanted adults

(e) 436 Clearwater B stock

(f) 97 Clearwater B stock

(g) includes 400 B stock

(h) includes 324 B stock

(i) 59 Clearwater B stock, outplanted to East Fork Salmon River

(j) 4 females rejected for spawning due to overripeness

Table 18. Sex and average fecundity for A(a) run summer steelhead from the Pahsimeroi Hatchery, Ellis, Idaho, by run year with ocean age identified (B. Moore, IDFG, pers. commun.).

Year	Ocean age[b] 1 M	F	Total	2 M	F	Total	Sex M	F	Sex ratio (M/F)	Fecundity[c] (eggs/female)
1977[d]							748	756	0.99	
1978[d]			3,343			533	1,253	1,550	0.81	
1979[d]			91			2,306	664	1,837	0.36	
1980[d]			1,527			97	718	902	0.80	3,625
1981[d]			2,967			524	1,619	1,789	0.90	4,131
1982[d]			1,011			2,081	1,143	1,949	0.59	5,367
1983	725	1,394	2,119	1,030	1,423	2,453	1,755	2,817	0.62	4,778
1984	4,200	7,150	11,350	1,633	803	2,436	5,833	7,953	0.73	3,945
1985	858	667	1,525	556	2,463	3,019	1,414	3,130	0.45	5,231
1986	1,539	1,577	3,116	249	816	1,065	1,788	2,393	0.75	5,500
1987	1,491	1,427	2,918	573	1,483	2,056	2,064	2,910	0.71	5,171

[a] "A" run fish separated from "B" run fish by total length in inches.

	Male	Female
1983-84	less than 31	less than 31
1985-87	less than 32	less than 30.5

[b] Ocean age was determined using total length distribution

1983-84 Age class	Total length in inches
1	21 - 25.5
2	25.5 - 31

1985-87 Age class	Total length in inches Male	Female
1	20 - 27	20 - 26
2	27 - 32	26 - 30.5

[c] Average fecundity for only females spawned.

[d] Fish were not sexed by ocean age.

Table 19. Sex and average fecundity for B[a] run summer steelhead from the Pahsimeroi Hatchery, Ellis, Idaho, by run year with ocean age identified (B. Moore, IDFG, pers. commun.).

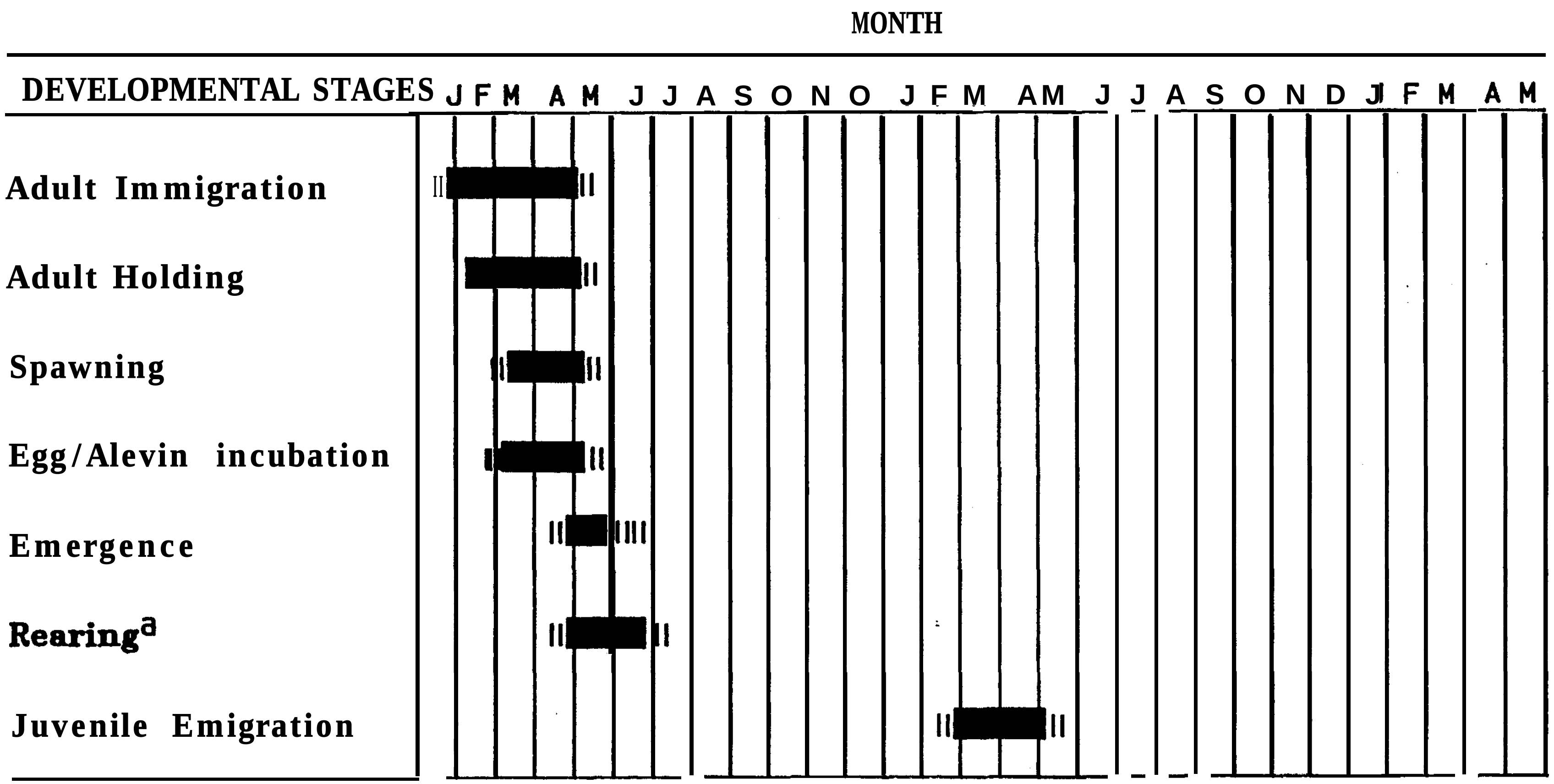
Year	Sex of fish M	Sex of fish F	Avg. fecundity[b] Eggs/female
1983	153	283	6299
1984	25	72	6583
1985	100	300	6758
1986	91	233	7611
1987	21	38	--

[a] Ocean age was determined using total length distribution

1983-84	Total length in inches	1985-87	Total length in inches Male	Total length in inches Female
	greater than 32		greater than 32	greater than 30.5

[b] Average fecundity for only females spawned.

Appendix F. Freshwater life history for steelhead spawned and reared at the Pahsimeroi Hatchery.

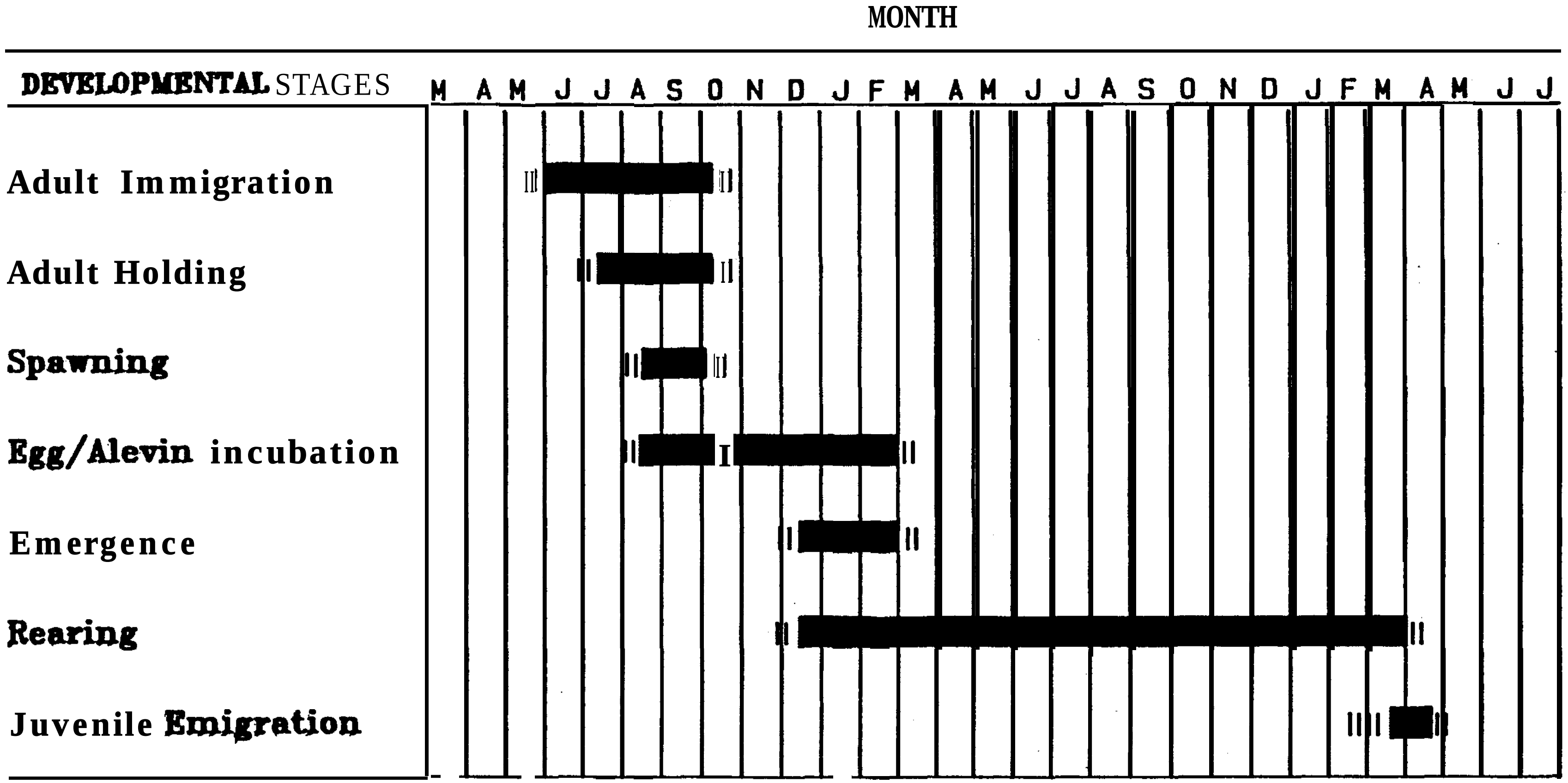


Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

[a] Fish released as fry. Denotes hatchery rearing only.

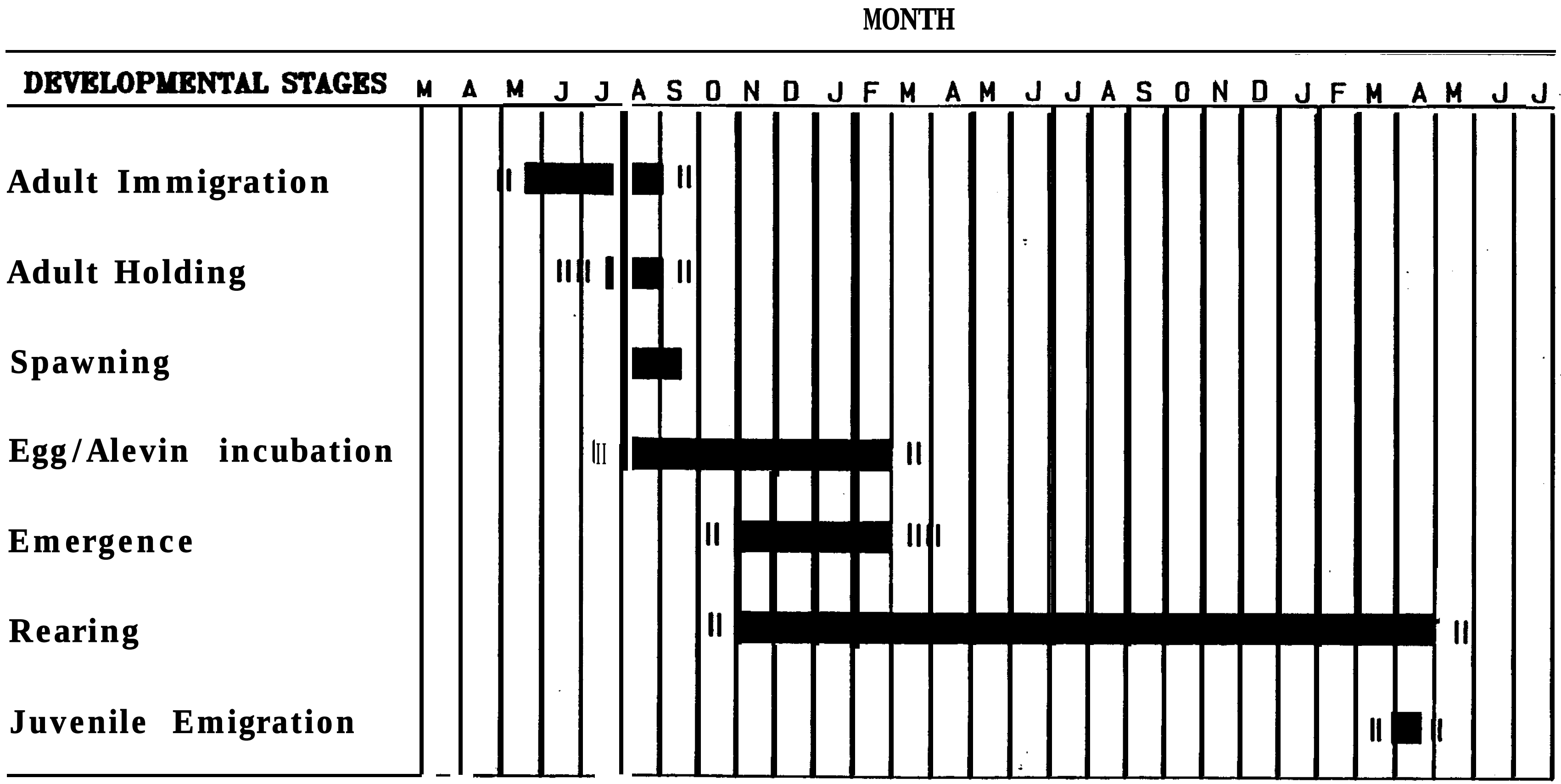
Appendix F. **Freshwater** life history **for summer chinook spawned and reared at the** Pahsimeroi **Hatchery.**



Notes:

1. **The** developmental stage timing **represents** basin-wide averages, local conditions **may cause some** variability.
2. Solid **bars** indicate periods of heaviest adult immigration, spawning **and** juvenile emigration.

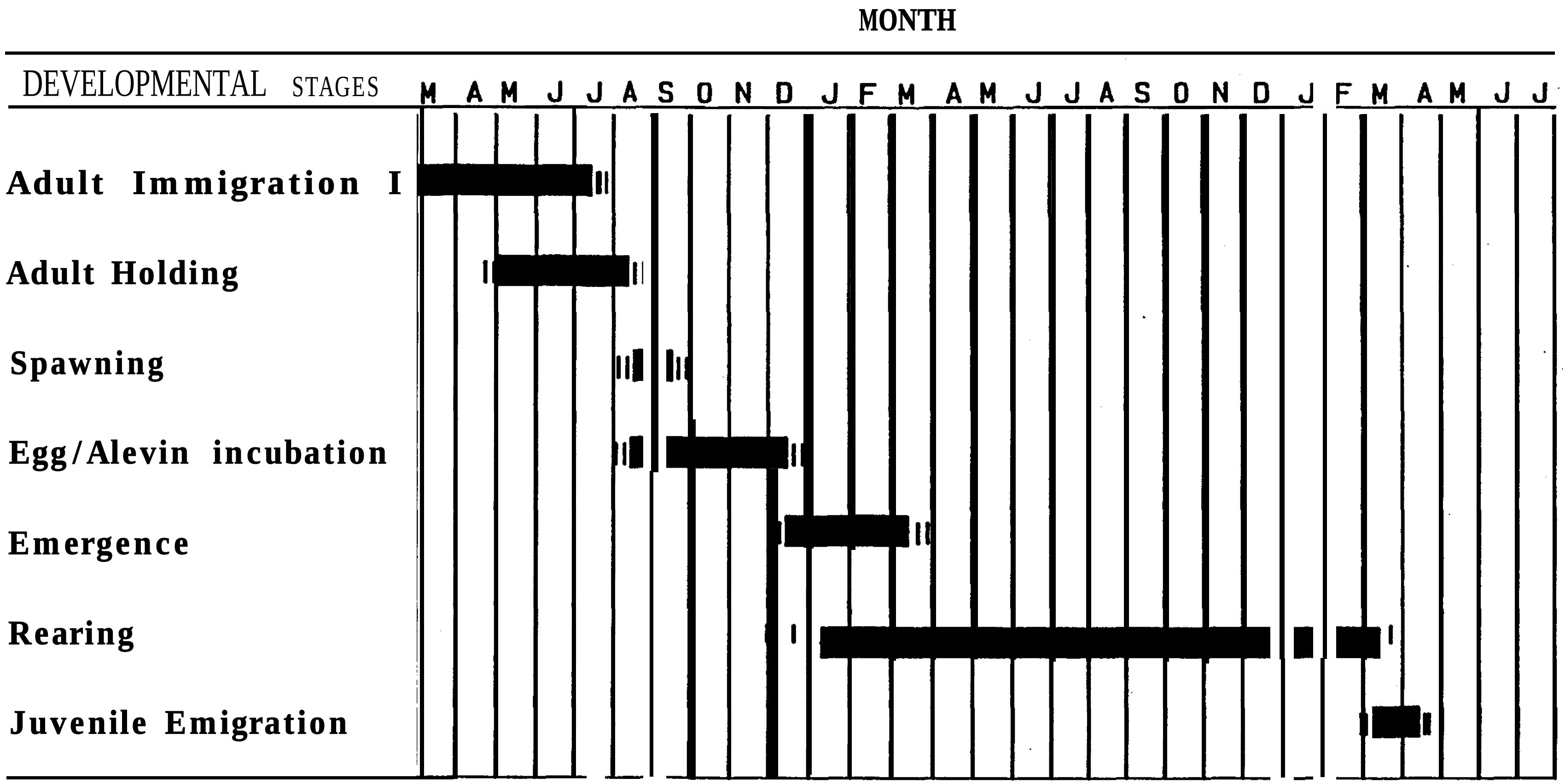
Appendix F. Freshwater life history for summer chinook spawned at the South Fork Salmon River and reared at the McCall Hatchery.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

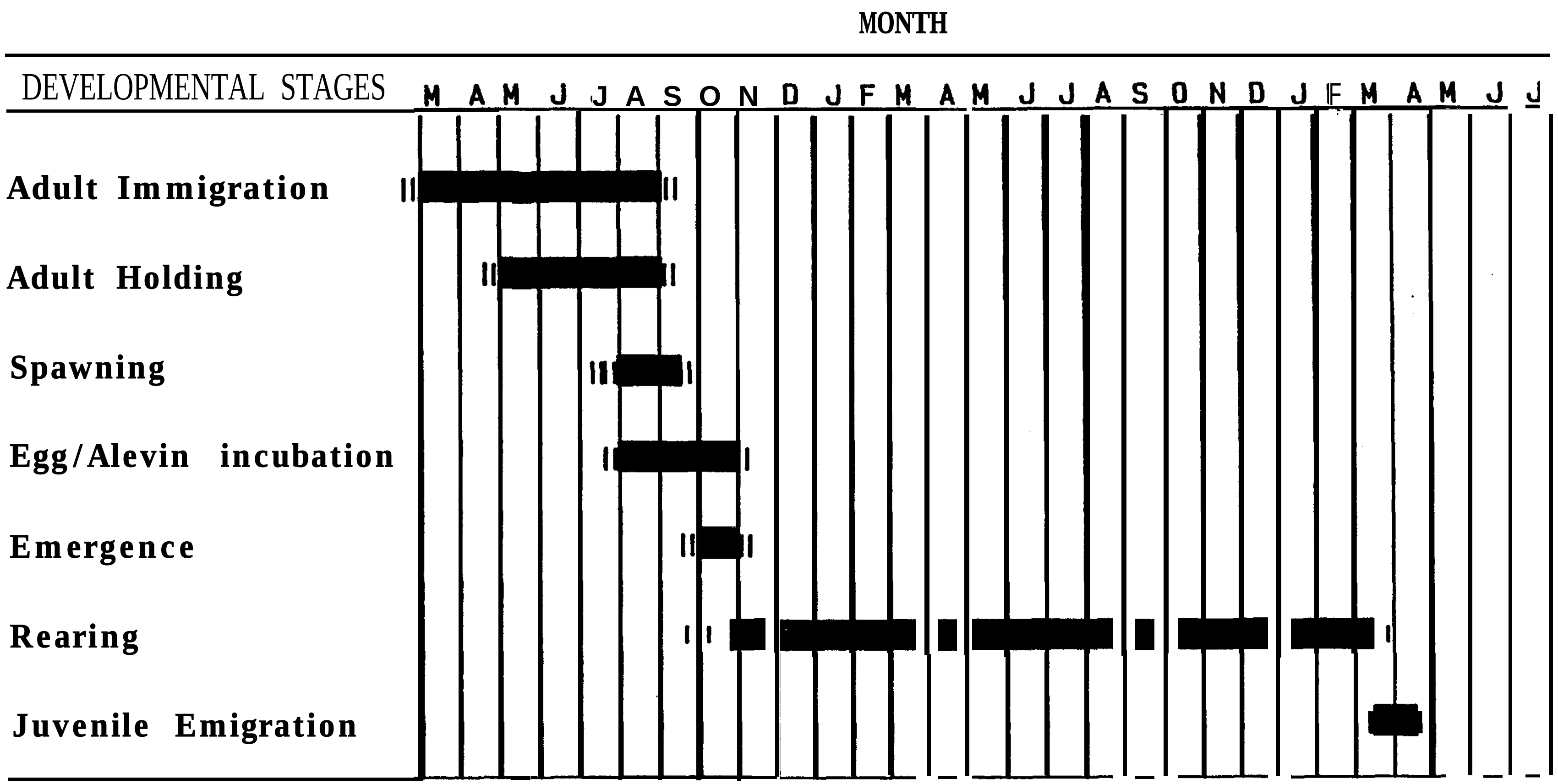
Appendix F. Freshwater life history for spring chinook salmon spawned and reared at the Rapid River (Circle C) Hatchery.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

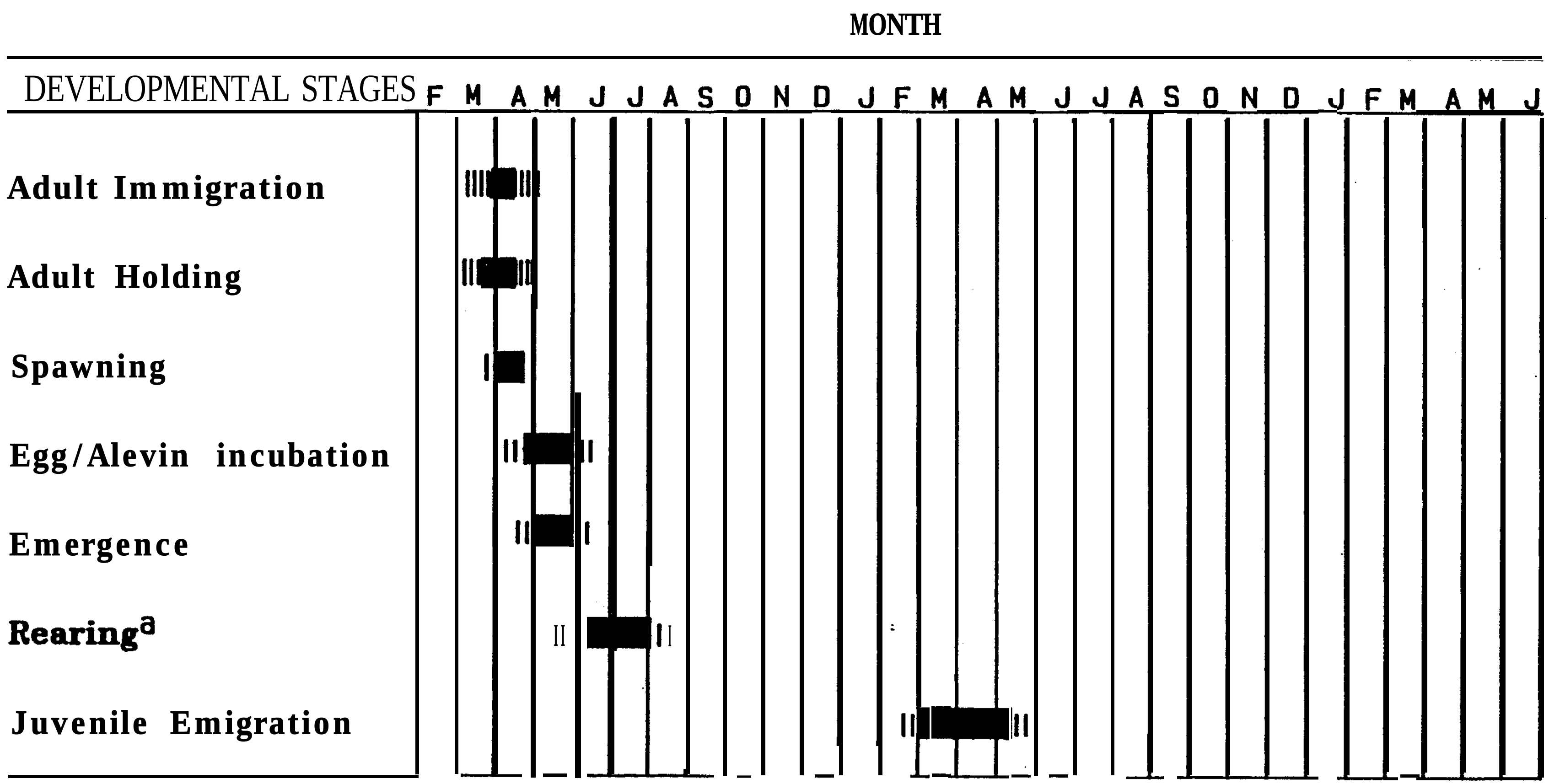
Appendix F. **Freshwater** life **history for** spring chinook salmon **spawned at the East Fork trap and the Sawtooth Hatchery and reared at Sawtooth Hatchery.**



Notes:

1. **The** developmental stage timing **represents** basin-wide **averages, local** conditions may **cause some** variability.
2. Solid **bars** indicate periods **of** heaviest adult immigration, spawning **and** juvenile emigration.

Appendix Fk. Freshwater life history for steelhead spawned at the East Fork and Sawtooth Hatchery traps and reared at the Sawtooth Hatchery.

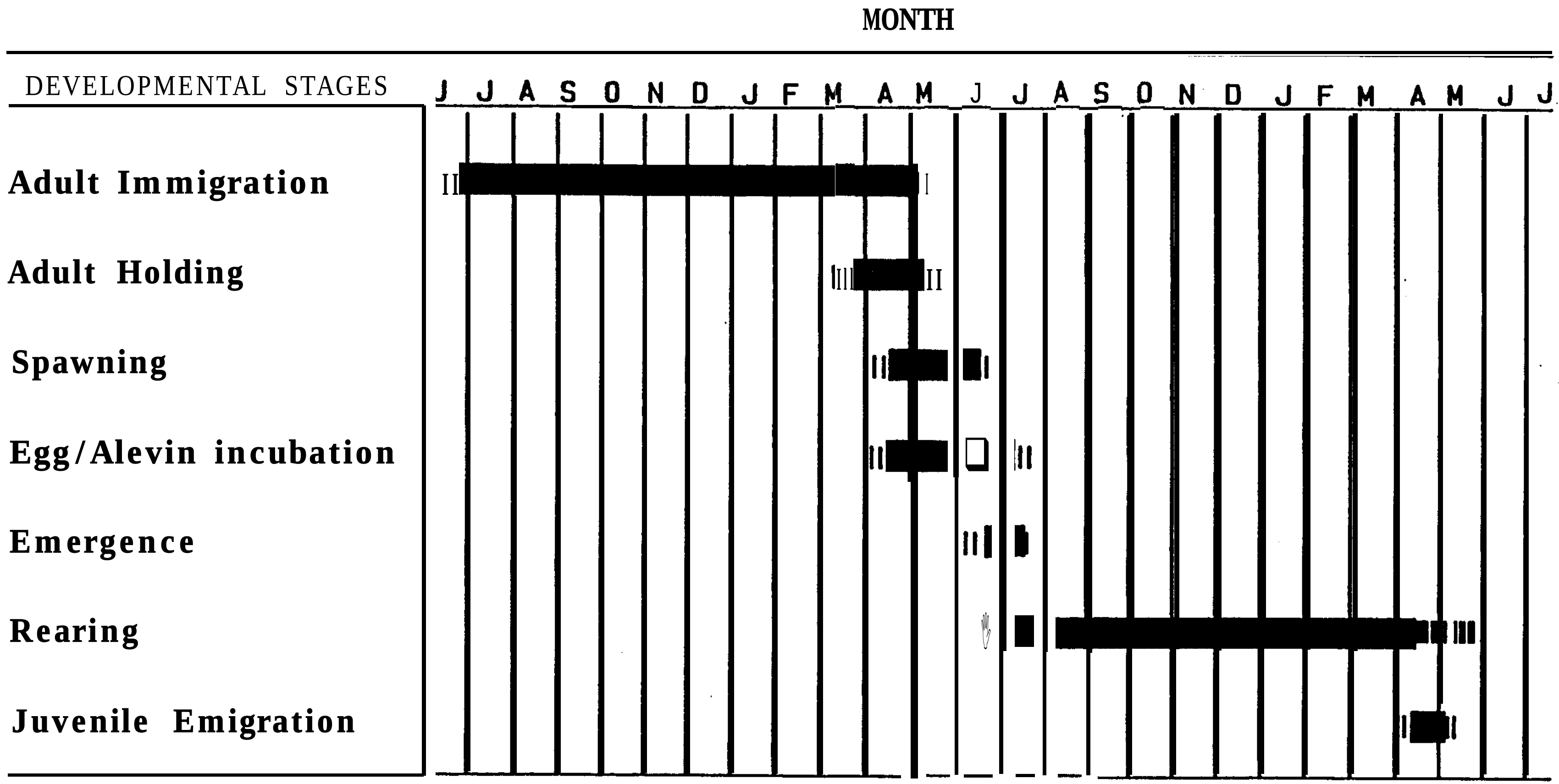


Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration. spawning and juvenile emigration.

[a] Fish released as fry. Denotes hatchery rearing only.'

Appendix F. Freshwater life history for steelhead trout spawned at Sawtooth, Pahsimeroi, and Oxbow hatcheries and reared at Magic Valley, Hagerman National and Niagara Springs hatcheries.



Notes:

1. The developmental stage timing represents basin-wide averages, local conditions may cause some variability.
2. Solid bars indicate periods of heaviest adult immigration, spawning and juvenile emigration.

APPENDIX G
RESEARCH NEEDS

A number of data gaps were briefly identified for anadromous species in Part IV. Several of the data gaps are expanded below to provide information in terms of types of research needed to effectively meet biological and utilization objectives.

1. Seasonal habitat use, juvenile rearing potential, and smolt yield for mainstem Salmon and major tributary mainstems. continuation of physical habitat evaluation to determine benefits of habitat improvements.

2. Wild and natural escapement into mainstem and major tributaries. Escapement estimates for utilization and production.

3. Mixed-harvest methods and structure, determination of mortality rates of catch and release chinook.
   a. Wild, natural and hatchery stock differentiation.
   b. Spring and summer chinook differentiation.

4. Baseline evaluation of genetic differences of stocks, races and populations in major tributaries for future genetic monitoring.

5. Seasonal mortality rates as related to habitat.
   a. Enhanced parr-to-smolt survival research.
   b. Long-term monitoring and evaluation.

6. Age structure, sex ratio, fecundity and age of runs.

7. Effects of sedimentation on seasonal habitat capacities and survival rates.

8. Migration timing and survival for smolts in mainstem and tributaries. Determination of where and why major losses of smolts occur prior to Lower Granite Dam.

9. Definition of most effective life stages for supplementation according to habitat.

10. Influence of hatchery supplementation on ecology and genetics of wild and natural stocks.

11. Better definition of migration timing of adults into subbasin and tributaries.

12. Sockeye recovery research and methods.