Endangered Species Act - Section 7 Consultation

BIOLOGICAL OPINION

ON ARTIFICIAL PROPAGATION

IN THE COLUMBIA RIVER BASIN

Incidental Take of Listed Salmon and Steelhead
from Federal and Non-Federal Hatchery Programs
that Collect, Rear and Release Unlisted Fish Species

Section 7 Consultations with:

Bonneville Power Administration
U.S. Army Corps of Engineers
U.S. Bureau of Indian Affairs
U.S. Fish and Wildlife Service
National Marine Fisheries Service

Authorization of Section 10 Incidental Take Permits with:

Idaho Department of Fish and Game
Oregon Department of Fish and Wildlife
Washington Department of Fish and Wildlife

Consultation Conducted by: National Marine Fisheries Service, Northwest Region

Date Issued: March 29, 1999
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I. INTRODUCTION

A. Background

The Columbia River Basin has extensive Federal and non-Federal hatchery programs that currently produce the majority of the annual adult production of 2.5 to 3.0 million salmon and steelhead in the Columbia River Basin. Adult hatchery fish in the Columbia River Basin comprise approximately 95% of the coho salmon (*Oncorhynchus kisutch*), 70 to 80% of the spring/summer chinook salmon (*O. tshawytscha*), 50% of the fall chinook salmon (*O. tshawytscha*), and 70% of the steelhead (*O. mykiss*) (CBFWA 1990). Artificial propagation of sockeye salmon occurs on a small scale, but nearly all adults originate from natural populations. There are also smaller numbers of chum salmon (*O. keta*), sea-run cutthroat salmon (*O. clarki*), and resident trout released into standing bodies of water and streams throughout the Columbia River Basin.

Artificial propagation has occurred in the Columbia River Basin since 1876 (Wahle and Smith 1979) with current releases of approximately 142.5 million smolts in 1999. The Columbia Basin Fish and Wildlife Authority and U.S. Fish and Wildlife Service (USFWS) have summarized the history, development, and management of anadromous fish facilities in the Columbia River Basin (CBFWA 1990). More recently, artificial propagation programs and projects in the Columbia River Basin have been reviewed in *Upstream: Salmon and Society in the Pacific Northwest* (NRC 1996), *Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem* (ISG 1996) and *Review of Salmonid Artificial Production in the Columbia River Basin: As a Scientific Basis for Columbia River Production Programs* (ISAB 1998).

This biological opinion (Opinion) is the result of an interagency consultation carried out pursuant to section 7(a)(2) of the Endangered Species Act (ESA) and implementing regulations found at 50 CFR Part 402. At issue are the Columbia River Basin hatchery programs and the effect of facilities operations, juvenile releases, adult collection, and related monitoring and evaluations on six listed species of anadromous salmon and steelhead in the Columbia River Basin. The Federal agencies that fund and/or operate hatcheries, namely the USFWS, National Marine Fisheries Service (NMFS), the U.S. Army Corps of Engineers (USACE), U.S. Bureau of Indian Affairs (BIA) and the Bonneville Power Administration (BPA), have initiated consultation with NMFS on operation of the Federal hatchery programs. In addition, NMFS is consulting with on its proposed issuance of research and enhancement permits, pursuant to section 10(a)(1)(A) of the ESA, to the Idaho Department of Fish and Game (IDFG), Oregon Department of Fish and Wildlife (ODFW) and Washington Department of Fish and Wildlife (WDFW) in 1999.

In developing this Opinion, NMFS considered the information presented in the following: non-Federal actions as described applications to modify the research and enhancement permits (issued pursuant to section 10(a)(1)(A) of the ESA) for IDFG (IDFG 1998a, 1998b), ODFW (ODFW 1998) and WDFW (WDFW 1997a, 1997b, 1998). For Federal actions NMFS considered the information in modifications to the 1995-1998 hatchery biological opinion received from the

Federal agencies from 1995-1999. Also, biological assessments received from BIA (1998), BPA (BPA 1994, BPA 1995, BPA 1997a, BPA 1997b, BPA 1998a, BPA 1998b), NMFS (NMFS 1995a, 1999b), USACE (USACE 1994, 1999), and USFWS (USFWS 1994, 1997, 1998a) were considered. Other sources of information considered in this Opinion included: NMFS' Interim Policy on Artificial Propagation of Pacific Salmon Under the Endangered Species Act (58 FR 17573, April 5, 1993); information published in the NMFS report, *Pacific Salmon and Artificial Propagation Under the Endangered Species Act* (Hard et al. 1992); NRC (1996), ISG (1996), ISAB (1998) and information available from the scientific literature. Additional information was received by NMFS from Federal and non-Federal agencies, which is too numerous to list. Please see Literature Cited.

B. Scope of Biological Opinion

This Opinion evaluates the incidental take of listed Snake River spring/summer chinook salmon, Snake River fall chinook salmon, Snake River sockeye salmon, Snake River steelhead, Upper Columbia River steelhead, and Lower Columbia River steelhead from all Federal and non-Federal hatchery programs that collect, rear and release *unlisted* hatchery fish in the Columbia River Basin. The proposed action in this Opinion is the operation of five Federal hatchery programs, and NMFS issuance of five incidental take permits for non-Federal hatchery programs.

The objective of this Opinion is to analyze actions and measures proposed by the action agencies and to determine whether they are likely to jeopardize the continued existence of listed Snake River spring/summer chinook salmon, Snake River fall chinook salmon, Snake River sockeye salmon, Snake River steelhead, Upper Columbia River steelhead, and Lower Columbia River steelhead or result in the destruction or adverse modification of critical habitat. This Opinion does not cover proposed species to be listed in March 1999. This Opinion will be revised to address the potential effects of artificial propagation programs in the Columbia River Basin on the salmon species listed in March 1999 and when the Columbia River Fish Management Plan (CRFMP) renegotiations pursuant to *U.S. v. Oregon* have been completed in 1999.

Direct take of *listed* salmon and steelhead is not described (II. Proposed Action) or evaluated (V. Project Effects) in this Opinion. A list of section research and enhancement permits, issued pursuant to section 10(a)(1)(A) of the ESA, for artificial propagation programs in the Columbia River Basin can be found in Table 1. The proposed actions (production, rearing and release) related to the direct take of listed salmon and steelhead are not described in this Opinion. Potential impacts to listed bull trout from artificial propagation programs in the Columbia River Basin are not covered in this Opinion.

There are two other actions that are not analyzed in this Opinion but are relevant to artificial propagation in the Columbia River Basin. These actions include bird predation and harvest in the Columbia River Basin. Impacts to listed and unlisted hatchery fish in the Lower Columbia River from bird predation is being analyzed in another opinion, while harvest actions have been analyzed by NMFS in a separate biological opinion (NMFS 1999a).

II. PROPOSED ACTION

For a comprehensive description of all proposed activities refer to the biological assessments and permit applications from Federal and non-Federal action agencies: NMFS 1999b; USFWS 1994, USFWS 1997, USFWS 1998a; USACE 1999; BPA 1994, BPA 1995, BPA 1997a, BPA 1997b, BPA 1998a, BPA 1998b; BIA 1994, BIA 1998; WDFW 1997a, WDFW 1997b,WDFW 1998; ODFW 1998; and IDFG 1998a, IDFG 1998b). A total of 80 hatchery programs (56 Federal and 24 non-Federal) are proposed for operation (Table 2 and Proposed Action section). The 1999 proposed releases in the Columbia River Basin total approximately 142.5 million anadromous fish (Table 3). Of the 142.5 million, approximately 19.4 million are released into the Snake River Basin and the rest (123.1 million) are released in other areas throughout the Columbia River Basin. Future releases may vary between individual agencies and/or facilities; however, reinitiation of consultation will be required if total releases exceed the 1995 levels (20.2 million in Snake River, 197.4 million total). The rationale for this ceiling is discussed later in this Opinion.

This consultation addresses 56 artificial propagation programs at 48 Federal hatchery facilities and the juvenile releases and broodstock collection[1] for those facilities. NMFS is consulting with on its proposed issuance of research and enhancement permits, pursuant to section 10(a)(1)(A) of the ESA, to the Idaho Department of Fish and Game (IDFG), Oregon Department of Fish and Wildlife (ODFW) and Washington Department of Fish and Wildlife (WDFW) on the operation, juvenile release, and broodstock collection for 24 non-Federal hatchery program at 26 hatchery facilities in 1999.

The majority of the information under the individual hatchery facilities was taken from the Integrated Hatchery Operations Team (IHOT) documents (IHOT 1996a, 1996b, 1996c) and the Montgomery Watson IHOT Audit Reports (1996, 1997). Updates or changes in the hatchery facilities and programs (goals, production, releases, etc.) were by provided the respective action agencies in comments to NMFS on the “Draft Biological Opinion on Artificial Propagation Programs in the Columbia River Basin” dated February 10, 1999.

Captive broodstock collection refers to collecting adults or juveniles, or both, from a local stock. The fish are then reared to maturity in a hatchery. Such programs are primarily carried out to prevent extinction. Secondarily, captive broodstock programs offer the opportunity to outplant more juveniles to the environment in an attempt to supplement natural production (NMFS Proposed Recovery Plan 1995).

Figure 2. Anadromous fish hatcheries in the Lower Columbia River Basin. Courtesy of BPA's Geographic Information Systems 1999.

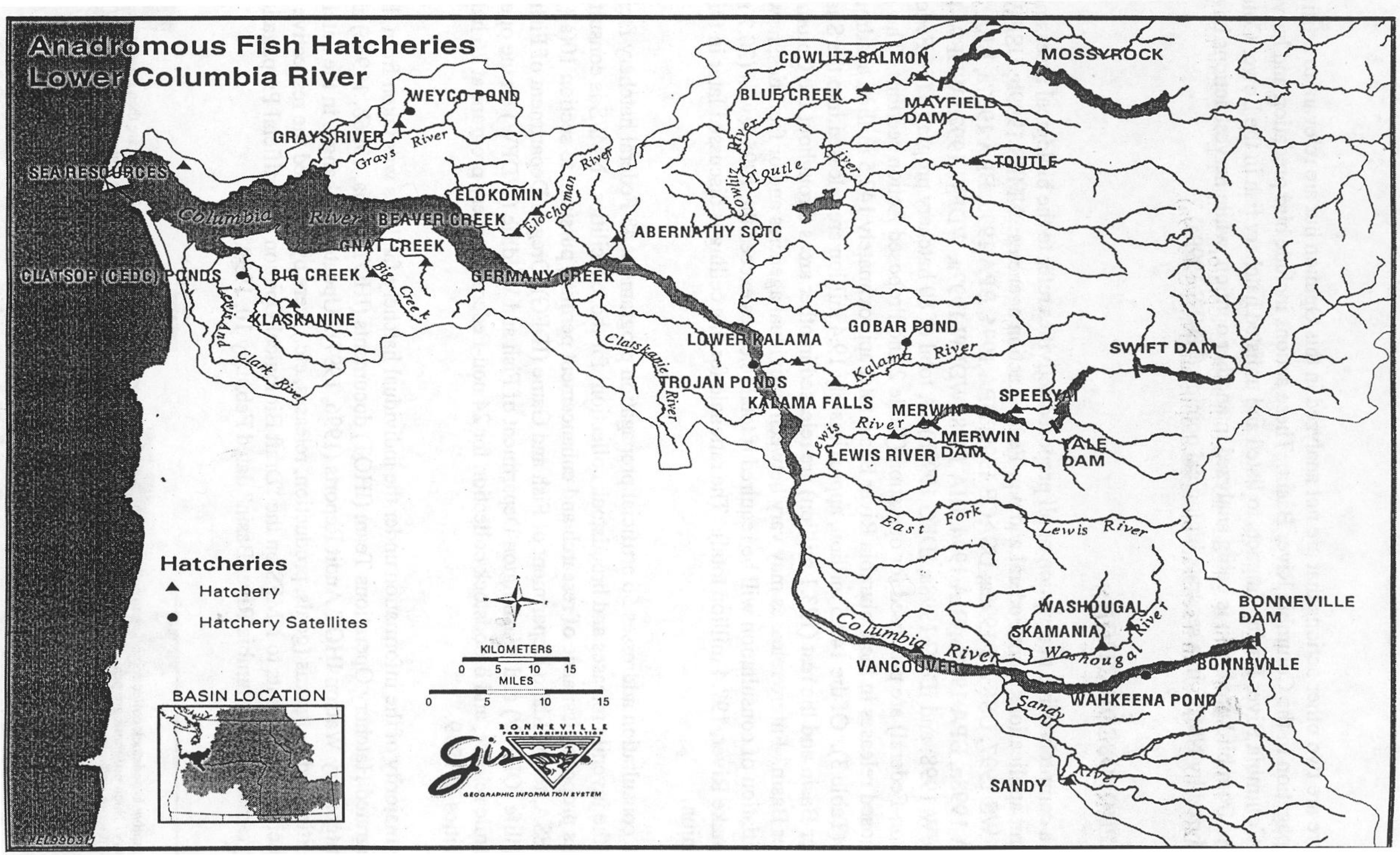


Figure 3. Anadromous fish hatcheries in the Middle Columbia River Basin. Courtesy of BPA's Geographic Information Systems 1999.

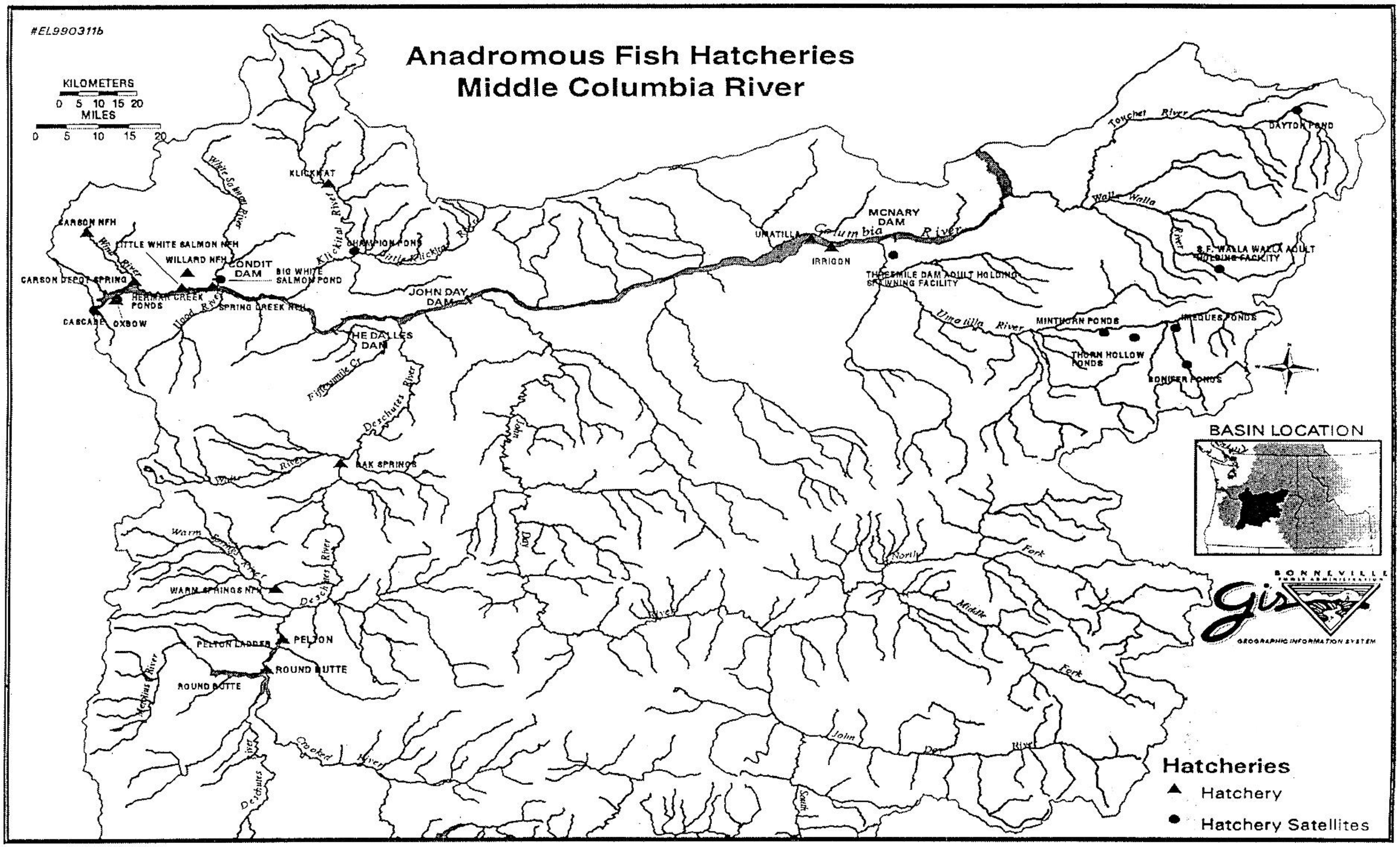


Figure 4. Anadromous fish hatcheries in the Upper Columbia River Basin. Courtesy of BPA's Geographic Information Systems 1999.

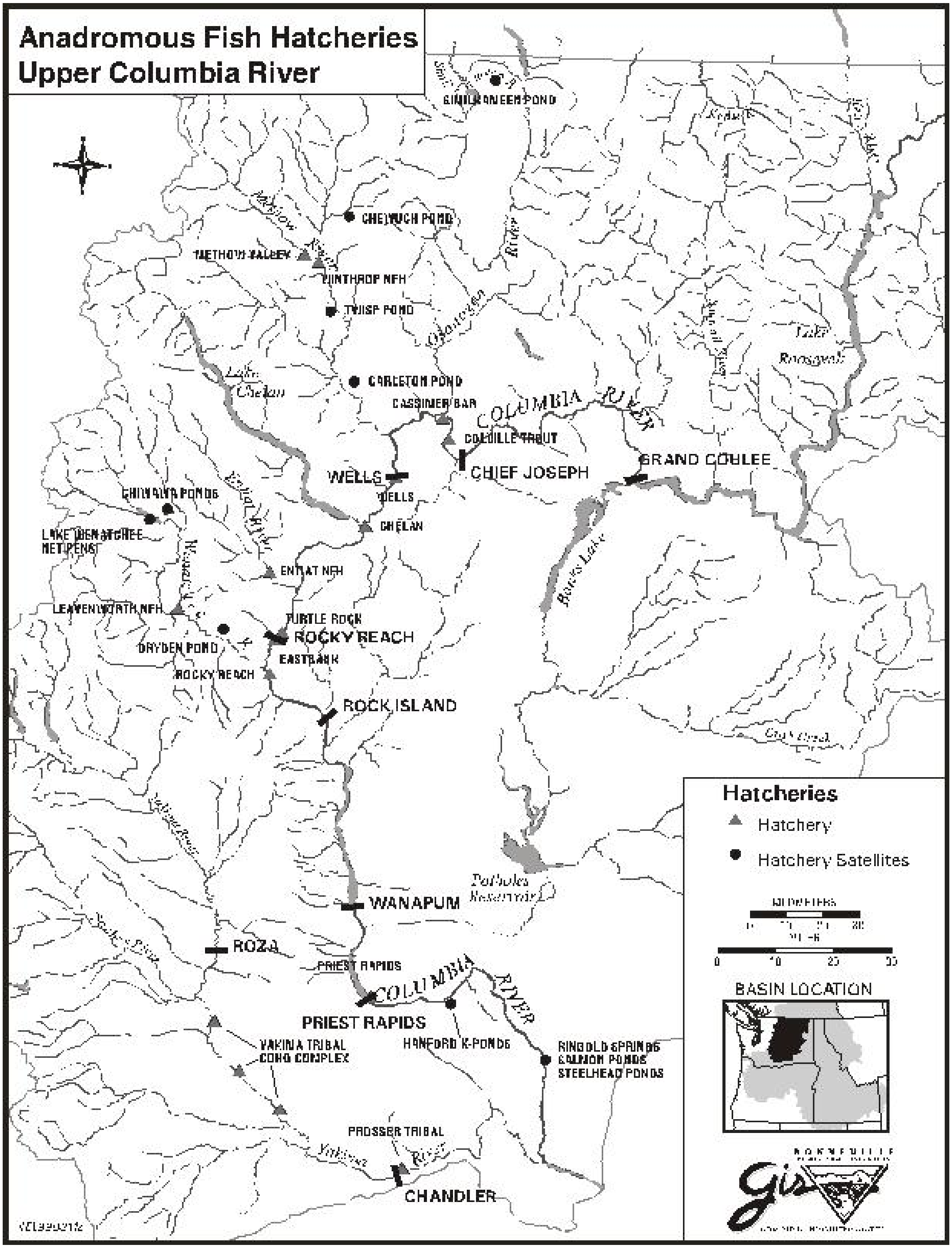


Figure 5. Anadromous fish hatcheries in the Snake River Basin. Courtesy of BPA's Geographic Information Systems 1999.

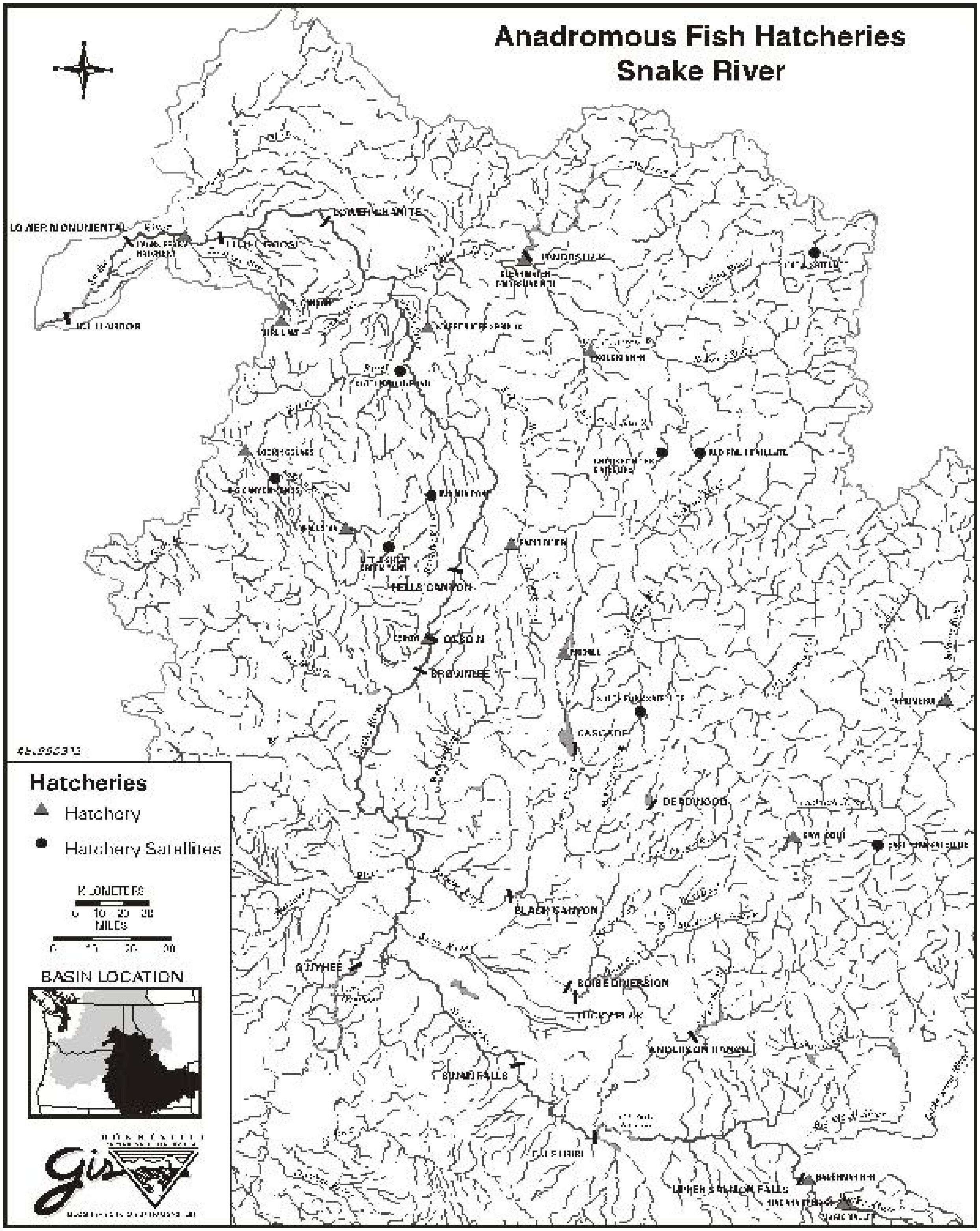


Figure 6. Anadromous fish hatcheries in the Willamette River Basin. Courtesy of BPA's Geographic Information Systems 1999.

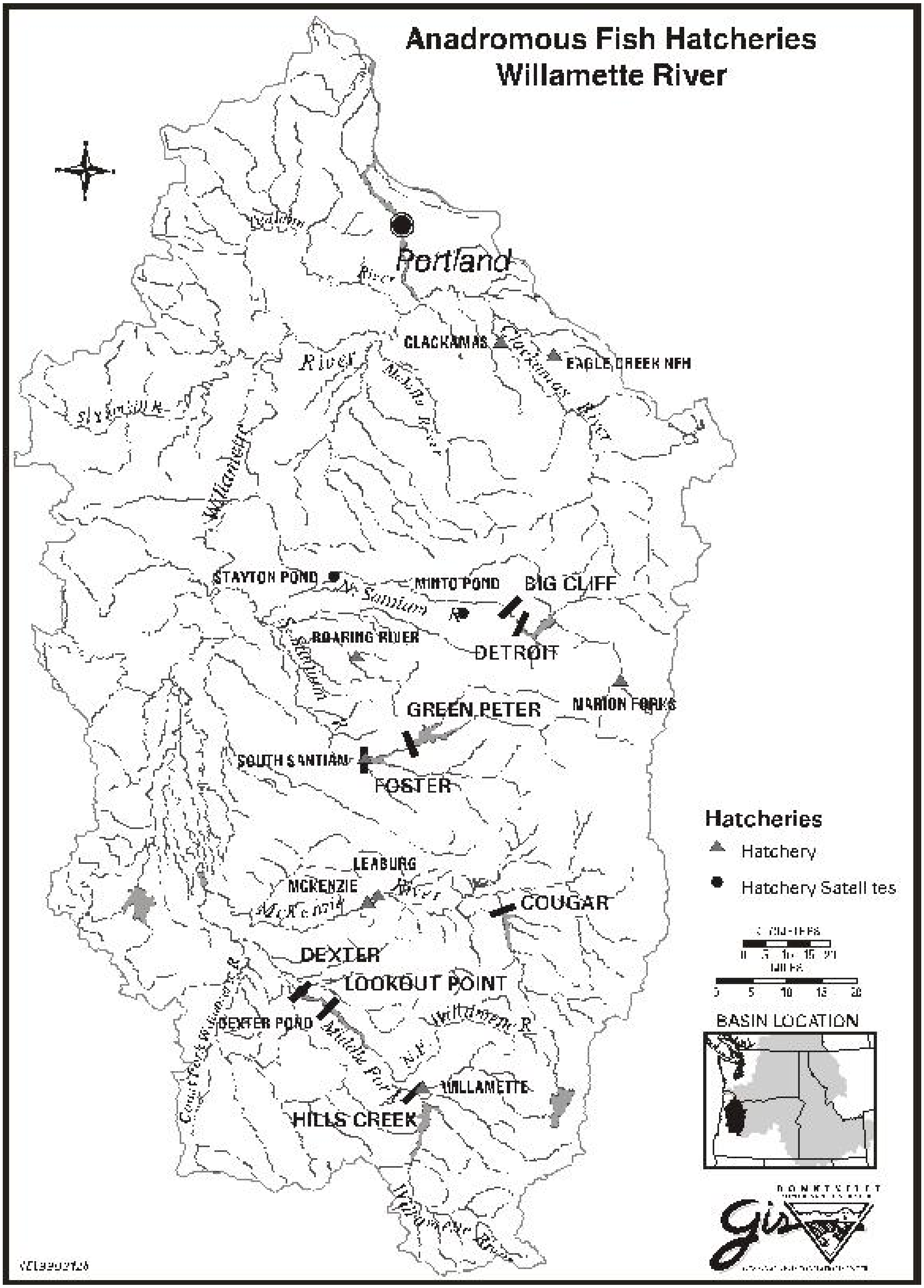


Table 1. Research and enhancement permits (issued pursuant to section 10(a)(1)(A) of the ESA) for hatchery programs in the Columbia River Basin not considered in this Opinion.

Agency	Permit #	Date Issued	Hatchery	Species	Release Locations
IDFG	919	6/16/94	Sawtooth	Snake River spring/summer chinook	Salmon River
IDFG	920	6/16/94	Sawtooth	Snake River spring/summer chinook	East Fork Salmon River
IDFG	921	8/2/96	McCall	Snake River summer chinook	South Fork Salmon River
IDFG	922	6/16/94	Pahsimeroi	Snake River summer chinook	Pahsimeroi River
IDFG	1010	8/22/97	Eagle, Sawtooth Manchester Marine	Snake River spring/summer chinook	Stanley Basin lakes and outlet streams
ODFW	1011	6/20/97	Lookingglass Bonneville Manchester Marine	Snake River spring/summer chinook	Upper Grande Ronde River Catherine Creek Lostine River
WDFW	1094	2/4/98	Wells Trout, Eastbank Winthrop, Chelan Turtle Rock, Ringold	Upper Columbia River summer steelhead	Methow River, Okanagon River Entiat River, Wenatchee River Columbia River mainstem
USFWS	1118	7/30/98	Winthrop	Upper Columbia River summer steelhead	Methow River
IDFG	1120	6/11/98	Eagle, Sawtooth Big Beef Creek Manchester Marine	Snake River sockeye	Stanley Basin lakes and outlet streams
ODFW	1128	not issued yet	Imnaha	Snake River spring/summer chinook	Imnaha River
WDFW	1129	not issued yet	Tucannon	Snake River spring/summer chinook Snake River fall chinook	Tucannon River
CRITFC	1147	7/14/98	McCall	Snake River summer chinook	South Fork Salmon River
NMFS	1148	9/2/98	Big Beef Creek, Manchester Marine, Bonneville	Snake River sockeye	Stanley Basin lakes and outlet streams
CRITFC	1149	not issued yet	Lookingglass	Snake River spring/summer chinook	Lostine River

A. Federal Actions

1. NMFS' Artificial Propagation Program

NMFS proposes to continue to fund the operation of 22 hatcheries and rearing ponds located in Oregon and Washington under authorization of the Mitchell Act. All 22 facilities are located outside of the Snake River Basin: two are located along the Columbia River upstream from its confluence with the Snake River, seven are located within the Bonneville Dam pool (four along Columbia River and three located on tributary streams), and sixteen are located below Bonneville Dam (one along Columbia River and fifteen located on tributary streams).

The Mitchell Act authorizes NMFS' support of hatchery programs within the Columbia River Basin. The Columbia River Fisheries Development Program (CRFDP) was established to administer projects initiated under the Mitchell Act. The hatchery complex supported by NMFS constitutes the largest hatchery program in the Columbia River Basin. The primary objective of the Mitchell Act is to provide for the conservation and maintenance of the fishery resources of the Columbia River.

NMFS proposes to release approximately 59,832,838 anadromous fish from the 22 facilities in 1999 (Table 2). Of the smolts proposed to be released, 7,443,338 are spring chinook salmon, 35,600,00 are fall chinook salmon, 14,510,000 are coho salmon, 2,110,000 are steelhead, 100,000 are chum and 69,500 are sea-run cutthroat trout. Refer to NMFS (1999b) for specific information on release locations and times at individual hatchery facilities.

Hatchery broodstock is collected at 20 hatchery facilities operated under the NMFS program. Approximately 140,000 to 300,000 adult anadromous fish have been collected in the past for broodstock each year at NMFS' hatcheries (Delarm and Smith 1989, 1991; Delarm and Wold 1984; Delarm et al. 1987). No sockeye salmon are collected at NMFS' hatcheries. Listed Snake River salmon are not targeted for collection. Refer to NMFS (1999b) for specific information on broodstock collection at individual hatchery facilities.

Carson National Fish Hatchery (NFH)

Carson NFH is located on the Wind River at the confluence of Tyee Creek, WA - 169.4 miles from the mouth of the Columbia River. It began operation in 1938 to rear and release chinook salmon and trout. Trout production was terminated in 1979. The hatchery was remodeled in 1956 under the Mitchell Act in an attempt to establish a spring chinook run in the Wind River. The hatchery has provided spring chinook eggs for re-establishing spring chinook runs in some Mid-Columbia River tributaries. The goal of the hatchery is to restore and maintain upriver Columbia River spring chinook salmon stocks and maintain tribal and sport fisheries.

The hatchery includes two ponds for adult holding, 46 concrete raceways, two rearing ponds, and incubation facilities. Water rights total 42,639 gpm from three sources: Tyee Creek, Tyee Spring, and the Wind River. The main water source for the hatchery is Tyee Creek; the Wind River is used as a secondary supply (Montgomery Watson 1997).

The production goals for Carson NFH are 1.42 million spring chinook salmon smolts for on-station release; 100,000 spring chinook salmon smolts for off-station release; and provide 500,000 spring chinook salmon fingerlings to Big White Salmon Ponds. The 1999 projected releases from Carson NFH are 1,420,000 million spring chinook smolts and a transfer of 100,000 spring chinook salmon smolts to the Umatilla River (NMFS 1999b).

Table 2. List of Federal and non-Federal hatchery programs considered in this Opinion. Locations are defined as: (1) Lower Columbia River, that portion of the Columbia River Basin below Bonneville Dam except for the Willamette River; (2) Middle Columbia River, that portion of the Columbia Basin from Bonneville Dam to Snake and Columbia rivers confluence; (3) Upper Columbia River, that portion of the Columbia River Basin above the confluence of the Snake and Columbia rivers; (4) Snake River Basin; and (5) Willamette River.

Action Agency	Hatchery	Location
USFWS	Abernathy	Lower Columbia River
NMFS	Eagle Creek	Lower Columbia River
NMFS	Big Creek	Lower Columbia River
NMFS	Bonneville (55%)*	Lower Columbia River
ODFW	Gnat Creek	Lower Columbia River
ODFW	Klaskanine	Lower Columbia River
NMFS	Sandy	Lower Columbia River
NMFS	Grays River	Lower Columbia River
NMFS	Elochoman	Lower Columbia River
NMFS	Kalama Falls/Lower Kalama Complex	Lower Columbia River
NMFS	Washougal	Lower Columbia River
NMFS	Toutle	Lower Columbia River
NMFS	Beaver Creek	Lower Columbia River
NMFS	Skamania	Lower Columbia River
BPA	Select Area Fisheries Evaluation	Lower Columbia River
USACE	Bonneville (45 %)*	Lower Columbia River
ODFW	CEDC	Lower Columbia River
ODFW	STEP Programs	Lower Columbia River
WDFW	Cowlitz Trout	Lower Columbia River
WDFW	Merwin	Lower Columbia River
WDFW	Volunteer Programs	Lower Columbia River
WDFW	Cowlitz Salmon	Lower Columbia River

Action Agency	Hatchery	Location
WDFW	Lewis River Salmon	Lower Columbia River
WDFW	Volunteer Programs	Lower & Middle Col. River
NMFS	Carson	Middle Columbia River
NMFS	Little White Salmon	Middle Columbia River
NMFS	Willard	Middle Columbia River
NMFS	Spring Creek*	Middle Columbia River
NMFS	Cascade	Middle Columbia River
NMFS	Oxbow	Middle Columbia River
NMFS	Klickitat	Middle Columbia River
USFWS	Warm Springs	Middle Columbia River
USFWS	Irrigon	Middle Columbia River
BPA	Umatilla	Middle Columbia River
ODFW	Round Butte	Middle Columbia River
ODFW	Oak Springs	Middle Columbia River
WDFW	Priest Rapids	Upper Columbia River
WDFW	Rocky Reach	Upper Columbia River
WDFW	Rock Island	Upper Columbia River
WDFW	Wells Salmon	Upper Columbia River
WDFW	Methow	Upper Columbia River
BPA	Cle Elum	Upper Columbia River
BPA	Lake Easton Satellite	Upper Columbia River
BPA	Clark Flats Satellite	Upper Columbia River
BPA	Prosser	Upper Columbia River
BPA	Marion Drain	Upper Columbia River
BIA	Cassimer Bar	Upper Columbia River
NMFS	Ringold Salmon	Upper Columbia River
NMFS	Ringold Trout	Upper Columbia River
USFWS	Leavenworth	Upper Columbia River

Action Agency	Hatchery	Location
USFWS	Entiat	Upper Columbia River
USFWS	Winthrop	Upper Columbia River
WDFW	Chelan	Upper Columbia River
WDFW	Eastbank	Upper Columbia River
WDFW	Wells	Upper Columbia River
USFWS	Wallowa Satellite (Irrigon)	Snake River Basin
USFWS	Lookingglass	Snake River Basin
	Big Canyon Satellite	Snake River Basin
	Imnaha Satellite	Snake River Basin
USFWS	Lyons Ferry Trout	Snake River Basin
	Cottonwood Pond Satellite	Snake River Basin
	Dayton Pond Satellite	Snake River Basin
	Tucannon Hat. Satellite	Snake River Basin
	Curl Lake Satellite	Snake River Basin
USFWS	Lyons Ferry Salmon	Snake River Basin
	Big Canyon Satellite	Snake River Basin
	Captain Johns Rapids	Snake River Basin
	Pittsburgh Landing	Snake River Basin
USFWS	McCall	Snake River Basin
	S.F. Salmon River Satellite	Snake River Basin
USFWS	Sawtooth	Snake River Basin
	E.F. Salmon River Satellite	Snake River Basin
USFWS	Clearwater	Snake River Basin
	Red River Satellite	Snake River Basin
	Crooked River Satellite	Snake River Basin
	Powell River Satellite	Snake River Basin
USFWS	Magic Valley	Snake River Basin
USFWS	Hagerman	Snake River Basin

Action Agency	Hatchery	Location
USFWS	Dworshak**	Snake River Basin
USFWS	Kooskia	Snake River Basin
IDFG	Niagara Springs	Snake River Basin
IDFG	Pahsimeroi	Snake River Basin
IDFG	Rapid River	Snake River Basin
IDFG	Oxbow	Snake River Basin
BPA	Cherrylane	Snake River Basin
	Yoosa/Camp Creek Satellite	Snake River Basin
	Mill Creek Satellite	Snake River Basin
	Newsome Creek Satellite	Snake River Basin
BPA	Sweetwater Springs	Snake River Basin
	Cedar Flats Satellite	Snake River Basin
	Luke's Gulch Satellite	Snake River Basin
	North Lapwai Valley Satellite	Snake River Basin
USACE	Dworshak**	Snake River Basin
ODFW	Wallowa	Snake River Basin
ODFW	Roaring River	Willamette River
USACE	Marion Forks	Willamette River
	Minto Pond Satellite	Willamette River
USACE	South Santiam	Willamette River
USACE	McKenzie River	Willamette River
USACE	Leaburg	Willamette River
USACE	Willamette	Willamette River
	Dexter Pond Satellite	Willamette River
NMFS	Clackamas	Willamette River

* Bonneville Hatchery - NMFS (55%) and USACE (45%) both support this facility.
Spring Creek - NMFS funds 50% of production costs and USACE 50%

** Dworshak Hatchery - USFWS (spring/summer chinook salmon) and USACE (steelhead) both support this facility.

Table 3. Projected hatchery releases of unlisted stocks from Federal and Non-Federal Programs in 1999 in the Columbia River Basin. Rainbow trout releases are not inlcuded in this table, but are described under the proposed hatchery section.

Agency	Spring Chinook	Fall Chinook	Coho	Steelhead	Chum	Sockeye	Sea-Run Cutthroat	Total
Federal Programs								
USFWS	8,046,500	2,375,000		5,255,000				**15,676,500**
NMFS	7,443,338	35,600,000	14,510,000	2,110,000	100,000		69,500	**59,832,838**
USACE	4,499,240	8,274,000		2,738,000				**15,511,240**
BPA	3,000,720	7,962,000	5,060,000	1,240,000				**17,262,720**
BIA			1,193,000			60,000		**1,253,000**
Total	**22,989,798**	**52,211,000**	**20,763,000**	**11,343,000**	**100,000**	**60,000**	**69,500**	**109,536,298**
Non-Federal Programs								
ODFW	320,000	530,700	2,393,000	515,140				**3,758,840**
WDFW	2,804,000	12,624,000	6,048,000	1,815,000	278,500	125,000	191,000	**23,885,500**
IDFG	3,200,000			2,180,000				**5,380,000**
Total	**6,324,000**	**13,154,700**	**8,441,000**	**4,510,140**	**278,500**	125,000		**33,024,340**
TOTAL	**29,313,798**	**67,365,700**	**29,204,000**	**15,853,140**	**278,500**	**320,000**	**191,000**	**142,560,638**

Little White Salmon NFH

The hatchery was originally constructed in 1896, began operations in 1898, and was remodeled and expanded in 1958. The hatchery is 159.8 miles from the mouth of the Columbia River. It is located where the Little White Salmon River, enters Drano Lake WA – a backwater area of the mainstem Columbia River that has supported a major fishery on upriver stocks of hatchery steelhead in the past (including substantial incidental catches and releases of wild steelhead). Some steelhead are collected at the hatchery trap and released back to the Columbia River. The opportunity exists for more development of terminal coho and chinook salmon fisheries at Drano Lake.

The Little White Salmon facility includes four ponds for adult holding, 52 concrete raceways of
various sizes, 10 starter tanks, and incubation facilities. Water rights total 33,868 gpm from the Little White Salmon River and springs. Water use for fish production ranges from 11,221 gpm to 28,232 gpm (Montgomery Watson 1997). The river supplies most of this water flow. A water re-use system was constructed in 1967 for egg incubation.

Production goals for Little White Salmon NFH are 1.0 million spring chinook for on-station release; 2.0 million upriver bright (URB) fall chinook subyearlings for on-station release; 3.4 million URB chinook subyearlings for release above John Day Dam; and provide incubation facilities for 3.0 million coho eggs. Of the 3.4 million URB fall chinook subyearlings for release above John Day Dam, 1.7 million are reared at Little White Salmon NFH and transferred to the YIN at their Prosser facility. The remaining 1.7 million are reared and released at Priest Rapids Fish Hatchery with USACE funding through the Little White Salmon NFH. Projected 1999 on station releases total 1,090,000 spring chinook smolts and 2.0 million URB fall chinook subyearlings on station (NMFS 1999b).

Willard NFH

Willard NFH was authorized by the Mitchell Act in 1946 and constructed in 1952. It began operations in 1952. The facility was originally planned as a fall chinook hatchery but was switched to spring chinook and coho because of cold water temperatures, and then switched completely to coho in the mid-1960's. The Willard facility includes 50 concrete raceways, 52 starter tanks, with incubation facilities provided by Little White Salmon NFH. Water use at the hatchery ranges from 11,221 to 24,442 gpm with most of the water supplied by the Little White Salmon River (Montgomery Watson 1997). Well water is used for incubation and temperature control during early rearing.

The production goal is 2.0 million coho smolts for on-station release. A total of 2,120,000 coho smolts are projected to be released in 1999 and 510,000 coho smolts are to be released into the Clearwater River Basin (NMFS 1999b).

Eagle Creek NFH

Eagle Creek NFH was authorized under the Mitchell Act and began operating in 1956 as part of the Columbia River Fisheries Development Program. It is located on Eagle Creek, a tributary to the Clackamas River, Oregon - 144.9 miles from the mouth of the Columbia River. The goal of the hatchery is to help compensate for fish losses in the Columbia River Basin caused by mainstem dams. The Eagle Creek facility includes one pond for adult holding, 75 concrete raceways, 10 starter tanks, and incubation facilities. Water rights total 116,730 gpm (260 cfs), almost all from Eagle Creek, approximately 150 cfs of the water right was for power generation and is not used for fish. A spring is used for incubation (Montgomery Watson 1997).

All coho released on-station are mass-marked to facilitate selective fisheries. About 400,000 subyearlings are transferred to the Yakima River Basin annually for tribal restoration programs and are not mass-marked. Juveniles are also provided to the Select Area Fisheries Evaluation (SAFE) over-wintering program for lower river terminal fisheries. Both these programs are described under BPA's Artificial Propagation Program section.

The production goals for Eagle Creek include 1 million coho smolts for on-station releases; 1 million coho smolts for transfer to net-pens in Youngs Bay; up to 1 million coho fingerlings for transfer to the Yakama Indian Nation; 200,000 winter steelhead smolts for on-station releases; 20,000 winter steelhead yearlings for transfer to net-pens at Oregon City; and 70,000 winter steelhead fry for transfer to the Clackamas Hatchery. The 1999 estimated releases from Eagle Creek NFH are 1.15 million coho smolts and 200,000 winter steelhead into Eagle Creek (NMFS 1999b).

Spring Creek NFH

Spring Creek NFH was constructed in 1900 and began operating in 1901. It was remodeled in 1955 under Mitchell Act authorization as part of the Columbia River Fisheries Development Program. In 1970, the USACE razed and remodeled most of the facility as partial mitigation for fishery losses caused by construction of the John Day Dam. The hatchery is located along the Columbia River at Underwood, WA, approximately 30 miles upstream of Bonneville Dam. This hatchery provides fish to the ocean and river fisheries and maintain the tule fall chinook stock originating from the Big White Salmon River. Hatchery facilities include 44 Burrows ponds, 30 troughs and one circular pond. Water rights total 12,290 gpm from an unnamed creek, two springs, one well and the Columbia River. The Columbia River accounts for approximately 50% of the water right and is only used as a heat source when production water needs heating to accelerate fish growth (IHOT 1996c).

The production goal for Spring Creek NFH is 15.1 million tule fall chinook salmon smolts for release in March, April, and May. Fry in excess of the hatchery's rearing capacity are placed in a holding pond and released into the Bonneville Pool in December. The 1999 estimated release from Spring Creek NFH is 10,700,000 tule fall chinook salmon smolts (NMFS 1999b).

Big White Salmon River Ponds is a satellite facility for Spring Creek NFH. It is located on the

Big White Salmon River (below Condit Dam) - 166.5 miles from the mouth of the Columbia River. The 1999 projected releases from the Big White Salmon Ponds are 500,000 sub-yearling and yearling spring chinook salmon.

Bonneville Hatchery

Bonneville Hatchery was constructed in 1909 and was originally funded by the State of Oregon. It is located at Tanner Creek on the mainstem Columbia River, below Bonneville Dam, OR - 140.9 miles from the mouth of the Columbia River. In 1957, the facility was remodeled and expanded as part of the Columbia River Fisheries Development Program. The Bonneville Hatchery facility includes four adult holding ponds, 30 converted Burrows ponds, 30 raceways, and incubation facilities. The water supply is gravity fed from Tanner Creek.

The hatchery underwent another renovation in 1974 as part of the USACE's mitigation of fish losses from the construction of the John Day Dam. It currently receives operations funding from both the Mitchell Act and the USACE (John Day Dam Mitigation). This hatchery provides fish for the ocean and river fisheries and eggs to other programs.

Bonneville Hatchery's production goal includes 2,900,000 URB fall chinook eggs to the Umatilla Hatchery; 2,830,000 URB fall chinook fingerlings for release in the Columbia River; 5,325,000 URB fall chinook smolts and fingerlings for on-station releases; 225,000 URB fall chinook smolts for release in the Umatilla River; 125,000 spring chinook smolts (Deschutes stock) for release into the West Fork Hood River; and 1,175,00 coho smolts for on-site release.

In 1999, Bonneville Hatchery under programs funded by the NMFS, proposes to release 1,175,000 coho smolts; 335,000 winter steelhead smolts; and 175,000 summer steelhead smolts (NMFS 1999b).

Bonneville Hatchery also plays a large role in the Grande Ronde River Basin endemic spring chinook captive broodstock program (Table 1, Permit 1011). Since Permit 1011 is for directed take of listed Snake River spring/summer chinook, the production, rearing and release of spring chinook is not covered in this Opinion.

Big Creek Hatchery

Big Creek Hatchery began operation in 1941 as a state-funded facility. It was refurbished in 1957 under the Mitchell Act as part of the Columbia River Fisheries Development Program. The facility is located on Big Creek, OR - 29.2 miles from the mouth of the Columbia River. It is approximately three miles upstream from Big Creek's confluence with the Columbia River, about 16 miles east of Astoria. The Big Creek facility includes two ponds for adult holding, 30 concrete raceways, one rearing pond, two Canadian troughs, and incubation facilities. There are four water sources for the hatchery: Big Creek, Mill Creek, and two springs. Current water rights total 36,158 gpm plus an additional 4.2 cfs reservoir water right (Montgomery Watson 1997).

The purpose of the hatchery is to produce adult salmon and cutthroat trout that will contribute to Northeast (NE) Pacific and Columbia River Basin commercial and sports fisheries. The Rogue River Fall chinook program is not funded under Mitchell Act. It is covered under the BPA SAFE section 7 permit and is described in BPA's Artificial Propagation Program section.

Big Creek's production goals are 5,700,000 fall chinook smolts (Big Creek Stock) and 5,200,000 fingerlings for on-station release; provide 6,810,000 fall chinook eggs for other ODFW programs; 1,000,000 fall chinook (Big Creek/Rogue Stock) smolts for on-station release; 535,000 coho smolts for on-station release; 60,000 coho smolts for release into the Tualatin River; 60,000 smolts winter steelhead for on-station release; 63,000 winter steelhead smolts for transfer to Klaskanine Hatchery; provide 557,300 winter steelhead eggs for other ODFW programs; and produce sea-run cutthroat when adults are available (NMFS 1999b).

Projected 1999 releases from Big Creek Hatchery include 5,200,000 tule fall chinook; 595,000 coho salmon smolts; and 110,000 winter steelhead (NMFS 1999b).

Cascade Hatchery

Cascade Hatchery was authorized under the Mitchell Act and began operating in 1959 as part of the Columbia River Fisheries Development Program. It is located at Eagle Creek on the mainstem Columbia River, above Bonneville Dam, Oregon - 143.0 miles from the mouth of the Columbia River. The primary goal of the hatchery is to produce coho salmon to help meet the production quotas for the Columbia River Fisheries Development Program (*U.S. v. Oregon*).

The Cascade facility includes one pond for adult holding, 30 concrete raceways, and incubation facilities. Water is supplied by gravity from Eagle Creek. The total water right is 20,197 gpm and the average water usage is about 7,117 gpm. (Montgomery Watson 1996).

The production goals at Cascade Hatchery are 700,000 coho smolts for release into the Yakima River; 1,000,000 coho smolts for release into the Umatilla River; 1,587,000 coho eggs to Oxbow Hatchery; 2,100,000 coho fingerlings for transfer to Upper Herman Creek Ponds (Oxbow Hatchery); and 500,000 coho fingerlings for transfer to Lower Herman Creek Ponds (Oxbow Hatchery). The 1999 projected production from Cascade Hatchery is 1,000,000 coho salmon smolts to the Umatilla for acclimation and release and 700,000 coho salmon smolts to the Yakima Basin for release.

Clackamas Hatchery

Clackamas Hatchery began operation in 1979 and is operated from four funding sources: ODFW, NMFS, Portland General Electric, and the City of Portland. The NMFS funding is part of the Columbia River Fisheries Development Program (Mitchell Act). Portland General Electric and City of Portland provide funding as mitigation for fishery losses caused by hydroelectric development in the Sandy and Clackamas river systems. Located on the Clackamas River, OR - 144.9 miles from the mouth of the Columbia River. Clackamette Cove net-pens, Marmot Ponds, and Hublou net-pens are operated as satellite facilities to Clackamas Hatchery. All spring chinook are mass-marked to facilitate a selective lower Willamette River fishery on hatchery spring chinook.

The Clackamas facility includes three ponds for adult holding, 10 concrete raceways, three rearing ponds, and incubation facilities. Water rights total 44,354 gpm form the Clackamas River and a well. The Clackamas River provides the majority of water used for hatchery operations (Montgomery Watson 1996).

Production goals for Clackamas Hatchery are 1,781,000 spring chinook eggs to other ODFW hatcheries and the Salmon and Trout Enhancement Program (STEP); 976,670 spring chinook smolts for on-station releases into the Clackamas River; 50,000 spring chinook smolts for release into the Clackamas River from the Clackamette Cove net-pens; 30,000 spring chinook smolts for release into the Clackamas River from the Hublou Harbor net-pens; 360,000 spring chinook smolts for release into the Sandy River; 100,000 spring chinook smolts for release into Sandy River from the Marmot acclimation pond; 30,000 winter steelhead smolts for on-station releases into the Clackamas River; 30,000 winter steelhead smolts for release into the Sandy River. Total releases from Clackamas Hatchery in 1999 include 2,033,338 spring chinook smolts, 120,000 winter steelhead and 175,000 summer steelhead (NMFS 1999b).

Oxbow Hatchery (Herman Creek, Lower Herman Creek Satellites)

Oxbow Hatchery was originally constructed in 1913 to provide additional rearing facilities for Bonneville Hatchery. It was relocated to its present site in 1937 following construction of Bonneville Dam. Oxbow has been operated as part of the Columbia River Fisheries Development Program. The facility is located at Oxbow Springs on the mainstem Columbia River, OR - 148.3 river miles upstream from the mouth. The Oxbow Hatchery includes 12 concrete raceways, incubation, and early rearing facilities. The hatchery obtains its water supply from Oxbow Springs through gravity flow. The Oxbow Springs flow dwindles to about 300 gpm in the summer and fall and is not used for rearing fish during that period (Montgomery Watson 1996).

Herman Creek Ponds and Lower Herman Creek Ponds are operated as satellite facilities to Oxbow Hatchery. The goal of the hatchery is to produce coho and spring chinook salmon that will contribute to the NE Pacific and Columbia River commercial, tribal, and sports fisheries.

The production goals for Oxbow Hatchery are 2 million coho fingerlings at Upper Herman Creek for transfer to Bonneville; 825,000 coho fingerlings (Tanner Creek stock) at Lower Herman Creek Ponds for transfer to Lower Columbia River net-pens; 600,000 coho fingerlings at Lower Herman Creek Ponds (Tanner Creek and Sandy River stocks) for transfer to Lower Columbia River net-pens; 500,000 coho smolts at Lower Herman Creek Ponds for release into the Umatilla River; and 637,000 spring chinook fingerlings for transfer to Clackamas Hatchery (NMFS 1999b).

There are no planned releases of hatchery fish from Oxbow Hatchery in 1999.

Sandy Hatchery (Marmot Pond Satellite)

Sandy Hatchery began operation in 1951 as a state-funded facility. It is located on Cedar Creek, in the Sandy River Basin, Oregon - 139.4 miles from the mouth of the Columbia River. In 1959, the hatchery became part of the Columbia River Fisheries Development Program. The Sandy facility includes one pond for adult holding, 20 concrete raceways, and incubation facilities. Water rights total 12,577 gpm from a spring and Cedar Creek. Water is supplied to the hatchery by gravity flow from Cedar Creek with a high flow of 8,000 gpm in March and a low flow of 1,800 gpm in July and August (Montgomery Watson 1996). A small amount of spring water is also used. Water is recirculated in the rearing ponds during the summer months. Adult holding ponds are supplied with water from the rearing ponds.

Sandy Hatchery has the following production goals: 1,000,000 coho smolts for on-station release; provide 2,000,000 green eggs to the Eagle Creek NFH as a backup to its program; provide 2,445,450 coho eyed eggs to McKenzie, Oxbow and Klamath hatcheries, Oregon's STEP, and Oregon State University. All of the coho production at Sandy Hatchery is mass-marked to facilitate selective fisheries. In 1999, Sandy Hatchery proposes to release 100,000 spring chinook, 780,000 coho smolts, and 50,000 winter steelhead (NMFS 1999b).

Grays River Hatchery

The hatchery was authorized under the Mitchell Act and began operating in 1961 as part of the Columbia River Fisheries Development Program. Located on West Fork Grays River, WA - 37.4 miles from the mouth of the Columbia River. The Grays River facility includes two ponds for adult holding, 10 concrete raceways, one rearing pond, and incubation facilities. Water rights total 22,448 gpm from three sources: the West Fork Grays River, an unnamed stream, and wells (Montgomery Watson 1997). Most of the water is supplied by gravity flow from an intake located approximately 0.5 miles upstream from the hatchery. During the summer and fall months, virtually the entire river flow is diverted for hatchery use.

The production goals for Grays River include 1,200,000 fall chinook subyearlings for on-station release; provide fall chinook eggs/fish to other facilities; 150,000 coho yearlings for on-station; provide coho eggs/fish to other facilities; and produce varying number of winter and summer steelhead yearlings for release in local streams release (NMFS 1999b). The 1999 estimated releases are 37,000 winter steelhead; 140,000 coho smolts; and 100,000 chum smolts (NMFS 1999b).

Elochoman Hatchery

Elochoman Hatchery was authorized under the Mitchell Act and began operating in 1954 as part of the Columbia River Fisheries Development Program. It is located on Elochoman River, WA - 44.0 miles from the mouth of the Columbia River. The Elochoman facility includes 20 raceways, three large ponds, and incubation facilities. Water rights total 20,583 gpm from four sources: the Elochoman River, one well, a small, unnamed steam, and Clear Creek (Montgomery Watson 1997).

The production goals for the hatchery are 4 million tule fall chinook subyearlings for on-station release; 325,000 tule fall chinook egg/fish to co-op programs; 500,000 coho yearlings (Type S) for on-station release; 1,200,000 coho (Type N) yearlings for on-station release; and provide coho egg/fish (surplus to on-station needs) to other facilities. Projected releases from the hatchery in 1999 are 2,000,000 fall chinook, 900,000 coho salmon smolts, 30,000 summer steelhead smolts, 100,000 winter steelhead smolts and 40,000 sea-run cutthroat smolts (NMFS 1999b).

Beaver Creek Hatchery (Gobar Pond Satellite)

Beaver Creek Hatchery was authorized under the Mitchell Act and began operating in 1957 as part of the Columbia River Fisheries Development Program. The Beaver Creek facility includes two ponds for adult holding, 20 concrete raceways, one earthen rearing pond, 10 intermediate raceways, and incubation facilities. Water rights total 16,013 gpm from three sources: Elochoman River, Beaver Creek, and a well. Beaver Creek is gravity flow while the other two sources are pumped (Montgomery Watson 1997). The Elochoman River is used in summer and fall while Beaver Creek water is used from mid-November through mid-May. Filtered well water (1 cfs) is used to incubate eggs and for early rearing.

Beaver Creek Hatchery's production goals are 260,000 winter steelhead smolts for on-station and off-station releases; 230,000 summer steelhead smolts for on-station and off-station releases; and 50,000 sea-run cutthroat smolts for on-station and off-station releases. A total of 1,500,000 fall chinook smolts; 84,000 winter steelhead; and 115,000 summer steelhead are proposed to be released in 1999 (NMFS 1999b).

North Toutle River Hatchery

The hatchery was authorized under the Mitchell Act and began operation as part of the Columbia River Fisheries Development Program. It is located on North Toutle (Green) River, Cowlitz River Basin, WA - 118.5 miles from the mouth of the Columbia River. The hatchery began operating in 1951, but was destroyed in the 1980 eruption of Mount St. Helens. Hatchery operations were reestablished in 1985. The goal of the hatchery is to produce adult fall chinook and coho that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries. The North Toutle facility includes one pond for adult holding, 14 concrete raceways, two rearing ponds, and incubation facilities. Water rights for the hatchery total 26,031 gpm from the Green River (Montgomery Watson 1997).

The production goals for the hatchery are 2,500,000 subyearling tule fall chinook for on-station release and 1,100,000 yearling coho (Type S) for on-station release. Projected releases in 1999 are 2,500,000 tule fall chinook; 100,000 spring chinook; 1,100,000 coho; and 25,000 summer steelhead (NMFS 1999b).

Kalama Falls Hatchery

Kalama Falls Hatchery was authorized under the Mitchell Act and began operation in 1958 as part of the Columbia River Fisheries Development Program. The hatchery is located on Kalama River, WA - 81.1 miles from the mouth of the Columbia River. A fish trap at Kalama River mile 1 captures all salmonids: hatchery steelhead are retained and released in the lower River for a sports fishery; wild steelhead are passed above to natural production areas. The goal of the hatchery is to produce Lower Columbia River fall chinook, spring chinook, and coho salmon that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries. Other Mitchell Act facilities in the Kalama River system are Fallert Creek and Gobar Pond - the operation of these facilities is coordinated as the Kalama River complex. Gobar Pond has also been used as a satellite for Beaver Creek Hatchery, Elochoman River.

The Kalama facility includes six ponds for adult holding (also used for rearing), 12 concrete raceways, and incubation facilities. Water rights total 8,055 gpm from four sources: Kalama River, two unnamed creeks and a domestic water well (Montgomery Watson 1997). The majority of water is supplied from the Kalama River with the two unnamed creeks providing seasonal water.

The production goals at the Kalama Hatchery are 550,000 spring chinook yearlings for the Lower Kalama Hatchery for extended rearing and release; 3,500,000 fall chinook subyearlings for on-station release; provide fall chinook eggs/fish to other facilities; and 900,000 coho (Type N) for on-station release (NMFS 1999b). A total of 3,500,000 fall chinook, 900,000 coho, 60,000 summer steelhead and 60,000 winter steelhead are estimated to be released in 1999 from the hatchery.

Fallert Creek Hatchery (Lower Kalama Falls)

Fallert Creek Hatchery began operation in 1895 and is one of the oldest hatcheries in the Columbia River Basin. It is located at Fallert Creek, Kalama River Basin, WA - 75.5 miles from the mouth of the Columbia River. The facility is operated as part of the Kalama Falls complex; it is used for final rearing. Facilities operations are funded as part of the Mitchell Act. The hatchery goal is to produce lower river fall chinook, spring chinook, and coho salmon that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries.

The Fallert Creek facility includes one pond for adult holding (also used for rearing), eight concrete raceways, one rearing pond, and incubation facilities. Facility water rights total 15,112 gpm from two sources: Kalama River and Fallert Creek (Montgomery Watson 1997). The hatchery water supply comes from the Kalama River by pumping and from Fallert Creek by gravity flow.

The production goals at the hatchery include 500,000 spring chinook yearlings for on-station release; 2,000,000 fall chinook subyearlings for on-station release; provide fall chinook eggs/fish to other facilities; 525,000 coho yearlings (Type S) for on-station release; and provide eggs/fish to other facilities (NMFS 1999b). The 1999 projected release from Fallert Creek Hatchery is 500,000 spring chinook.

Lewis River Hatchery/Speelyai Hatchery

The hatchery is located adjacent to the Lewis River, three miles downstream from Merwin Dam. Speelyai Hatchery is operated as a satellite facility to the Lewis River Hatchery. It is located in a mountainous area at the upper end of Lake Merwin on the Lewis River. Lewis River and Speelyai hatcheries were originally constructed to provide mitigation for hydroelectric system development in the Lewis River System. An almost total remodel at Lewis River Hatchery was funded with state enhancement funds in 1979 and 1980. The goal of the hatchery is to produce adult coho and spring chinook salmon that will contribute to NE Pacific and Columbia River Basin sport and commercial fisheries. These facilities operate under NMFS and WDFW funding.

The Lewis River facility includes 12 concrete raceways, two rearing ponds, and incubation facilities. The Speelyai facility includes one adult holding pond, 12 concrete raceways, and one rearing pond. Lewis River Hatchery water rights total 38,613 gpm from three sources: the Lewis River, an unnamed stream, and Colvin Creek (Montgomery Watson 1997). Speelyai Hatchery water rights total 6,732 gpm from Speelyai Creek.

The Lewis River Hatchery production goals are 900,000 spring chinook yearlings for on-station release; 2,100,000 coho yearlings (Type N) for on-station release; 50,000 coho eggs to co-op programs; provide eggs and fish to other facilities; 1,400,000 coho yearlings (Type S) for on-station release; 1,000,000 coho yearlings for upriver release; 870,000 coho yearlings (from Speelyai Hatchery) for on-station release; provide 14,000 coho eggs to co-op programs; provide coho eggs and fish to other facilities. The Speelyai Hatchery production goals are 315,000 spring chinook yearlings for transfer to Lewis River Hatchery; 200,000 coho yearlings (Type S) for release into Lake Merwin; and provide 31,000 coho eggs/fish to co-op programs. The 1999 projected releases from Lewis River include 1,300,000 coho salmon smolts. The remaining releases are described in WDFW Artificial Propagation Program section.

Washougal River Hatchery

The Washougal Hatchery was authorized under the Mitchell Act and began operating in 1959 as part of the Columbia River Fisheries Development Program. It is located on Washougal River, WA - 140.9 miles from the mouth of the Columbia River. The goal of the hatchery is to produce lower river fall chinook and coho salmon that will contribute to NE Pacific and Columbia River Basin commercial and sports fisheries while providing adequate escapement for hatchery production. The Washougal facility includes one pond for adult holding, 24 concrete raceways, three earthen ponds, and incubation facilities. Water rights total 15,061 gpm from four sources: Washougal River, Bob Creek, Boyle Creek, and C-Creek (Montgomery Watson 1997).

Washougal Hatchery's production goals are 6 million tule fall chinook subyearlings for on-station release; provide 500 tule fall chinook eggs/fish to co-op programs; provide tule fall chinook eggs/fish to other facilities; 500,000 coho yearlings (Type N) for on-station release; provide 220,000 coho eggs/fish to co-op programs; and 2.5 million coho yearlings for release into the Klickitat River as per *U.S. v. Oregon* (NMFS 1999b). The 1999 estimated releases from Washougal Hatchery include 4,000,000 tule fall chinook, 3,000,000 coho salmon smolts, 125,000 summer steelhead smolts, 125,000 winter steelhead smolts and 29,500 sea-run cutthroat smolts.

Skamania Hatchery

Skamania Hatchery is located the North Fork Washougal River about 0.5 mile above the Washougal River. It was authorized under the Mitchell Act and began operating in 1956 as part of the Columbia River Fisheries Development Program. The goal of the hatchery is to produce winter steelhead, summer steelhead, and sea-run cutthroat for harvest by sport anglers. The Skamania facility includes three ponds for adult holding, 10 intermediate concrete raceways, 32 concrete raceways, and incubation facilities. Water rights total 11,670 gpm from two sources: North Fork Washougal River and Vogel Creek (Montgomery Watson 1997). The Washougal River provides most of the water used by the hatchery. Actual water use averages 9,800 gpm and ranges from 6,650 to 11,460 gpm. Vogel Creek water is used for incubation and early rearing, while Washougal River water is used thereafter until spring release.

The production goals for Skamania Hatchery are 315,000 winter steelhead smolts for on-station and off-station releases; 200,000 winter steelhead eyed eggs to Vancouver Hatchery; 300,000 summer steelhead smolts for on-station and off-station releases; provide 400,000 summer steelhead eyed eggs to Beaver Creek Hatchery; 400,000 summer steelhead eyed eggs to Vancouver Hatchery; and 50,000 sea-run cutthroat smolts for on-station and off-station releases (NMFS 1999b). A total of 199,000 winter steelhead and 130,000 summer steelhead are projected to be released from Skamania Hatchery in 1999.

Klickitat Hatchery

Klickitat Hatchery was authorized and constructed under the Mitchell Act and began operation as part of the Columbia River Fisheries Development Program. It is located on the Klickitat River - 218.6 miles from the mouth of the Columbia River. The purpose of the hatchery is to produce URB fall chinook, Type-N coho, and spring chinook that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries. The Klickitat facility includes one pond for adult holding, 22 concrete raceways, 12 vinyl raceways, three rearing ponds, and incubation facilities. Water rights total 28,338 gpm from four sources: Indian Ford Springs, an unnamed spring (designated Indian Ford "B"), Wonder Springs, and the Klickitat River. (Montgomery Watson 1997).

The hatchery's production goals are 600,000 spring chinook yearlings for on-station release; 1,200,000 spring chinook subyearlings for release into the Upper Klickitat River; 4,000,000 URB fall chinook subyearlings for on-station release; and 1,350,000 coho yearlings (Type N) for on-station releases. In 1999, the Klickitat Hatchery proposes to releases 4,000,000 URB fall chinook, 600,000 spring chinook, 1,350,000 coho salmon smolts, and 120,000 summer steelhead smolts (NMFS 1999b).

Ringold Springs Hatchery

Ringold Springs Hatchery serves as an adult collection, rearing, and release facility for spring chinook, rearing and release for summer steelhead, and final rearing and release for fall chinook. salmon. It is located on the mainstem Columbia River, WA - 348.3 miles from the mouth of the Columbia River. The hatchery is about 17 miles west of Mesa, WA. The Ringold Springs spring chinook facilities include a 9-acre earthen rearing pond and 14 vinyl raceways. Summer steelhead rearing facilities consist of a 4.8-acre earthen pond. The facility water supply consists of a gravity-flow, spring supply of approximately 27,000 gpm (Montgomery Watson 1996).

Ringold Springs Hatchery's production goals are 1,100,000 spring chinook smolts; final rearing for 3,500,000 URB fall chinook; and 180,000 summer steelhead smolts (NMFS 1999b). In 1999, Ringold Springs Hatchery proposes to release 1,100,000 spring chinook and 187,000 listed Wells Hatchery summer steelhead. The Wells Hatchery summer steelhead are included in a section 10 directed take permit issued to WDFW on February 4, 1998 (Table 1).

2. USFWS' Artificial Propagation Program

USFWS proposes to operate 16 hatcheries and 12 satellite facilities and conduct evaluation studies associated with those facilities. Eleven of the hatcheries, ten Lower Snake River Compensation Plan (LSRCP) hatcheries and one additional hatchery, are located within the Snake River Basin. Three are located on Columbia River tributaries above the Snake River confluence, one is located on a tributary to the Deschutes River (Columbia River confluence above The Dalles Dam) and one is located in the Lower Columbia River. All of the satellite facilities are located within the Snake River Basin and are operated under the LSRCP.

The ten LSRCP hatcheries were authorized by the Water Resources Development Act of 1976 to mitigate losses caused by the construction and operation of the four lower Snake River dams and navigation lock projects. Production levels are based on the number of juvenile fish needed to compensate for losses of adult salmon and steelhead at the four lower Snake River hydroelectric projects. Eggs are obtained for the production program by trapping adults at hatchery weirs.

The three USFWS hatcheries located on Upper Columbia River tributaries were authorized by the Grand Coulee Fish Maintenance Project, April 3, 1937, and re-authorized by the Mitchell Act. The fishery objectives were identified as: (1) to bring, by stream rehabilitation and supplemental planting, the fish populations in the 677 miles of tributary streams between Grand Coulee Dam and Rock Island Dam up to figures commensurate with earlier undisturbed conditions; and (2) to produce in addition, by the combination of artificial spawning, feeding, rearing and planting in these streams, a supplemental downstream migration equivalent to that normally produced by the 1,245 miles of streams and tributaries above Grand Coulee Dam (USFWS 1993). The Warm Springs Hatchery in the Deschutes River Basin is operated to enhance salmon fisheries for the Confederated Tribes of the Warm Springs Indian Reservation.

USFWS is proposing to release 15,676,500 anadromous fish in 1999. Of this number, 6,986,500 are spring chinook salmon, 1,060,000 are summer chinook salmon, 2,375,000 are fall chinook salmon (all released in Snake River Basin), and 5,255,000 are steelhead. In addition, the USFWS is proposing to conduct steelhead monitoring and evaluation studies in the Columbia River Basin for their hatchery programs.

USFWS proposes to collect broodstock at ten hatcheries and 13 satellite facilities in the Columbia River Basin. Six of the hatcheries and all of the satellite facilities are located within the Snake River Basin. Three hatcheries are located in the Upper Columbia River Basin above the Snake and Columbia rivers confluence. One hatchery is located in the Middle Columbia River Basin, on a tributary to the Deschutes River and the other one is located in the Lower Columbia River on Abernathy Creek. Steelhead, spring/summer chinook salmon and fall chinook salmon are the species collected for hatchery broodstock. Refer to USFWS (1993, 1994, 1998a) for specific information on broodstock collection at individual hatcheries.

Artificial propagation programs funded by the USFWS are currently in negotiations with the *U.S. v Oregon* parties. The federal agencies (NMFS and USFWS 1999) submitted a draft proposal called the Fed-1 Plan for Artificial Propagation (January 7, 1999) for consideration to the parties that outlined changes to existing production programs to conserve endemic (listed) populations while at the same time protect important fishery-related benefits to programs that do not jeopardize listed salmon and steelhead. While the negotiations have not been completed, the USFWS will continue to modify its hatchery programs to meet Tribal Trust, mitigation/compensation and ESA responsibilities. The USFWS will use the proposed Fed-1 Plan for Artificial Propagation as the basis for meeting its responsibilities until the *US v. OR* parties have completed their negotiations.

Abernathy Salmon Culture Technology Center

The facility was originally established as a National Fish Hatchery under provisions of the Mitchell Act. The hatchery began operations in 1960 and in 1961, when fall chinook research activities at the Salmon Culture Laboratory in Entiat, Washington were transferred to this facility. Abernathy Salmon Culture Technology Center is currently funded and operated by the USFWS as a research facility. This facility is not funded by Mitchell Act in 1999, and is not scheduled for NMFS funding in the future.

The hatchery is located along Abernathy Creek, approximately three miles upstream from the creek's confluence with the Columbia River. The facility includes one pond for adult holding, 12 concrete raceways, 92 circular starter tanks, six troughs, and incubation facilities. Water rights total 20,600 gpm from Abernathy Creek and one well (Montgomery Watson 1996). Actual water use averages about 6,000 gpm from Abernathy Creek and 300 gpm from the well.

The production goal for Abernathy is 1.5 million subyearling tule fall chinook for on-station release. The 1999 projected release is 475,000 tule fall chinook.

Lyons Ferry Hatchery

Lyons Ferry Hatchery started operation in 1984. This hatchery is a LSRCP facility that produces summer steelhead, fall and spring chinook salmon. The hatchery is used for collection of adult fall chinook and summer steelhead, egg incubation of fall chinook, spring chinook, steelhead, and rainbow trout and rearing of all four species. The purpose of the spring chinook program is to assist in the recovery of the native Tucannon spring chinook while maintaining the genetic integrity of the wild spring chinook. These activities are done in conformance with the ESA Salmon Recovery Plan and tribal agreements. The fall chinook program is an egg bank program for Snake River fall chinook to provide fish for mitigation/compensation, natural production (recovery above Lower Granite Dam), and Tribal Trust responsibilities. The steelhead program is designed to provide in-river fisheries and the rainbow trout program is designed to replace stream-fishing opportunities.

Production goals are 450,000 yearling smolts for on-station release and 450,000 fall chinook yearling smolts for acclimated release above Lower Granite Dam (NPT) and 2.1 million subyearlings for release above Lower Granite Dam or at Lyons Ferry; 132,000 spring chinook fingerlings for transfer to Tucannon Hatchery for final rearing and release; and 931,200 summer steelhead smolts for on-station release and for release from satellite facilities. The hatchery also rears 237,500 legal-sized and 200,000 sub-legal rainbow trout (108,000 lb) to provide recreational fisheries in Idaho. Water is supplied to the hatchery from wells. No river water is currently being used.

Several satellite facilities are operated in conjunction with Lyons Ferry Hatchery, including: Tucannon Hatchery (spring chinook, trout, and steelhead programs) Curl Lake Rearing Pond on the Tucannon River (spring chinook program), Cottonwood Rearing Pond (steelhead program) and Dayton Rearing Pond (steelhead program); and Big Canyon, Captain Johns Rapids and Pittsburg Landing (fall chinook program).

Steelhead (Wallowa stock) reared are A-run, Snake River stock which originated from adults taken from fish ladders at Snake River dams, while the Lyons Ferry steelhead stock were developed from Wells and Wallowa stock that returned to Lyons Ferry Hatchery. Programed steelhead smolt releases for 1999 are 250,000 from Cottonwood Acclimation Pond, on Cottonwood Creek, a tributary to the Grande Ronde River; 80,000 smolts direct from the hatchery; 125,000 smolts in Dayton Pond, on the Touchet River; 175,000 to the Walla Walla River; and 160,000 to the Tucannon River. Chinook releases programed in 1999 include 1,900,000 fall chinook smolts: 450,000 released at the hatchery, 150,000 each from three NPT satellite facilities at Big Canyon on the Clearwater River, Captain Johns Rapids and Pittsburg Landing on the Snake River. A total of 600,000 sub-smolts will be split and released from Big Canyon and Captain John Rapids satellites in 1999 and 200,000 sub-smolts at Lyons Ferry.

Dworshak National Fish Hatchery

Dworshak NFH is located on the North Fork Clearwater River at its confluence with the Middle Fork. The facility began operations in 1969 rearing summer steelhead and resident trout. Additional construction was completed in 1982 under LSRCP. The facility is operated by USFWS with USACE and LSRCP funding. The hatchery is to mitigate for loss of summer steelhead and resident trout habitat after the construction of Dworshak Dam on the North Fork Clearwater River. Summer steelhead production is entirely B-Run fish originating from the North Fork Clearwater River above Dworshak Dam. Spring chinook production is based on stock originating at Rapid River Hatchery.

The production goal for summer steelhead is 1.2 million yearling smolts for on-station release and 1.1 million yearling smolts for off-station release in Clearwater River tributaries. Spring chinook production is 1.1 million yearling smolts for on-station release. Spring chinook of the Kooskia stock may be at Dworshak Hatchery for holding of adults, spawning, and incubation to green-eggs only. Rainbow trout production of 200,000 fish is scheduled for mitigation of lost resident trout fisheries in Dworshak Reservoir. The Dworshak Reservoir rainbow trout mitigation is currently reared at Hagerman NFH. Water supply is pumped from the North Fork Clearwater River downstream from Dworshak Dam (Montgomery Watson 1997). The USFWS plans on releasing 1,050,000 spring chinook from Dworshak Hatchery into the North Fork Clearwater River in 1999.

Kooskia National Fish Hatchery

The hatchery is located in north-central Idaho, approximately 75 miles southeast of Lewiston in northwest Idaho County. The hatchery is used for adult collection, incubation, and rearing of spring chinook and operated as a satellite of Dworshak NFH. The Kooskia facility includes one pond for adult holding, 12 concrete raceways, six Burrow’s ponds, 42 circular starter tanks, 32 rectangular starter tanks, and incubation facilities. The purpose of the hatchery is to enhance the stocks of chinook salmon in Middle Fork Clearwater River Basin. The hatchery was authorized in 1961 to facilitate restoration of depleted, nationally significant fishery resources. Its first year of operation was 1969.

The production goal for Kooskia NFH is 600,000 yearling spring chinook for on-station release. Total production capacity is 40,000 lb per year. Water supply includes water rights of 13,456 gpm from six wells and Clear Creek. Just over half the water is from Clear Creek.

Planned release in 1999 is 600,000 spring chinook smolts released from the hatchery into Clear Creek, in the Clearwater River Basin.

Clearwater Fish Hatchery

The Clearwater Fish Hatchery was constructed in 1992 as part of the LSRCP to compensate for anadromous fishery losses caused by the four Federal dams constructed on the lower Snake River. The IDFG operates the facilities including two ponds for adult holding, 35 concrete raceways, incubation facilities, which are located at the confluence of the North Fork and Middle Fork Clearwater River near Orofino, Idaho. There are also three satellite facilities for adult collection, spawning, and acclimation located on Clearwater River tributaries. The LSRCP mitigation goals are to return 11,915 adult spring chinook and 14,000 adult steelhead above Lower Granite, for the Clearwater River.

The production goal for summer steelhead is 2.3 million smolts for release in the Clearwater River drainage, for spring chinook 300,000 smolts are produced for final rearing and release at the Red River satellite facility and 800,000 smolts for final rearing and release at the Crooked River satellite facility, and 300,000 smolts for final rearing and release at the Powell River satellite facility. Variable numbers of rainbow trout (catchables) are produced for resident fisheries in ponds in the Clearwater River drainage. Total salmon production capacity is 420,000 lb. Water is supplied to Clearwater Fish Hatchery by gravity via two pipes located in Dworshak Dam at different depths, allowing some degree of temperature regulation.

The 1999 projected releases from Clearwater Fish Hatchery includes 170,000 summer steelhead into Clear Creek, 430,000 summer steelhead into South Fork Clearwater and 5,000 summer steelhead into South Fork Red River. The following spring chinook releases are projected for 1999 - 335,000 at Powell River satellite; 700,000 at Crooked River satellite; 335,000 at Red River satellite; 50,500 at Papoose Creek, 163,000 presmolts at Crooked River satellite and 66,700 Red River satellite.

Irrigon Hatchery

Irrigon Hatchery began operation in 1984 as part of the LSRCP a program to mitigate for spring chinook and summer steelhead losses caused by the four Federal dams constructed on the lower Snake River. The Irrigon facility includes 32 concrete raceways, 68 circular starting tanks, and incubation facilities. The hatchery facility is located adjacent to the Columbia River near Irrigon, Oregon and is operated in conjunction with satellite facilities which trap adults, take eggs and acclimate smolts located in the Grande Ronde and Imnaha River basins. The hatchery water supply consists of five wells supplying 19,000 gpm. The hatchery is operated by ODFW.

Irrigon Hatchery serves as an egg incubation and rearing facility for summer steelhead destined for the Grande Ronde and Imnaha River systems. Irrigon is also used as a final rearing site for legal-sized rainbow trout destined for northeast Oregon waters. The 1998 production goal for summer steelhead (stock) is to produce 1,350,000 smolts: 200,000 direct stream release into the Upper Grande Ronde; 62,500 smolts direct release into Catherine Creek; and 1,087,500 smolts from satellite facilities at Big Canyon and Wallowa. In addition, 50,000 smolts from Lyons Ferry are directly released into Wildcat Creek in the Lower Grande Ronde River. Irrigon Hatchery also produces 330,000 smolts (Imnaha stock) for release at the Little Sheep Creek satellite facility in the Imnaha River Basin.

The 1999 projected releases from Irrigon Hatchery are being changed from direct stream releases to acclimated releases and includes the elimination of the 50,000 release into Wildcat Creek. The total release of 1,350,000 summer steelhead smolts will be divided into 125,000 direct stream releases into the Upper Grande Ronde River Basin and 1,225,000 acclimated at the Big Canyon and Wallowa facilities. In 1999, 330,000 summer steelhead smolts will be released into Imnaha River.

Irrigon Hatchery is also used to produce and release listed Snake River spring/summer chinook into the Imnaha River for recovery purposes (Table 1, ODFW section 10 direct take permit 1128). This program is not described in this incidental take Opinion.

Lookingglass Hatchery

Lookingglass Hatchery is located along Lookingglass Creek, a tributary of the Grande Ronde River, 2 miles from Palmer Junction in northeast Oregon. The hatchery is used for adult collection, incubation, and rearing of spring chinook salmon. Lookingglass Hatchery was constructed in 1982 as part of the LSRCP - a program to mitigate for spring chinook and summer steelhead losses caused by the four Federal dams constructed on the lower Snake River. Lookingglass is operated by ODFW and is used to raise spring chinook for ocean and river fisheries. The production goal is 900,000 chinook salmon smolts of Grande Ronde stock for release into the Grande Ronde River Basin. Water rights for the hatchery total 38,782 gpm from Lookingglass Creek and wells.

The 1999 projected release is 312,000 spring chinook salmon (Rapid River stock) into Lookingglass Creek from Lookingglass Hatchery. This will be the last release of Rapid River stock spring chinook into the Grande Ronde River Basin.

Lookingglass Hatchery and the associated satellite facilities are used to recover listed Snake River spring/summer chinook in the Grande Ronde and Imnaha River basins (Table 1). Lookingglass Hatchery is used for spawning, incubation and rearing of listed Snake River spring/summer progeny from the endemic adult supplementation program and endemic captive broodstock program in the Grande Ronde River Basin (Table 1, Permits 1011, ODFW and 1149 CRITFC) and endemic spring chinook in the Imnaha River Basin (Table 1, Permit 1128).

Wallowa Hatchery

Wallowa Hatchery began operation in 1920 as a resident trout hatchery. In 1985, the hatchery was renovated as part of the LSRCP - a program to mitigate for spring chinook and summer steelhead losses caused by the four Federal dams constructed on the lower Snake River (Montgomery Watson 1996). This hatchery provides fish for ocean and river fisheries and eggs to other programs.

The Wallowa Hatchery facility includes one pond for adult holding, two acclimation ponds, and two separate incubation facilities. The satellite facilities include adult holding and acclimation ponds.

The production goals for Wallowa Hatchery are collect 2.33 million summer steelhead eggs (Grande Ronde stock) for transfer to Irrigon Hatchery; collect 425,000 summer steelhead eggs for transfer to Lyons Ferry Hatchery (when needed); acclimate 612,500 summer steelhead smolts from Irrigon Hatchery for on-station release; acclimate 375,000 summer steelhead smolts from Irrigon Hatchery for release into Deer Creek (Big Canyon facility); collect 480,000 summer steelhead (Little Sheep stock) eggs for transfer to Irrigon Hatchery; and acclimate 200,000 summer steelhead smolts (Little Sheep stock) from Irrigon Hatchery for release into Little Sheep Creek (Little Sheep Creek facility).

McCall Hatchery

The McCall Hatchery is located within the city limits of McCall, Idaho on the North Fork Payette River, approximately 0.25 miles downstream from Payette Lake. The hatchery is used for incubation, and rearing of summer chinook. The McCall facility includes two ponds for rearing, 14 indoor rearing tanks, and incubation facilities. Adult collection and spawning is conducted at the South Fork Salmon Satellite facility which includes two adult holding ponds and a covered spawning area. This facility is located near Warm Lake on the South Fork Salmon River approximately 50 miles southeast of the hatchery. McCall Hatchery was constructed in 1979 by the USACE as part of the LSRCP and is operated by IDFG. The LSRCP mitigation goal is to return 8,000 adult summer chinook above Lower Granite Dam.

The production goal is to produce 1.0 million smolts of the native stock of summer chinook for release in the South Fork Salmon River. The hatchery may also provide surplus summer chinook eggs/or fish to other hatcheries in the Snake River Basin. Water is supplied to the hatchery from Payette Lake through two inlets, one at the lake surface and the other at a depth of 50 feet.

A total of 1,060,000 summer chinook smolts are proposed to be released at Knox Bridge in 1999 from McCall Hatchery.

McCall Hatchery is also used to rear and release listed Snake River spring/summer chinook into the South Fork Salmon River for recovery purposes. Section 10 permits issued to IDFG

(921) and CRITFC (1147) describe and evaluate these programs, they are not part of this incidental take Opinion (Table 1).

Sawtooth Hatchery

The Sawtooth Hatchery is located along the upper Salmon River near Stanley, Idaho. The hatchery is used for adult collection, incubation, and rearing of spring chinook and adult collection, spawning, and incubation of summer steelhead. The Sawtooth facility includes three adult holding ponds, 28 concrete raceways, 12 outside early rearing raceways (three have modified for natural rearing), 16 indoor early rearing vats, 30 semi-square tanks and incubation facilities. There is a satellite facility located on the East Fork Salmon River (EFSR). The Sawtooth Hatchery was constructed in 1984-85 as part of the LSRCP. The LSRCP mitigation goal is to return 19,445 spring chinook adults above Lower Granite Dam.

The production goal is to produce 1.6 million spring chinook smolts of the native Salmon River stock for on-station release and to produce 700,000 smolts of the indigenous stock for release into the EFSR. Adult chinook are trapped at the Sawtooth Hatchery weir and at a the EFSR satellite trap and spawning facility. However, due to low run sizes no adult chinook have been trapped at the EFSR facility since 1994. Adult steelhead are trapped and spawned at Sawtooth Hatchery. Eggs are shipped to other LSRCP hatcheries, typically Hagerman NFH for rearing. Smolts are trucked to release sites in the Salmon River Drainage, including the Sawtooth rack, to provide broodstock and sport fisheries. Approximately 750,000 steelhead smolts are reared and transferred Hagerman NFH for release into the Salmon River at the Sawtooth weir. Water is supplied to the hatchery by gravity flow from the Salmon River and also pumped from two wells.

The 1999 projected release from Sawtooth Hatchery is 104,000 spring chinook. The fish will be released directly from the hatchery to the Salmon River. In 1999, the Sawtooth Hatchery will also release 1,680,000 summer steelhead smolts.

Sawtooth Hatchery also rears and releases listed Snake River spring/summer chinook into the Salmon River. Section 10 direct take permits 919, 920 and 1010 (spring chinook captive rearing program) issued to IDFG (Table 1) all describe and evaluate these programs. Plus, the Snake River sockeye salmon captive broodstock program uses Sawtooth Hatchery to rear and release listed sockeye salmon into the Stanley Basin lakes (Table 1, IDFG permit 1120 and NMFS permit 1148). These programs are not part of this incidental take Opinion.

Hagerman National Fish Hatchery

The hatchery is located in the upper Snake River Basin in southern Idaho and is used for egg incubation, and rearing of summer steelhead. The hatchery complex includes an administration building, two hatchery buildings, 102 raceways, several springs used for water supply, water supply intakes, a pumped water supply from Riley Creek for emergency use, a fish waste sedimentation system, four on-site residences, feed storage facilities and several outbuildings.

Water supply to the hatchery is from springs and include water rights of 92.5 cfs from six major collecting structures.

The hatchery was authorized in 1930 and began operating in 1933. Historically, production consisted of rearing rainbow trout for stocking waters in Idaho, Oregon and Nevada. In the late 1970's, trout production was reduced and the production of steelhead for mitigation started. The hatchery was remodeled and expanded from 1982 to 1984 as part of the LSRCP.

The goal of the hatchery is to produce summer steelhead for the Snake River Basin. The production goal for summer steelhead is 1.15 million smolts for off-station release into the Salmon and Snake rivers. Rainbow trout are produced at Hagerman NFH for Dworshak Reservoir mitigation. The 1999 projected releases from Hagerman NFH include 410,000 summer steelhead into the Little Salmon River; 710,000 summer steelhead smolts at the Sawtooth Hatchery weir and 200,000 rainbow trout into Dworshak Reservior.

Magic Valley Hatchery

The Magic Valley Hatchery is located on the Snake River, approximately seven miles northwest of the town of Filer in the Snake River Canyon in Idaho. The hatchery is used for egg incubation and rearing of summer steelhead. The Magic Valley facility includes 32 concrete raceways, 20 start tanks and upwelling incubators. Magic Valley Hatchery was constructed in 1987 by the USACE as part of the LSRCP. The LSRCP mitigation goal is to return 11,600 adult steelhead above Lower Granite Dam. The production goal for summer steelhead is to produce 2.0 million "A" and "B" strain smolts (400,000 lb) for release into the Salmon River and its tributaries. The hatchery is located on the south shore of the Snake River while the Crystal Springs water supply is on the north side. Water is delivered to the hatchery by gravity flow and an inverted siphon under the Snake River at an average flow rate of 125 cfs.

Summer steelhead are proposed to be released at the following locations in 1999 from Magic Valley Hatchery: 300,000 smolts into the Little Salmon River; 300,000 smolts into the Lower East Fork, 820,000 smolts into the Salmon River; 400,000 smolts at Squaw Creek and 30,000 smolts at Sawtooth Hatchery weir.

Leavenworth Hatchery

The hatchery is located along Icicle Creek, a tributary of the Wenatchee River approximately 30 miles above the Wenatchee's confluence with the Columbia River. The hatchery is about four miles northeast of Leavenworth, Washington. Entiat NFH and Winthrop NFH are operated as satellite facilities. The hatchery is used for adult collection, incubation, and rearing of spring chinook. The Leavenworth facility includes two ponds for adult holding, 59 concrete raceways, 40 Foster Lucas rearing ponds, 108 starter tanks, and incubation facilities.

Water rights total 25,551 gpm from wells, Icicle Creek, and Snow and Nada lakes. Average flow available to the hatchery is 18,170 gpm. There is insufficient water to operate all rearing facilities. Water from Snow and Nada lakes is used to supplement Icicle Creek during low flow periods.

The hatchery was originally authorized by the Grand Coulee Fish Maintenance Project in 1937 and re-authorized by the Mitchell Act in 1938. It began operations in 1940. Leavenworth is one of three mid-Columbia hatcheries constructed by the Bureau of Reclamation as mitigation for the Grand Coulee Dam Columbia Basin Project.

The production goal is 1.6 million spring chinook smolts for on-station release. The 1999 projected releases are 1.66 million spring chinook into Icicle Creek.

Entiat Hatchery

Entiat Hatchery is located along the Entiat River, east of Entiat, Washington. The facility is operated as a satellite of Leavenworth NFH. The Entiat NFH facility includes two ponds for adult holding, 30 concrete raceways, 43 starting tanks, and incubation facilities. Water rights total 15,340 gpm from three sources: the Entiat River, Packwood Springs and wells. Approximately 7,786 gpm is available for hatchery use. The Entiat River and wells provide most of this water flow.

Entiat NFH was originally authorized by the Grand Coulee Fish Maintenance Project in 1937 and re-authorized by the Mitchell Act in 1938. The original hatchery purpose was to mitigate for the loss of salmon spawning grounds caused by the Grand Coulee Dam. Current production goals are 400,000 yearling spring chinook smolts for on-station releases and 400,000 subyearling spring chinook smolts for on-station releases. A total of 344,000 spring chinook will be released from Entiat Hatchery in 1999.

Warm Springs Hatchery

Warm Springs Hatchery was authorized in 1966 and began operating in 1978. The Confederated Tribes of the Warm Springs Reservation of Oregon entered into an agreement with the USFWS to stock the waters of the Water Springs Indian Reservation with salmon and trout to increase fishing opportunities (Montgomery Watson 1997). The hatchery is located on the north bank of the Warm Springs River, approximately 14 miles north of Warm Springs, Oregon. The hatchery is used for adult collection, incubation, and rearing of spring chinook. The facility includes three ponds for adult holding, 40 concrete raceways, 20 starter tanks, and incubation facilities. The water supply is provided by pumping from the Warm Springs River. Water use ranges from 9,000 to 18,000 gpm.

The production goal is 750,000 spring chinook smolts for on-station release. The 1999 projected release is 750,000 spring chinook smolts into the Warm Spring River.

Winthrop Hatchery

The hatchery is located along the Methow River in north-central Washington, near the town of Winthrop. The hatchery is used for adult collection, incubation, and rearing of spring chinook and summer steelhead. The hatchery was originally authorized as part of the Grand Coulee Fish Maintenance Project. The first fish cultural operation began in 1942 by trapping adult sockeye, chinook, and steelhead at Rock Island Dam and transporting them to the hatchery. By 1951, the station was rearing sockeye, chinook, steelhead, kokanee, coho, and resident trout. Recently, the hatchery has been used as an acclimation site for restoration of coho salmon in the Methow River Basin.

The Winthrop Hatchery includes 62 concrete raceways, 46 starter tanks, and incubation facilities. Water rights total 29,930 gpm from the Methow River, Spring Branch spring, and two wells (6,000 gpm total capacity). Water use ranges from 8,528 to 27, 686 gpm with the Methow River providing the majority of the flow. Current production goals are 1 million yearling spring chinook for on-station release and 100,000 summer steelhead smolts for on-station release. However, to improve rearing conditions, the production goal has been reduced to 800,000 spring chinook. A total of 546,500 spring chinook are proposed for release in 1999.

Winthrop Hatchery also rears listed Wells stock summer steelhead that are discussed in section 10 permit 1118, issued to USFWS on July 30, 1998 (Table 1). The release of listed summer steelhead are not part of the proposed action for this Opinion.

3. BPA's Artificial Propagation Program

BPA proposes to release approximately 17,262,720 anadromous fish in 1999. Of the smolts proposed to be released 3,000,720 are spring chinook salmon, 7,962,000 are fall chinook salmon, 5,060,000 are coho salmon, and 1,240,000 are steelhead.

Cle Elum Hatchery

BPA proposes to fund the release of up to 810,000 spring chinook salmon smolts in the upper Yakima River. The purpose of this project is to increase the numbers of native Yakima River spring chinook salmon returning to appropriate habitat in the upper Yakima Basin for natural spawning. The Cle Elum Hatchery includes a central rearing facility near Cle Elum, Washington, and three acclimation facilities: two on the Yakima River (Easton and Clark Flat), and one on the North Fork Teanaway River. Broodstock are collected at Roza Dam (river mile 131) on the Yakima River. Up to 1,100 upper Yakima River spring chinook salmon adults will be collected annually, and transported to Cle Elum Hatchery.

Eggs will be incubated, and fry will be reared at the Cle Elum Hatchery. Approximately one year after swim-up, yearling juveniles will be transferred to the satellite facilities for up to five months of final rearing and acclimation. All smolts will be marked. Smolts will then be allowed to outmigrate volitionally from mid-April to mid-May. Up to 810,000 spring chinook salmon smolts at a size of 15 fish per pound, and a mean length of 150 mm (six inches) will be released. In 1999, a total of 496,720 spring chinook salmon smolts are being proposed for release from Easton and Clark Flat acclimation sites.

BPA, YIN and WDFW have proposed a series of cooperative studies to monitor and evaluate the success of the project. These include a comparison of "conventional" and "innovative" rearing techniques, and monitoring of pre-release fish health, morphology, behavior, and survival, and post-release survival, reproductive success, long-term fitness, and ecological interactions. NMFS completed a biological opinion on the 1997-2001 Cle Elum Hatchery operations on April 1, 1996 (NMFS 1996b). For more details on the Cle Elum Hatchery program, please see the biological assessment (BPA 1995) and NMFS (1996b).

Hood River Program

In the Hood River Basin BPA proposes to fund the release of 125,000 spring chinook (Deschutes River stock). Adults will be trapped at the Powerdale Dam and then transferred, held and spawned at the Parkdale facilities. Eggs will be incubated and hatched at Round Butte Hatchery, reared to smolt stage at Pelton Ladder, and acclimated at Dry Run Bridge, in the West Fork Hood River. In addition, BPA funds the production at Oak Springs Hatchery of summer and winter steelhead derived from naturally produced adults collected at the Powerdale Dam. In 1999, 30,000 summer steelhead and 60,000 winter steelhead will be released in the Hood River into the West Fork and East Fork, respectively.

Nez Perce Tribal Hatchery

BPA proposes to fund the construction and operation of the Nez Perce Tribal Hatchery (NPTH). The NPTH is a supplementation program for fall and spring chinook salmon located within the Clearwater River subbasin in Idaho. The NPTH maximum production goals are 768,000 spring chinook (265,000 presmolts and 503,000 fingerlings), 2,000,000 subyearling smolt fall chinook and 800,000 subyearling "early run" fall chinook (BPA 1997a).

The NPTH will consist of two central incubation and rearing facilities (CIRF), six satellite rearing facilities and 11 temporary weir sites. The Cherrylane CIRF will be located within the NPT Reservation on the south bank of the Clearwater River about 32 km east of Lewiston, Idaho and the Sweetwater CIRF is located approximately 20 km southeast of Lewiston, Idaho. The satellite facilities will be located on: Yoosa/Camp, Mill and Newsome creeks for spring chinook and Cedar Flats, Luke's Gulch and North Lapwai Valley for fall chinook. The 11 temporary spring chinook weir sites will be located on Mill, Johns, Tenmile, Newsome, Meadow, Lolo, Eldorado, Fish, Boulder, Warm Springs and Brushy Fork creeks. The BPA (1997b) fully describes the construction sites, proposed facilities, and activities in the Final EIS. Final design of the NPTH facilities is nearly complete and construction should start in 1999. Construction of all facilities and satellites will occur over a multi-year time span, with initial construction focusing on the Cherrylane and Sweetwater Springs CIRF, and the

Yoosa/Camp Creek and the Cedar Flats satellite facilities (BPA 1997a).

Currently, 669,000 spring chinook smolts are be reared at the Clearwater Fish Hatchery and 300,000 parr are being reared at Sweetwater Springs for as part of NPTH. The parr are progeny from adults (Rapid River stock released at Lookingglass Hatchery) collected at Lower Granite Dam in 1998 (NPT 1999).

In 1999, BPA propose to release spring chinook into the following areas: 20,000 smolts into Warm Springs Creek; 84,000 smolts into Boulder Creek; 150,000 smolts into Lolo Creek; 75,000 into Newsome Creek; 40,000 into Mill Creek and 300,000 into Meadow Creek. The 300,000 parr will be released into various NPTH treatment streams. NMFS completed a biological opinion on the NPTH for 1998-2002 operations on November 24, 1997 (NMFS 1997). For specific details on NPTH please see BPA 1997a, BPA 1997b and NMFS 1997.

Salmon River Steelhead Stream-Side Egg Incubation Boxes

In the Upper Salmon River, BPA proposes to fund the Shoshone-Bannock Tribes outplanting 1 million Group-A summer steelhead eggs in stream-side incubator boxes between mid-April and early June. The eggs will originate from marked, hatchery adult steelhead collected at the Sawtooth, Pahsimeroi, or Oxbow (Hells Canyon) hatchery traps, in that order of priority. The eggs will be taken at various times during the run, to avoid inadvertently selecting for a particular run-timing. The stream-side incubator boxes will be placed at various sites in the Upper Salmon River Basin (above Middle Fork Salmon River). The fry will volitionally leave the hatch boxes in approximately six to eight weeks. For more specific details, please see SBT (1998) and the NMFS biological opinion (NMFS 1998d).

Select Area Fisheries Evaluations (SAFE)

SAFE activities take place exclusively in the Lower Columbia River (downstream of river mile 49). The sites and specific operations are described in detail in the biological assessment (BPA 1998b), and so are only briefly summarized here. NMFS completed a biological opinion on the SAFE program on November 18, 1998 (NMFS 1998e).

The terminal fishery efforts evaluated here involve the establishment of net-pen sites for the rearing of salmonids. The eggs for these fish will be initially collected, incubated, and reared at hatcheries in the Lower Columbia River. When the fish are of sufficient age and size (which varies depending on the species), they will be transferred to the net-pens, where they will be reared further until released. The timing of release depends on a number of criteria, including time of year, and age and size of fish; these factors are some of the criteria being evaluated, and vary between release groups, depending upon modifications being tested. For these reasons, the size of fish to be released from each site is not specified.

Eight sites have been identified as having potential for terminal fishery development in the Lower Columbia River. The sites are as follows: 1) Youngs Bay, OR; 2) Tongue Point, OR; 3)

Blind Slough, OR; 4) Clifton Channel, OR; 5) Wallace Slough, OR; 6) Deep River, WA; and 7) Steamboat Slough, WA. Evaluation of the sites includes water quality and bio-monitoring studies, to determine impacts to water quality and biological assemblages in the areas of the net-pens (Hirose et al. 1998).

In 1999, BPA proposes to rear and release the following number of hatchery-produced fish from the SAFE program: 1) Youngs Bay - 450,000 Willamette spring chinook salmon, 750,000 select area bright fall chinook salmon, and 200,000 early stock coho salmon; 2) Tongue Point - 250,000 Willamette spring chinook salmon, and 200,000 early stock coho salmon; 3) Blind Slough - 200,000 Willamette spring chinook salmon, and 200,000 early stock coho salmon; 4) Deep Creek - 40,000 Cowlitz spring chinook salmon and 400,000 early stock coho salmon; and 5) Steamboat Slough - 200,000 early stock coho salmon.

Umatilla Hatchery

BPA proposes to support operation of the Umatilla Hatchery located along the Columbia River below McNary Dam (river mile 292). Four juvenile acclimation facilities, located within the Umatilla River Basin, are operated in conjunction with the main hatchery.

The Umatilla Hatchery programs' primary objective is to re-establish salmon and enhance native steelhead stocks in the Umatilla River Basin. Carson stock spring chinook salmon, Tanner Creek coho stock and Columbia River upriver bright fall chinook salmon will be used in the re-introduction effort. Eggs for the production program will be obtained by trapping adults that are returning to the Umatilla River and egg/fish transfers from other hatchery facilities.

The 1999 Umatilla Hatchery juvenile production is 5,622,000 anadromous fish, of which 810,000 will be spring chinook, 3,162,000 will be fall chinook, 1,500,000 will be coho and 150,000 will be steelhead. All juvenile fish are released into the Umatilla River. Hatchery broodstock are proposed to be collected at Three Mile Dam located within the Lower Umatilla River Basin. BPA (1994) can be referred to for specific information on production and broodstock collection.

Upper Columbia (Mid-Columbia) River Coho Reintroduction

The Upper Columbia River Coho Reintroduction program will not be included in this Opinion due to pending review of several documents and technical discussions with BPA, YIN, WDFW, USFWS and NMFS. The documents include the Mid-Columbia Coho Salmon Study Plan (BPA 1999a), Mid-Columbia Coho Reintroduction Feasibility Project, Preliminary Environmental Assessment (BPA 1999b) and the Biological Assessment for Mid-Columbia Coho Reintroduction Feasibility Project (BPA 1999c). BPA, YIN, WDFW, USFWS and NMFS will be meeting in early March to discuss specific details of the program. NMFS does not anticipate details will be worked out in time to be included in this Opinion. A separate biological opinion will be written by NMFS on the Upper Columbia River coho reintroduction project.

Yakima River Coho

BPA proposes to fund the restoration of locally-adapted coho salmon stocks into the Yakima River. For 1999-2000, BPA proposes to determine: 1) the feasibility of restoring coho natural production to the Yakima River Basin; 2) the feasibility of developing a Yakima River broodstock using adult returns (egg bank) from releases of lower river coho hatchery stocks; 3) spatial, temporal, and stock survival differences between Upper Yakima and Naches sub-basins; and 4) the first and second generation ecological interactions of coho on species of concern in the Yakima River Basin.

During 1999 through 2002, a total of up to 2,135,000 coho smolts which include up to 400,000 coho subyearlings per year will be released into the Yakima River Basin. Broodstock will be trapped at Prosser, Cowiche and Roza dams and held and spawned at Prosser Tribal Hatchery. If additional rearing capacity is needed, eggs will be transferred to Eagle Creek National Fish Hatchery (USFWS), Cascade Hatchery (ODFW) or Lewis River Hatchery (WDFW) until pre-smolt stage.

Yakima River and Marion Drain Fall Chinook (Prosser Tribal Hatchery)

BPA proposes to fund the supplementation and acclimation of fall chinook in the Marion Drain and Yakima River. The Marion Drain population spawns naturally in the Marion Drain. The Drain was constructed to return irrigation overflow and groundwater seepage to the Yakima River from agricultural lands located on the Yakima Indian Reservation. This section also has a large component of high quality groundwater. The Yakima River population resides in the mainstem Yakima River where the majority of spawning occurs below Prosser Dam. This stock has been previously supplemented with out-of-basin stocks (Little White Salmon NFH), but with the new Prosser Tribal Hatchery, the development of a locally-adapted broodstock has begun.

In 1999, BPA proposes to release a total of 2,050,000 fall chinook salmon at Prosser and in the Yakima River. Approximately, 1.2 million and 500,000 smolts (Little White Salmon NFH stock) will be released at Prosser and in the Yakima River respectively. Another 350,000 fall chinook salmon smolts that were progeny of Yakima River adult returns will be released at Prosser.

Approximately, 5,000 fall chinook smolts from adults collected at Marion Drain will be released in the Marion Drain in 1999. For the period 2000-2003, approximately 75,000 Marion Drain stock fall chinook smolts per year will be needed for experiments in the Marion Drain. Achieving this production goal is dependent upon developing efficient broodstock collection methods.

4. USACE's Artificial Propagation Program

The USACE proposes to support, in whole or part, the operation of seven hatcheries (Marion Forks, South Santiam, McKenzie, Leaburg, Willamette, Bonneville, and Dworshak) and two associated satellite facilities (Minto and Dexter holding ponds) within the Columbia River Basin. The USACE shares funding at two hatcheries with NMFS and with USFWS. Spring Creek Hatchery is also partially supported by the USACE, but for this Opinion, is included in the NMFS' hatchery program described above. Five of the hatcheries (Marion Forks, South Santiam, McKenzie, Leaburg, and Willamette) are located within the Willamette River Basin. Bonneville Hatchery is located along the lower Columbia River below Bonneville Dam, and Dworshak Hatchery is located at the confluence of the North Fork and mainstem Clearwater River located within the Snake River Basin.

These hatchery programs' primary objective is to mitigate for impacts associated with lost or altered habitat caused by construction of USACE projects. Hatchery production levels are based on estimates of the number of adult fish originally spawning upstream of specific USACE projects and estimates of the number of juveniles required to replace that number of adult fish. Eggs for the production programs are obtained by trapping returning adults.

The USACE proposes to releases 15,512,240 anadromous smolts in 1999. Approximately, 4,499,240 are spring chinook salmon, 8,274,000 are fall chinook salmon (all released outside Snake River Basin) and 2,739,000 are steelhead. These numbers do not include releases from Spring Creek Hatcheries, which are included in NMFS' release summary.

The USACE is proposing to collect hatchery broodstock at five hatcheries and two satellite facilities. Spring chinook salmon, upriver bright fall chinook salmon, steelhead, and coho salmon are collected at USACE hatcheries. USACE (1994, 1999) can be referred to for specific information on hatchery facilities, production and broodstock collection.

Below are current production goals for anadromous species at USACE hatchery facilities (USACE 1999). These production levels do not include transfers to other hatchery facilities; only on-station releases, direct stream releases, and Salmon Trout Enhancement Program (STEP) releases are included.

Marion Forks Salmon Hatchery and Minto Holding Pond

Marion Forks Salmon Hatchery is located on Marion and Horn creeks, tributaries to the North Santiam River, about 17 miles from the town of Detroit in Marion County, Oregon. Minto Holding Pond, a satellite facility of the Hatchery, is located 33 miles downstream on the North Santiam River below Detroit and Big Cliff dams (USACE 1999).

Marion Forks Hatchery has eight raceways, 48 circular ponds and 12 Canadian-style starting troughs. The water supply is from Marion Creek from April through September and Horn Creek from October through March when Marion Creek is frozen. Maximum water use is

12,890 gpm from Marion Creek and 7,400 gpm from Horn Creek both occurring in March and April prior to smolt release. There is only one water right of 15,260 gpm from Marion Creek (USACE 1999).

Current production goals are the release of 667,000 spring chinook salmon and 350,000 winter steelhead into the North Santiam River. Approximately 50% of the smolts are transferred from Marion Forks Hatchery to Minto Holding Pond one month prior to release for acclimation. Projected releases in 1999 are 654,000 spring chinook and 105,000 winter steelhead.

South Santiam Hatchery

The South Santiam Hatchery is located on the South Santiam River, just below Foster Dam, on the north bank, opposite the powerhouse in Linn County, Oregon. The rearing facilities consist of 10 Burrows ponds of 4,147 cubic feet each and four Burrows ponds of 5,022 cubic feet (USACE 1999). An adult holding pond is also available but is not used for rearing. The hatchery water supply currently comes from Foster Reservoir with 8,400 gpm available for the rearing ponds and 5,500 gpm for the adult holding pond.

Current production goals are 2,366,000 spring chinook salmon and 184,500 summer steelhead. Approximately 1.3 million chinook are used for STEP with the remainder released into the South Santiam River. Seventy-eight percent of the summer steelhead production is released in the South Santiam River with the remainder released in the North Santiam River. The 1999 projected releases include 1,013,000 spring chinook and 184,000 summer steelhead.

McKenzie River Salmon Hatchery

The McKenzie River Salmon Hatchery is located along the McKenzie River Highway (U.S. Highway 126) in Lane County about 26 miles east of Eugene, Oregon, and two miles below Leaburg Dam. The site is between the Leaburg Canal and the McKenzie River, a tributary to the Willamette River. Hatchery facilities consist of 30 raceways, two adult holding ponds and eight Canadian-style starting troughs (USACE 1999). Water rights total 31,500 gpm from the McKenzie River and Cogswell Creek.

Only spring chinook salmon are reared and released from the McKenzie Hatchery. Approximately 69% of the 1.43 million smolts release are in the McKenzie River. The remainder are released into the Willamette and Clackamas rivers. A total of 1,435,000 spring chinook are proposed to be released in 1999.

Leaburg Hatchery

Leaburg Hatchery is located on the McKenzie River 23 miles east of Springfield, Oregon. Leaburg Hatchery has 40 concrete raceways of 7,320 cubic feet and one of 3,660 cubic feet, six concrete circular ponds, 20 aluminum incubation troughs and 13 Canadian style starting troughs (USACE 1999). Two of the raceways are used for adult capture and holding, four for rearing anadromous fish and the remainder of the facilities for the resident trout program. Water rights for the hatchery total 44,883 gpm from the McKenzie River.

The current production goal is the release of 108,000 summer steelhead smolts into the McKenzie River. A total of 108,000 summer steelhead will be released from the Leaburg Hatchery in 1999.

Willamette Hatchery and Dexter Holding Ponds

Willamette Hatchery is located on Salmon Creek, a tributary to the Middle Willamette River, in Lane County, Oregon. Dexter Holding Ponds, a satellite facility, is located on the Middle Willamette below Dexter Dam. There are 10 raceways, 40 modified Burrows ponds, four circular ponds, two adult trout brood ponds, and one adult salmon holding pond at Willamette Hatchery (USACE 1999). Water supply to the hatchery is from Salmon Creek and ranges from 29,623 to 37,028 gpm. The total instantaneous rearing capacity of the hatchery is 2,160,000 yearling fish at 30 fish per pound, or 72,000 pounds. Dexter Holding Ponds consist of an adult collection facility and holding ponds.

Existing production goals at this facility are the release of 3.86 million spring chinook salmon and 42,000 summer steelhead. Spring chinook are released as fingerlings and smolts into Willamette Basin rivers. Summer steelhead are released into Fall Creek, a tributary to the Middle Fork Willamette River. The USACE proposes to release 1,397,240 spring chinook and 42,000 summer steelhead from the Dexter Ponds in 1999.

Bonneville Fish Hatchery

Bonneville Fish Hatchery is located on the Oregon shore of the Columbia River, just below Bonneville Dam at river mile 145. Bonneville Hatchery has 30 raceways, 28 Burrows or converted Burrows ponds and three adult holding ponds (also used for fish rearing) (USACE 1999). Water has historically been provided from Tanner Creek and wells. The construction of a new navigation lock at Bonneville Dam lead to vacating the original wells. New wells were drilled and are supplying the necessary quantity and quality of water to the hatchery. The hatchery requires 17,500 gpm during much of the rearing cycle.

Current production goals are the release of 175,000 summer steelhead, 355,000 winter steelhead, 5.3 million fall chinook, and 1.17 million coho salmon. Steelhead are released as smolts into the Sandy and Clackamas rivers. Fall chinook are released on-station, in Youngs Bay, and in the Umatilla River. The USACE's 1999 projected release from Bonneville Hatchery is 7,794,000 URB fall chinook.

Dworshak National Fish Hatchery

Dworshak Hatchery is located at the confluence of the North Fork and mainstem Clearwater River near Ahsahka, Idaho, which is just downstream from Dworshak Dam on the North Fork

Clearwater River. The hatchery was constructed with 84 Burrows ponds, 25 on a re-use water system and 59 on a single pass system, and began operation in 1969 (USACE 1999). In 1972, all the ponds were placed on recycled flow. Water from the hatchery is taken from Dworshak Reservoir.

Existing production goals at this facility is the release of 2.3 million summer steelhead smolts. Approximately 48% of the release is off-station in various tributaries to the Clearwater River Basin. The USACE plans on releasing 2.3 million B-run steelhead smolts in 1999.

5. BIA Artificial Propagation Program

The BIA proposes to fund the operation of the Clearwater River coho restoration and Cassimer Bar sockeye hatchery programs in the Columbia River Basin. The two programs are described below. In 1999, BIA proposes to release 1,253,000 anadromous smolts. A total of 1,193,000 are coho salmon and 60,000 are sockeye salmon. Please see BIA 1994 and 1998 for more details.

Clearwater River Coho Restoration

BIA proposes to fund the release of 770,000 coho smolts, 450,000 coho parr and 30,000 eggs/fry into the Clearwater River Basin in 1999. These coho will be from Willard and Tanner Creek (Cascade Hatchery) stocks from lower Columbia River hatcheries. The smolts will be reared at Willard NFH and the Dworshak NFH. Smolts reared at Dworshak NFH will be transferred to Kooskia NFH for acclimation three to four weeks and will then be released into Clear Creek.
The Willard NFH smolts will be transported to the Clearwater River Basin and half will be direct released into Lapwai Creek and the other half will be released into Potlatch Creek

Coho parr are being reared at Clearwater Fish Hatchery and will be released into Meadow Creek, Eldorado Creek and the Potlatch River. The fry will be reared in streamside incubators located at Jaype Mill and Potlatch Mill. Jaype Mill fry will be volitionally released into Quartz Creek and the Potlatch Mill fry will be transplanted into Mission Creek. The BIA and NPT are in the process of developing a long term management plan for coho restoration in the Clearwater River subbasin (Whitman 1998).

Six weirs will be operated from September through November on release streams to monitor and trap returning adults. Presently, there are weirs on Upper Lolo, Eldorado Creek and Meadow creeks for spring chinook and a weir on Lapwai Creek for fall chinook as part of the NPTH program. Kooskia NFH operates a weir on Clear Creek for spring chinook and a weir is proposed for Potlatch Creek to trap coho. NMFS completed a biological opinion on 1998 coho releases into the Clearwater River Basin on March 31, 1998 (NMFS 1998b). Please refer to BIA (1998) and NMFS (1998b) for more details on the Clearwater River coho restoration program.

Cassimer Bar

The BIA is consulting on behalf of the Colville Confederated Tribes on the Cassimer Bar sockeye hatchery operation and release. The facility is located in the Upper Columbia River Basin near the confluence of the Okanogan and Columbia rivers. Adult Okanogan River sockeye salmon are collected from June to August from the eastbank fishway trap at Wells Dam. Adults are spawned and up to 200,000 juveniles are planned for release into Lake Osoyoos. The projected release number in 1999 is approximately 60,000 sockeye salmon.

B. Non-Federal Actions

1. ODFW's Artificial Propagation Program

Five ODFW propagation programs that are not Federally funded (See NMFS, USFWS, BPA above) are included in this analysis: Clatsop Economic Development Council (CEDC) Fisheries Project, the Salmon and Trout Enhancement Program (STEP), Roaring River Hatchery, Oak Springs Hatchery, and Round Butte Hatchery. These programs are covered under Permit #899 and included trout releases from Wallowa Hatchery.

Wallowa Hatchery

Wallowa Hatchery began operation in 1920 as a resident trout hatchery. The Wallowa Hatchery facility includes one pond for adult holding, two acclimation ponds, and two separate incubation facilities. The satellite facilities include adult holding and acclimation ponds.

The trout program at the Wallowa Hatchery released legal-sized rainbow trout into the Wallowa and Grande Ronde rivers, and Catherine Creek. These and all hatchery trout releases into streams in the Snake River ESU in Oregon have been discontinued or shifted to standing waters in the Grande Ronde Basin, eliminating interactions with listed salmon and steelhead. Releases of hatchery trout into streams of the Imnaha River Basin were discontinued in 1991. Releases into the Wallowa River subbasin were discontinued after 1995. The releases in the Upper Grande Ronde River and Catherine Creek were discontinued after 1997. No listed fish from the Snake River ESU are handled during the operation of this trout program at Wallowa Hatchery making inclusion in this Opinion unnecessary. The 1999 releases from Wallowa Hatchery are 80,000 rainbow trout. The steelhead releases are covered the USFWS 1999 releases.

CEDC Fisheries Project

The CEDC Fisheries Project currently operates a salmon hatchery on the South Fork Klaskanine River and a net-pen rearing and acclimation facility at Youngs Bay. Additional acclimation sites exist in Blind Slough and at Tongue Point. These rearing and acclimation sites are all down river from the Lower Columbia River steelhead ESU. The goal of the state funded portion is to supplement ODFW Federally funded hatchery programs and to enhance the local economy through the Youngs Bay gill net fishery. The Federally funded proportion of this program is described above(BPA's artificial propagation programs).

The 1999 state funded releases for the CEDC are 2,393,000 coho salmon; 200,000 URB fall chinook salmon; and 400,000 Rogue River fall chinook.

Salmon Trout Enhancement Program (STEP)

The STEP provides opportunities for volunteer conservation organizations and school groups to conduct projects beneficial to anadromous and resident salmonids. STEP projects generally involve habitat improvement efforts or the release of unfed fry from hatch boxes into standing water bodies. No STEP-reared fish will be released into any Columbia River tributaries where they could interact with listed salmon and steelhead, making inclusion in this opinion unnecessary.

Roaring River Hatchery

Roaring River Hatchery was constructed in 1924. The hatchery is located on a tributary to the South Fork Santiam River. The hatchery produces resident rainbow trout and summer steelhead In 1987, six new rearing ponds were constructed to replace the original ponds. Water rights total 11,225 gpm from Roaring River. Some water is pumped through a filter system to ensure a clean supply for incubation and early rearing. Water is reused from the upper to lower ponds. The goal of the hatchery is to increase the sport catch of summer steelhead in the Molalla River, Santiam River mainstem, and North Santiam River (Montgomery Watson 1997).

The production goals are 65,000 summer steelhead smolts for release into the Molalla River and 121,000 summer steelhead smolts for release into the Santiam River.

No adult steelhead are collected at Roaring River Hatchery. The production goal for the program is to release 192,000 summer steelhead that originated from Skamania stock into the North Santiam and Upper Willamette River. No hatchery trout are scheduled for release into the Santiam River and tributaries after 1998. Trout releases into the Upper South Santiam above Foster Reservoir were discontinued after 1997. Summer steelhead in the Upper Willamette are non-endemic and have low natural production with the runs being maintained by hatchery releases (Busby et al. 1996). In 1999, Roaring River Hatchery will release 161,500 summer steelhead smolts.

Oak Springs Hatchery

Oak Springs Hatchery is located on the Deschutes River. The Oak Springs facility includes four ponds for rainbow trout broodstock holding, eight concrete raceways, two Burrow's ponds, five circular ponds 14 rearing ponds, and incubation facilities (Montgomery Watson

1997). The facility produces steelhead and resident trout. The present water delivery system can deliver approximately 11,670 gpm to the hatchery. Some mixing with re-use water occurs from one pond series to another.

The production goals for Oak Springs Hatchery are 225,000 summer steelhead fingerlings for transfer to South Santiam Hatchery; 170,000 summer steelhead fingerlings for transfer to Gnat Creek Hatchery; 270,000 summer steelhead fingerlings for transfer to South Santiam Hatchery; 75,000 summer steelhead smolts for release into the Salmon/Zigzag River System; 60,460 smolts for release into the Hood River; 40,000 summer steelhead (Clackamas River stock) smolts for transfer to Clackamas River; and 50,000 winter steelhead (Hood River stock) smolts) for transfer to Hood River

No adult steelhead are collected at Oak Springs Hatchery. Adult steelhead are trapped on the Clackamas and Hood rivers and their progeny are reared at Oak Springs Hatchery, with the smolts released back into their respective basins of origin. Two resident rainbow trout broodstocks are maintained at the hatchery. The current fishery management goal is not to release hatchery rainbow trout into the Deschutes River mainstem. There are several tributaries, reservoirs, and standing water bodies in the lower Deschutes that are stocked. The goals of the trout stocking programs in the Warm Springs River and White River drainages are to provide recreational fishing opportunities and consumptive fisheries in small streams that may not be sustained by natural production alone.

Currently, summer steelhead that originated from Skamania stock are reared at Oak Springs Hatchery and directly released into the Sandy River as well as being acclimated and released from the Sandy Hatchery. The last year that summer steelhead were released into the upper tributaries of the Sandy River was in 1998. Beginning in 1999, all summer steelhead releases will occur below Marmot Dam. Management plans call for the adult hatchery returns to be trapped and removed at a fish trap at Marmot Dam. Currently, a trap at the fish ladder is not functional and there is a question of whether funding for a retro-fit of the fish ladder to trap and hold adults is available. In addition to concerns about removing adult hatchery returns, the proposed releases of summer steelhead still have the potential to impact listed natural winter and summer steelhead through competition and predation within the lower Sandy River and the shared migration corridor.

Three of these new ‘wild-type’ steelhead programs are operated from Oak Springs Hatchery. These programs collect broodstock from and release smolts into the Hood River Basin (both a summer and winter steelhead program) and the Clackamas River Basin (a winter steelhead program).

The Oak Springs Hatchery rears the progeny of naturally, late-run Clackamas River winter steelhead (Stock #122) collected at the North Fork Fish Ladder. The smolts reared at Oak Springs Hatchery are released back into the Clackamas River. This hatchery stock is considered part of the Lower Columbia River steelhead ESU, but not essential for recovery. Winter steelhead used for broodstock have included marked hatchery adult returns from this program.

The Clackamas River late-run winter steelhead program was started with goal of providing harvestable winter steelhead in the Clackamas River from March 1 to the mid-May to gain public support for having the fishery become a hatchery-retention only fishery. The program has provided marked steelhead for harvest during the spring when Eagle Creek Hatchery winter steelhead and summer steelhead are not in the river. This program is currently providing a number of benefits including supplementing the natural returns to above North Fork Dam, by providing up to 50% of the adult spawners; providing a winter steelhead fishery eliminating the need for use of non-local stocks; and providing native adult broodstock for natural spawning below River Mill Dam. Broodstock needs are for 20 pair to produce the 40,000 smolts that are reared at Oak Springs Hatchery.

In the Hood River Basin, ODFW is developing a local stock developed from Hood River wild fish to replace Big Creek Hatchery winter steelhead stock. This program was started in 1991. In 1997, ODFW started the development of a local summer steelhead stock for supplementation of the naturally-produced summer steelhead population. Non-local Skamania summer steelhead will continue to be released below Powerdale Dam to support local fisheries. No Skamania summer steelhead will be passed above the trap at Powerdale Dam.

These three steelhead programs directly take listed steelhead from the Hood and Clackamas rivers for broodstock, release smolts into areas occupied by listed steelhead and pass hatchery adults into areas occupied by listed steelhead. The progeny of the two hatchery programs in the Hood River are not currently recognized as part of the ESU (FR Notice March 19, 1998, Vol. 63. No. 53 p. 13347). All three programs were initiated in the 1990's to augment or replace previous programs that used Big Creek stock winter steelhead or Skamania stock summer steelhead broodstocks (ODFW 1998).

The programs are being operated to respect the limits on taking wild fish into the broodstock (being limited to 25% or less of the wild fish present) and on the number of hatchery fish allowed to enter the natural spawning areas above dams (being limited to 50% of the fish passed) provided by Oregon’s Wild Fish Management Policy (ODFW 1992). ODFW has not developed hatchery guidelines, objectives or implementation protocols for the “wild-type” programs for the Hood and Clackamas rivers steelhead programs. Since these programs take listed steelhead, a section 10 direct take permit will be required to continue collection of broodstock, once section 9 take prohibitions are in effect.

Oak Springs Hatchery does not release fish directly on-station, so all production from this hatchery is described under the facility that releases the fish.

Round Butte Hatchery

The Round Butte Hatchery was constructed in 1972 to mitigate for the fisheries losses caused by Pelton/Round Butte Hydroelectric Complex. The hatchery is located on the Deschutes

River at the base of Round Butte Dam, and uses the Pelton Ladder as a satellite rearing facility. The hatchery is used for adult collection, egg incubation, and rearing of spring chinook, summer steelhead, and brown trout. The facility includes two ponds for adult holding, 10 concrete raceways, 30 circular tanks, one rearing pond (at Pelton Ladder), and incubation facilities (Montgomery Watson 1997). The water is supplied to the hatchery from tunnels in the canyon wall that collects seepage from the upstream reservoir.

The production goals are 162,000 summer steelhead smolts for release into the Deschutes River and 454,404 spring chinook smolts for release into the Deschutes. In 1999, the hatchery proposes to release 162,000 summer steelhead and 320,000 spring chinook into the Deschutes River. In addition approximately 125,000 spring chinook are scheduled for release into the Hood River Basin, see BPA Proposed Actions. Adult steelhead are collected at traps at Pelton Dam and Sherars Falls.

Klaskanine Hatchery

Klaskanine Hatchery was first operated in 1911 by the state of Oregon. In 1953, the hatchery was enlarged and renovated under the Columbia River Fisheries Development Program (Mitchell Act). It is located on the Klaskanine River, tributary to Youngs Bay, OR - 23.8 miles from the mouth of the Columbia River. The goal of the hatchery is to produce lower river coho that will contribute to NE Pacific and Columbia River Basin commercial and sport fisheries and create a consumptive winter steelhead fishery in the Klaskanine River. The Klaskanine facility includes six series ponds, 16 concrete raceways, one rearing pond, and incubation facilities. Water is supplied by gravity flow and from three intakes located on the North Fork Klaskanine River and North Fork of the North Fork Klaskanine River. The current water right is for 22,442 gpm although the maximum water usage is 11,000 gpm (Montgomery Watson 1997).

Due to reduction in NMFS funding, this hatchery has changed its goals and operations and is now funded by Bonneville Power Administration to produce anadromous salmonids for the Youngs Bay terminal fisheries project (SAFE). Starting in 1999, Klaskanine Hatchery will operate the broodstock program for Rogue River fall chinook for the BPA funded SAFE project (this program was moved from Big Creek Hatchery due to straying problems). This facility is not funded by Mitchell Act in 1999, and is not scheduled for NMFS funding in the future. However at present, some Mitchell Act winter steelhead production from Big Creek Hatchery is scheduled for release in the Klaskanine River at Klaskanine Hatchery (NMFS 1999b).

The production goals for Klaskanine Hatchery are 1,125,000 coho smolts for on-station releases; 600,000 green coho eggs to the Clatsop Economic Development Commission (CEDC) when needed; 20,000 coho eyed eggs to Oregon's STEP; 60,000 winter steelhead smolts for on-station release. The 1999 releases from Klaskanine Hatchery of 700,000 Rogue Area Brights are included as part of the releases from the SAFE program described above in this Opinion.

Gnat Creek Hatchery

Gnat Creek Hatchery was constructed in 1960 as part of the Columbia River Fisheries Development Program (Mitchell Act). Hatchery production was designed to meet harvest objectives of creating consumptive steelhead trout fisheries for the North Coast, Lower Columbia River and Willamette River tributaries. Due to reduction in NMFS funding, this hatchery has changed its goals and operations and is now funded by BPA to produce anadromous salmonids for the Youngs Bay terminal fisheries project (SAFE). This facility is not funded by Mitchell Act in 1999, and is not scheduled for NMFS funding in the future. However at present, some Mitchell Act winter steelhead production from Big Creek Hatchery is planned for release at Gnat Creek Hatchery.

The Gnat Creek facility includes 15 concrete raceways, six starter tanks, and incubation facilities. Water rights total 21,643 gpm from Gnat Creek, an unnamed stream, and a well. Water flows range from a high of 15,700 gpm to a low of 1,200 gpm (Montgomery Watson 1997).

Production goals for Gnat Creek include 446,000 winter steelhead smolts for release into Clackamas, Sandy, Tualatin, Gales Creek, North Fork Scappose, Clatskanine, Lewis and Clark, and Gnat Creek river systems; and 210,000 summer steelhead smolts for release into Clackamas, Salmon, and Molalla river systems. The 1999 projected releases of 900,000 Willamette Spring chinook salmon smolts are part of the SAFE program described previously.

2. WDFW's Artificial Propagation Program

WDFW operates seven major salmon hatcheries and five major steelhead hatcheries within the Columbia River Basin under the auspices of mitigation by several Pubic Utility Districts and state wildlife funds. WDFW also cooperatively operates with local organizations several small scale volunteer projects to rear steelhead and sea-run cutthroat.

WDFW proposes to release approximately 23,885,700 anadromous fish in 1999. Of the smolts proposed to be released 2,804,000 are spring chinook salmon, 12,624,000 are summer/fall chinook salmon, 6,048,000 are coho salmon, 1,815,000 are steelhead, 278,500 are chum salmon, 125,000 are sockeye and 191,000 are sea-run cutthroat trout. Please see WDFW 1997a and 1997b for more details.

Cowlitz Trout Hatchery

The Cowlitz Trout Hatchery (Blue Creek) is located on the Cowlitz River about 42 miles above its confluence with the Columbia River. The purpose is for mitigation for lost wild steelhead production resulting from hydroelectric dam placement and operation. The goal of the hatchery is to produce adult winter steelhead, summer steelhead, and sea-run cutthroat for sport fisheries. The mitigation goal is to produce 191,000 pounds of smolts and return 38,600 adult steelhead and sea-run cutthroat to the river. The 1999 releases for the Cowlitz Trout Hatchery are 160,000 sea-run cutthroat, 455,000 summer steelhead, and 650,000 winter steelhead.

Included in the Cowlitz program is a BPA-funded effort to re-establish late-run winter steelhead juveniles above the Cowlitz Falls Dam near river mile 89 on the Cowlitz River. The Cowlitz Trout Hatchery is used to collect and rear native late-run broodstock for re-establishment of winter steelhead above Cowlitz Falls Dam. This directed take will be addressed under a section 10 permit. The Cowlitz Falls restoration effort is now administered and managed by WDFW (WDFW 1997a).

Adult winter steelhead originating from Cowlitz Trout Hatchery releases migrate into the freshwater from late October through May, with a peak in December and January. Early maturing fish (spawning in December and January) have historically been selected for use as the hatchery steelhead broodstock. Wild-origin, naturally-produced winter steelhead are considered a late run population in the Cowlitz River, returning to the river between December and May, with peak spawning occurring in April and May (WDFW 1997a).

Significant levels of non-native steelhead population transfers have been made into the Cowlitz watershed. The winter-run hatchery stock originated from a mixture of both native Cowlitz River and Chambers Creek fish. Since 1968, sufficient broodstock have been available as returning adults to Cowlitz Hatchery, eliminating the need for inclusion of out-of-basin steelhead. Although it is thought that Cowlitz River wild winter-run fish are almost all progeny of feral Cowlitz Trout Hatchery steelhead (WDF et al. 1993), significant populations are present in the lower river tributaries that were not derived from hatchery parents (WDFW 1997a).

Hatchery summer steelhead are recovered in the Cowlitz from May through December. Summer steelhead are collected as broodstock in summer and fall, and spawned at the hatchery from December through January. The hatchery summer run stock originated from Skamania adults. Transfers from Skamania are no longer necessary to support production of this race at Cowlitz Trout Hatchery. Wild summer steelhead are not native to the Cowlitz River Basin.

Sea-run cutthroat enter the river from July through October, with broodstock collected at the hatchery from August through January (WDFW 1997a).

Merwin Hatchery

Merwin Hatchery is situated on the North Fork Lewis River downstream of Merwin Dam. It was constructed by Pacific Corp to mitigate for losses of resident and anadromous trout resulting from construction and operation of the Merwin Project on the North Fork Lewis River. The goal of the hatchery is to provide winter and summer steelhead, sea-run cutthroat trout, and rainbow trout for harvest by sport anglers. The hatchery is used for adult collection, incubation, and rearing of winter steelhead, summer steelhead, and sea-run cutthroat.

Production goals for the hatchery include: 125,000 winter steelhead smolts, 125,000 summer steelhead, and 25,000 sea-run cutthroat smolts for release into the Lewis River and 1 million rainbow trout for release in area lakes. The 1999 Merwin Hatchery projected releases are 26,000 sea-run cutthroat, 260,000 summer steelhead, and 100,000 winter steelhead.

Wild summer steelhead indigenous to the Lewis River system commence migration into freshwater in April and complete migration into the Lewis drainage by October. Early spawning winter steelhead have been selected for hatchery broodstock so that spawning time of hatchery fish precedes wild fish. Adult hatchery-produced winter steelhead are collected and spawned from December through January. Approximately 80% of the hatchery-origin winter steelhead spawning is completed by February 1, while wild winter steelhead spawning peaks in April and May. The hatchery operation at Merwin has also relied on a significant level of importation of non-native steelhead stocks into the Lewis River drainage. The winter-run hatchery stock originated from Beaver Creek adults, and the summer-run fish originated from broodstock developed at Skamania Hatchery. Steelhead eggs are presently obtained from adults returning to the Lewis River, although other lower Columbia River hatchery stocks of similar genetic lineage may be transferred in if adequate returns to the Lewis River are not available (WDFW 1997a).

Cooperative Trout Volunteer Programs

The WDFW cooperatively operates five volunteer enhancement projects within the lower Columbia River Region that release steelhead and cutthroat trout into anadromous waters. Two of the cooperatives are located on the Cowlitz and Lewis rivers and two release fish into the Coweeman River. The fifth cooperative produces steelhead smolts for release into the Big White Salmon River (WDFW 1997a). These projects are conducted by local sports clubs and schools for fishery enhancement purposes, and by hydroelectric operators to meet mitigation requirements.

Production goals for cooperative steelhead and cutthroat trout rearing projects in the lower Columbia River Region are the following: 1) Friends of the Cowlitz - 90,000 steelhead smolts into the Cowlitz River; 2) Columbia Flyfishers Coweeman Pond #1/Lower - 10,000 steelhead smolts into the Coweeman River; 3) Columbia Flyfishers Coweeman Pond #2/Lower - 5,000 cutthroat smolts into the Coweeman River; 4) Merwin Net Pens/Lewis River Steelheaders - 60,000 steelhead smolts in the Lewis River; and Northwestern Lake Net Pens/White Salmon Steelheaders - 40,000 steelhead smolts in the Northwestern Res., Little White Salmon River

Cowlitz Salmon Hatchery

The hatchery was built in 1967 and is owned and funded by Tacoma Public Utilities as mitigation for the fish impacts caused by Mossyrock and Mayfield dams. The facility is used for collection, egg incubation, and rearing fall chinook salmon, spring chinook salmon and late (Type-N) coho. In addition, this facility provides some eggs and fish to volunteer and/or educational fish rearing projects. The production goals for the hatchery are 1,720,000 spring chinook yearlings and subyearlings for on-station releases, 60,000 spring chinook egg/fish to co-op programs, 6,500,000 fall chinook subyearlings for on-station releases, 10,500 fall chinook eggs/fish to co-op programs, 4.7 million coho (Type N), 800,000 to 1,200,000 subyearlings for upstream coho fishery and provide 61,200 coho eggs/fish to co-op programs.

The proposed 1999 production releases for the Cowlitz Salmon Hatchery are 1,090,000 spring chinook salmon, 4,300,000 fall chinook salmon, 4,000,000 million coho, 30,000 summer steelhead and 120,000 winter steelhead.

Broodstock collected at this site is also used for the re-establishment of spring chinook salmon, fall chinook salmon, and coho above Cowlitz Falls Dam as part of the Cowlitz Falls restoration effort. WDFW continues to use procedures and protocols identified in the IHOT reports for this production facility (IHOT 1995). The spring chinook salmon broodstock for this facility originated mainly from the Cowlitz River with some contribution from Willamette River stock. Tule fall chinook salmon broodstock propagated at Cowlitz originated from the Toutle River. Currently, importing eggs/fish from other facilities is not done at this hatchery and eggs from hatchery returning adults are always given priority for station use (IHOT 1996c).

Lewis River Salmon Hatchery

Lewis River Hatchery is located on the Lewis River three miles downstream from Merwin Dam. The Speelyai Hatchery is operated as a satellite facility to the Lewis River Hatchery and is located at the upper end of Lake Merwin on the Lewis River. The operation of the Lewis River Hatchery is currently funded by Pacificorp (66%) and through NMFS-Mitchell Act (34%)(IHOT 1996c). The goal of the hatchery is to produce adult coho and spring chinook that will contribute to NE Pacific and Columbia River Basin sport and commercial fisheries. Production goals for the hatchery are 900,000 spring chinook yearlings and 2.1 million coho yearlings (Type N) and 50,000 coho eggs to co-op programs. The projected 1999 hatchery releases for Lewis River Hatchery are 944,000 spring chinook and 1,814,000 coho.

The Lewis River Hatchery is used for adult collection, egg incubation and rearing of early (Type-S) and late (Type-N) coho as well as spring chinook salmon. Lewis River also final rears a component of spring chinook salmon from Speelyai for three months. Speelyai Hatchery is used for adult holding, egg incubation and rearing of spring chinook salmon and Type-N coho.

The WDFW continues to operate the Lewis and Speelyai hatcheries as outlined in the IHOT (1995) operations report. Current operating protocols allow for the importation of eggs or fish from other facilities with acceptable stocks to achieve production goals while trying to maintain genetic integrity in times of inadequate hatchery returns. Eggs from hatchery-returning adults are given priority for on station use (IHOT 1995). After Lewis River spring chinook salmon, the next suitable stocks, as identified by WDFW, are Cowlitz River spring chinook salmon, or Kalama River spring chinook salmon. Lewis River coho Type-S and Type-N stocks are preferred, but WDFW will make up any short fall with any Columbia River Type-S and Type-N coho stock.

Educational and Volunteer Salmon Enhancement Projects

The WDFW is involved in 34 educational and volunteer salmon enhancement projects located in the tributaries below Bonneville Dam (WDFW 1997b). Educational enhancement projects are confined to small egg incubation and fry/fingerling release efforts, with the exception of Sea Resources (a private hatchery) and Cathlamet High School (a rearing pond). The volunteer enhancement projects include fall chinook salmon, spring chinook salmon and coho rearing programs. These volunteer salmon rearing programs produce their own smolts (Sea Resources) or receive yearling salmon from WDFW hatcheries. Continued rearing and release of yearling salmon occurs away from the donating the WDFW hatchery site at the individual facilities. The Sea Resources Hatchery project traps fall chinook and chum broodstock for on station use. Coho propagated at Sea Resources are supplied from WDFW facilities. No adult salmon are trapped or handled at other volunteer group locations (WDFW 1997b). In 1999 these volunteer projects are expected to produce 1,029,000 total salmon composed of 300,000 fall chinook fingerlings, 20,000 spring chinook yearlings, 234,000 coho, 5,000 sea-run cutthroat trout and 270,000 chum to be released each year.

East Bank Hatchery

Eastbank Hatchery is located on the east side of the Columbia River near Rocky Reach Dam, 7 miles north of Wenatchee, Washington. Five satellite facilities are located on four different rivers (Wenatchee, Chiwawa, Methow, and Similkameen). The hatchery was built to mitigate for smolt losses at Rock Island Dam and began operation in 1989. The hatchery is used for incubation and rearing of steelhead; spring chinook, summer chinook, and sockeye. The annual production goals are 440,000 yearling summer chinook for release in the Wenatchee River Basin; 672,000 yearlings spring chinook for release into the Chiwawa River; 400,000 yearling summer chinook for release into the Methow River Basin (Carlton Pond); 576,000 yearling summer chinook for release into the Similkameen River; 200,000 subyearling sockeye for release into Lake Wenatchee net-pens; and 200,000 summer steelhead smolts for off-station release (Table 1 Permit 1094).

The 1999 projected releases from Eastbank Hatchery are 265,000 spring chinook into the Chiwawa Pond; 380,000 summer chinook into the Carlton Pond; 585,000 summer chinook into the Similkameen River; 435,000 summer chinook into the Wenatchee River; and 125,000 sockeye into the Lake Wenatchee net-pens.

Methow Hatchery

The hatchery is located along the Methow River upstream from the confluence with the Chewuch River in north-central Washington, near the town of Winthrop. The Methow Hatchery began operating in 1992 with the purpose of mitigating fish losses caused by the construction of the Wells Project. Douglas County PUD provides funding for this hatchery under the FERC Wells Dam Settlement Agreement (FERC Project No. 2149). The goal of this hatchery is to increase the number of naturally spawning spring chinook salmon adults in the Methow, Twisp, Chewuch rivers and Lost Creek. The hatchery is used for adult collection, incubation, and rearing of three spring chinook stocks. In 1996 and 1998, all spring chinook were collected at Wells Dam and the three stocks were spawned together to make a composite broodstock.

The hatchery has satellite facilities located on the Twisp and Chewuch rivers; these sites have adult traps and juvenile acclimation ponds. Rearing units at the central facility consist of 24 start tanks, 15 raceways, and an acclimation pond. Three of the raceways also serve as adult holding ponds. Fish are released at both the central and off-station acclimation ponds. Adult fish that are collected from the Twisp and Chewuch rivers are transported to Methow Hatchery where they are held and spawned. Following egg incubation and early rearing, juvenile fish are transported to acclimation ponds at the parent river for final rearing and release. A broodstock selection protocol is developed each year. All fish are spawned at 1:1 male to female ratio. The fish are reared to 15 fpp, acclimated to their natal river water for minimum of six weeks, and volitionally released in April-May.

WDFW in cooperation with YIN started an adult-based supplementation program based on a single Methow population in 1998 (Bugert 1998). Adult broodstock will be taken at Wells Dam to supplement the Methow, Chewuch, and Twisp rivers. This program will be augmented by captive rearing of pre-emergent fry collected on the Twisp River or from gametes of marked Twisp adults taken at Wells Dam. Production will be distributed proportionately among the three streams. The production goal is 550,000 yearling smolts (36,667 lbs. at 15 fpp) at Methow Hatchery. The projected 1999 releases are 130,000 spring chinook into the Chewuch River, 330,000 spring chinook into the Methow River and 25,000 spring chinook into the Twisp River.

Priest Rapids

The Priest Rapids Hatchery is operated as mitigation for fishery impacts caused by the Priest Rapids Project (Priest Rapids and Wanapum dams). The Priest Rapids facility includes six ponds for adult holding and rearing, 12 vinyl-lined raceways, and incubation facilities for production of upriver bright fall chinook. The production goals are 5 million fall chinook subyearlings for on station release and 1.7 million fall chinook smolts as part of John Day mitigation. The projected 1999 releases are 5 million fall chinook subyearlings and 1.7 million fall chinook smolts.

Turtle Rock

The Turtle Rock Hatchery is located along the Columbia River 2 miles upstream from Rocky Reach Dam. The hatchery includes the old Rocky Reach Hatchery, located just downstream from Rocky Reach Dam. The hatchery is used for incubation and rearing of summer chinook and the rearing of steelhead. The Turtle Rock Hatchery is operated as a mitigation facility for the fishery impacts caused by the construction and operation of Rocky Reach Dam. The Turtle Rock Hatchery includes one rearing pond, eight vinyl-lined raceways, and incubation facilities. Water available for use in the Turtle Rock Hatchery averages 12,000 gpm and is from the Columbia River. Water rights for the Rocky Reach satellite total 3,613 and are from the Columbia River.

The production goals are to produce 200,000 yearling summer chinook and 1,600,000 subyearling summer chinook for release from Turtle Rock Hatchery. The 1999 projected releases are 207,000 summer chinook yearlings and 615,000 summer chinook sub-yearlings.

Wells Hatchery

Wells Hatchery is located along the Columbia River just below Wells Dam. The hatchery is operated as a mitigation facility for fishery impacts caused by the Wells Dam. The mitigation agreement with Douglas County PUD requires an annual production of 56,200 pounds of summer steelhead. The hatchery is used for adult collection, incubation, and rearing of summer chinook and summer steelhead. The hatchery production goals are 320,000 summer chinook yearlings and 484,000 subyearling for on-station releases and 450,000 summer steelhead for off-station release. The 1999 projected releases from Wells Hatchery include: 410,000 summer chinook smolts; 392,200 sub-yearling summer chinook and 758,000 listed summer steelhead. The Wells Hatchery summer steelhead program is included in the ESU and therefore is covered under a section 10 directed take permit (1094) with WDFW, which was issued on February 4, 1998 (Table 1).

3. IDFG's Artificial Propagation Program

IDFG requests authorization to operate four Idaho Power Company (IPC) mitigation hatcheries. These four facilities (Niagara Springs, Pahsimeroi, Rapid River and Oxbow/Hells Canyon) are funded by the IPC pursuant to the Hells Canyon Settlement Agreement, a fish and wildlife mitigation plan approved by FERC in 1980. The Settlement Agreement provides mitigation for impacts to anadromous fish caused by IPC's three-dam Hells Canyon Complex. Operation of the facilities is guided by the mitigation goals of the Settlement Agreement and the management goals of IDFG.

IDFG proposes to release approximately 5,380,000 anadromous smolts in 1999 from the IPC facilities. Of the smolts to be released 3,200,000 are spring chinook salmon and 2,180,000 are steelhead.

Rapid River Hatchery

Rapid River Hatchery is located on Rapid River, a tributary to the Little Salmon River near Riggins, Idaho. It is located approximately 606 river miles from the mouth of the Columbia River at an elevation of 2,185 feet above mean sea level. The hatchery was constructed in 1964 to mitigate for fishery losses caused by IPC’s Hells Canyon Complex. The hatchery has reared spring chinook salmon only and is used for adult collection, egg incubation and rearing smolts. Surplus eggs are provided to other hatchery programs in the basin.

The production goal is 3 million spring chinook smolts, with 2.5 million released directly from the rearing ponds into Rapid River and 0.5 million released into the Snake River below Hells Canyon Dam. The 1999 projected release from Rapid River Hatchery is 3,200,000 spring chinook.

Pahsimeroi Hatchery

The hatchery is located on the Pahsimeroi River near Ellis, Idaho and is used for adult collection and spawning of summer steelhead and the adult collection, spawning, incubation, rearing, and release of summer chinook. The Pahsimeroi facility includes three ponds for adult holding, four concrete raceways and incubation facilities. The satellite facility has two earthen rearing ponds.
The main hatchery receives its water (17,953 gpm) directly from the Pahsimeroi River by both gravity and pumped supplies. It also receives a small flow (225 gpm) from a series of small nearby springs.

The hatchery is funded by IPC as mitigation for fishery losses caused by construction of hydroelectric dams on the Snake River in Hells Canyon. The hatchery is divided into two locations with the lower facility one mile upstream and the satellite facility seven miles upstream from the river mouth. The hatchery began operation in 1969. The goal of the hatchery is to relocate steelhead and chinook salmon runs from the Snake river(which was blocked by Hells Canyon, Oxbow, and Brownlee dams) to the Salmon River drainage.

The production goal for summer chinook is 1 million smolts for release into Pahsimeroi River and the Salmon River drainage, and to provide surplus eggs to other hatchery programs in the state. Summer steelhead goals are to provide green and eyed eggs to Niagara, Magic Valley, and Hagerman hatcheries. There are no releases of unlisted fish from Pahsimeroi Hatchery in 1999.

Niagara Springs Hatchery

Niagara Springs Hatchery is in the Snake River Canyon, 10 miles south of Wendell, Idaho at an elevation of 3,000 feet above sea level. The hatchery is used for incubation and rearing of summer steelhead smolts from eggs provided by Oxbow and Pahsimeroi hatcheries. The Niagara Springs facility includes 19 concrete raceways, 10 raceways for early rearing, and incubation facilities. The hatchery's water supply is by gravity flow from Niagara Spring, with a constant water temperature of 58 ˚F. flow increases from 50 cfs in June to 120 cfs in March. The hatchery is funded by IPC as mitigation for fishery losses caused by construction of hydroelectric dams on the Snake River in Hells Canyon.

The mitigation goals for the hatchery are to (1) enhance steelhead runs in the Snake River below Hells Canyon Dam, and (2) relocate part of this run to the Salmon River and its tributaries. The production goal for summer steelhead is 900,000 smolts for release into the Salmon River and its tributaries, and 900,000 smolts for release into the Snake River below Hells Canyon Dam. IDFG proposes to release a total of 1,820,000 summer steelhead smolts from Niagara Springs Hatchery in 1999, including 660,000 smolts into the Snake River below Hells Canyon; 150,000 smolts into the Little Salmon River; 830,000 smolts at the Pahsimeroi trap; 150,000 smolts at Salmon River (Hammer Creek) and 30,000 smolts into the Salmon River (Pine Bar) from Niagara Springs. No broodstock are collected at Niagara Springs Hatchery.

Oxbow/Hells Canyon Hatchery

Oxbow Hatchery began operating in 1962 as part of the IPC's mitigation for fishery losses caused by construction of hydroelectric dams on the Snake River in Hells Canyon. The hatchery is located in Oregon near the Oxbow hydroelectric facility on the Snake River. The Oxbow River facility includes four ponds for adult holding, six concrete raceways, and incubation facilities. Water used at Oxbow Hatchery is obtained by pumping it from either the Snake River or an on-site well. The two production pumps produce approximately 6,750 gpm and the two wells produce a total of 200 gpm.

The goal of the hatchery is to trap and spawn adult steelhead. The eggs are incubated to the eyed stage then transferred to other hatcheries. Adult spring chinook are also trapped and held for eventual transfer to the Rapid River Hatchery.

4. IDFG's Resident Trout Stocking Program

IDFG proposes to stock catchable-size (average 25 cm), sub-catchable (average length 15 cm) and fingerling (average length 10 cm) hatchery rainbow trout in sections of the Salmon and

Clearwater rivers and in lakes and ponds tributary to these waters. The release of hatchery trout is to provide recreational fisheries. The fish are generally released in areas and at times where contact with listed species is less likely to occur.

In 1999, IDFG is proposing to release 69,700 hatchery catchable trout (average 25 cm in length), and approximately 20,000 hatchery sub-catchable rainbow trout into the Salmon River and tributary streams; 50,000 sub-catchable trout (15 cm in length) into the lower Salmon River (downstream of Whitebird Creek); and 50,000 sub-catchable trout into the lower Clearwater River. IDFG has also proposed to release a total of 25,000 hatchery catchable rainbow trout into the Stanley Basin lakes. Refer to IDFG (1998) for specific information concerning release locations and numbers.

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

There are three salmon and three steelhead ESUs listed under the ESA that are potentially affected by the proposed action. This Opinion addressing the following six ESUs: 1) Snake River sockeye salmon (*O. nerka*) - listed as endangered under the ESA (56 FR 58619) on November 20, 1991; 2) Snake River spring/summer chinook salmon and 3) Snake River fall chinook salmon ESUs - listed as threatened on April 22, 1992 (57 FR 14653); 4) Snake River steelhead - listed as threatened and 5) Upper Columbia River steelhead - listed as endangered on August 18, 1997 (62 FR 43937); and 6) Lower Columbia River steelhead ESU - listed as threatened (63 FR 13347). The Wells Hatchery steelhead stock was derived from steelhead populations native to the Upper Columbia River area, and has been determined useful and necessary for recovery of the ESU.

A. Life History and Population Trends

The biological information, life history information, and population trends for the listed salmon and steelhead ESUs considered in this Opinion are described in Appendix A. Greater detail of life history traits, particularly as related to the determination of ESUs, can be found for steelhead in Busby et al. (1996), and for chinook salmon in Myers et al. (1998). The more recent All Species Review (ASR) prepared by the *U.S. v Oregon* TAC focused on the status of Columbia River Basin salmonids, including steelhead (TAC 1997).

In general, it can be said that population trends are down all over the Columbia River Basin. The causes for this are numerous and varied. In the Lower Columbia River urbanization and other habitat alterations have severely curtailed populations. In the Mid-Columbia and Snake River drainages, hydropower development and habitat destruction account for many of the problems salmon and steelhead face. In the Upper Columbia River, hydropower facilities and habitat destruction come to the fore front as the major causes of the population decreases (along with harvest effects). To these effects are added recent poor ocean conditions and vastly increased avian predation in the Columbia River estuary, both of which affect all of the basin's salmon and steelhead populations. All these effects are described in greater detail in the following sections. But the net result is that, despite recent improvements in all the areas mentioned, all the listed salmon and steelhead ESUs face a number of difficult obstacles during their life cycle.

This fact can be seen in the projected run sizes at the Columbia River mouth in 1999 for spring chinook, summer chinook, and sockeye salmon and steelhead (Table 4). After a temporary increase in returns in 1997 and, based on preliminary run information, in 1998, return numbers are expected to decline again, due to the very low escapements in 1994 and 1995.

Table 4. Preliminary estimates of 1999 upriver run sizes for salmonid species listed or proposed for listing under the Endangered Species Act (TAC 1998). Final run size forecasts are not yet available for some species.

Listed Salmonid species/run	Preliminary estimate of run size at Columbia River mouth
Snake River naturally-produced fall chinook	2,009
Snake River sockeye	<5
Snake River naturally-produced spring chinook	3,600
Snake River naturally-produced summer chinook	2,200
Snake River naturally-produced spring/summer chinook	5,800
Upper Columbia River hatchery-produced steelhead	14,900
Upper Columbia River naturally-produced steelhead	1,600
Upper Columbia River steelhead	16,500
Snake River naturally-produced steelhead	21,600
Lower Columbia River naturally-produced steelhead	2,800

† Spring-run component only.

B. Critical Habitat

Critical habitat was designated for Snake River sockeye salmon, Snake River spring/summer chinook salmon, and Snake River fall chinook salmon on December 28, 1993 (58 FR 68543), effective on January 27, 1994. However, critical habitat has not yet been designated or proposed for the Snake River, Upper Columbia River or Lower Columbia River steelhead ESU's (62 FR 43937, 63 FR 13347). The designation of critical habitat provides notice to Federal agencies and the public that these areas and features are vital to the conservation of listed Snake River salmon.

The essential features of the Columbia River adult migration corridor for listed salmon and steelhead are described in Appendix A.

IV. ENVIRONMENTAL BASELINE

Environmental baselines for biological opinions include the past and present impacts of all state, Federal or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR §402.02). The environmental baseline for this Opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species in the action area. In addition to artificial propagation actions, the activities having the greatest impact on the environmental baseline generally fall into three categories: hydropower system impacts on juvenile outmigration and adult return migration; habitat degradation effects on water quality and availability of adequate incubation and rearing locations; and harvest impacts on adults. The fish are also affected by fluctuations in natural conditions. In addition to hatchery actions, the following discussion reviews recent developments in each of the sectors, and outlines their anticipated impacts on natural conditions and the future performance of the listed ESUs.

The analysis of the environmental baseline is not fully developed here with respect to actions taken in other sectors. This is due to the short time frame imposed by the upcoming release of hatchery fish and the number of listed salmon and steelhead. However, in developing conclusions with respect to the proposed action, NMFS has paid particular attention to the discussion of the species' status and population trends which reflect the additive effects of past and on-going human and natural factors leading to the current status of the species.

A. Hydropower Impacts

Columbia River Basin salmon and steelhead, especially those above Bonneville Dam, have been dramatically affected by the development and operation of the Federal Columbia River Power System (FCRPS). Storage dams have altered the natural hydrograph of the Snake and Columbia rivers, decreasing spring and summer flows and increasing fall and winter flows.

Power operations cause fluctuation in flow levels and river elevations, affecting fish movement through reservoirs and riparian ecology and stranding fish in shallow areas. The eight dams in the migration corridor of the Snake and Columbia rivers block migration of smolts and adults. Smolts experience a high level of mortality passing the dams. The dams also have converted the once-swift river into a series of slack-water lakes, slowing the smolts' journey to the ocean and creating habitat for predators.

There have been numerous changes in the operation and configuration of the FCRPS as a result of ESA consultations between the action agencies (Bureau of Reclamation, BPA and USACE) and the Services (NMFS and USFWS). These have resulted in survival improvements for listed fish migrating through the Snake and Columbia rivers. Increased spill at all of the FCRPS dams allows smolts to avoid both turbine intakes and bypass systems. Increased flow in both the Snake and Columbia River mainstems provides better inriver conditions for smolts. The transportation of smolts from the Snake River has also improved by the addition of new barges and modification of existing barges.

In addition to the flow, spill and transportation improvements, the USACE implemented numerous other improvements to project operations and maintenance at all Columbia and Snake River dams. These improvements, such as operating turbines at peak efficiency, new extended length screens at McNary, Little Goose, and Lower Granite dams, and extended operation of bypass screens, are enumerated in greater detail in the 1995 biological opinion on operation of the FCRPS (NMFS 1995d).

Since the 1995-1998 FCRPS opinion, a concerted effort has continued in the region to evaluate options for modification and future operation of the hydropower system. The 1998 report of the Plan for Analyzing and Testing Hypotheses (PATH) process describes Snake River spring/summer chinook salmon recovery prospects under several modeled scenarios (Marmorek et al. 1998).

Results of the PATH analysis indicate that, under some sets of assumptions, current harvest practices coupled with any of the future hydro actions will lead to meeting biological requirements. Under other sets of assumptions, biological requirements are not met. Actions that meet biological requirements under a larger proportion of the hypothesis sets examined by PATH are more robust, given the uncertainties that led to consideration of alternative assumptions.

Results of these analyses suggest that the first sensitivity harvest rate schedule made little difference in the unweighted mean probabilities of exceeding survival thresholds or achieving recovery levels (an increase of approximately 1% or less). The second sensitivity harvest rate schedule (constant 3% harvest rate) had a somewhat greater effect (an increase of approximately 1-3%) for hydro actions that produced smaller numbers of forecasted spawners (those representing current hydrosystem configuration). However, at higher levels of forecast abundance (such as dam breaching alternatives), larger reductions in harvest rates in some cases lead to small decreases in the probability of meeting jeopardy standards (less than 3%

reduction) due to over-escapement, which leads to lower levels of recruitment. The results of this analysis cannot be used to explicitly adjust the unweighted mean probabilities, because the same sets of alternative assumptions were not included in each analysis. However, the sensitivity analyses provide an approximate understanding of the level of change that might occur as a result of changing harvest rates.

In any case, some improvements in the hydropower system (such as passage improvements at dams) benefit only those listed salmonids that pass those dams; other improvements (such as increased flows) benefit all salmonids in the Columbia Basin. It is difficult to quantify the survival benefits from these many actions for each listed ESU. For Snake River spring/summer chinook smolts migrating inriver, the estimated survival through the hydropower system is now 40-60%, compared to an estimated survival rate during the 70's of 20-40%. It is likely that Snake River steelhead have received a similar benefit as their life history and run timing is similar to that of spring/summer chinook. It is more difficult to obtain direct data and compare survival improvements for fish transported from the Snake River, but there are likely to be improvements for transported fish as well. It is reasonable to expect that the improvements in operation and configuration of the FCRPS will benefit all listed Columbia Basin salmonids and that the benefits will be greater the farther upriver the ESU is. Nonetheless, because the hydropower system is widely accepted to be the single greatest source of salmon mortalities in the basin, further improvements must continue to be made.

B. Habitat Impacts

Land management activities affect aquatic health and salmon and steelhead survival in a number of ways. For example, timber harvest, road-building, grazing, cultivation and other activities can increase sediment, destabilize banks, reduce organic litter and woody debris, increase water temperatures, simplify stream channels, and increase peak flows. Habitat quality for Columbia River Basin salmon and steelhead varies widely from ESU to ESU, and the habitat of each is affected by a different set of land management activities. The vast majority of land management activities on Federal land have undergone consultation and the U.S. Forest Service and Bureau of Land Management have adopted forest plans that should improve watershed health. (For example, the Aquatic Conservation Strategy of the Northwest Forest Plan, on which NMFS has consulted, includes strong measures to protect aquatic habitats.) NMFS expects habitat quality to improve over time on Federal land to the point that all Federal land provides properly functioning watershed conditions for salmon and steelhead. This, in turn, should result in improved spawning and rearing success for the listed ESUs.

ESA consultations do not cover non-Federal lands as completely as Federal lands. NMFS has consulted on some activities on non-Federal land, but the acreage covered is quite small and the impact will therefore be much less on non-Federal than on Federal lands. The Cumulative Effects section of this opinion considers likely future impacts from land management activities not subject to section 7 consultations.

NMFS has not analyzed fully how much of the habitat for each ESU is in Federal ownership, what role that habitat might play in establishing population strongholds, and whether there is sufficient physical connectivity between high quality habitats to ensure persistence for each ESU. NMFS is also not able at this time to quantify improvements in productivity that should result from improvements in habitat conditions. It is reasonable to expect, however, that improvements in land management on Federal land throughout the Basin will result in improved overall survivals for the listed ESUs considered in this Opinion. It must be noted that the vast area over which habitat needs to be improved — coupled with the long time periods such a process generally requires — will tend to limit progress both in terms of scope and pace. It took many years of poorly-informed land management to arrive at the current degraded conditions, and it will take many more to see a similar improvement.

C. Natural Conditions

Recent natural conditions have not been good for listed Columbia River Basin ESUs. Most have suffered from poor ocean survivals over the past two decades, exacerbated by El Niño events. In addition, a recent increase in bird populations in the Lower Columbia River has resulted in high levels of predation on smolts. The world's largest colony of Caspian terns and the two largest colonies of double-crested cormorants on the west coast of North America have recently become established in the Columbia estuary. The tern colony alone is estimated to take between 6 and 25 million smolts annually. Total predation impacts are estimated to be in the range of 10 to 30 percent of all salmonid smolts that reach the estuary. NMFS biologists estimate that one to three million smolts of listed or proposed species are being taken from the estuary annually by avian predators. This smolt loss may represent more than 30,000 adults of listed species that are lost to future spawning escapements. Two smaller tern colonies, several large gull colonies and cormorants living on islands in the upstream hydropower reservoirs consume additional millions of smolts. Nonetheless, it is reasonable to expect that ocean conditions are cyclic and will eventually improve. It is also reasonable to expect that current efforts to relocate the bird populations will eventually reduce the bird predation. These conditions, however, are currently creating a survival bottleneck for many listed populations.

D. Additional Snake Basin Fisheries

Fish harvest in the Columbia River basin affects the listed species by incidentally taking them in fisheries that target non-listed species. Most take is in the form of catch and retention, mortalities resulting from hooking and release, and mortalities resulting from encounters with fishing gear as a consequence of fishery activities. Taking occurs in both Treaty and non-Treaty harvest. A recent biological opinion on inriver harvest concluded that, due to the constrains set on harvest levels, the activities associated with the Treaty and non-treaty fisheries were not likely to jeopardize the continued existence of any of the listed species (NMFS 1999a).

To illustrate, the Treaty Indian fisheries considered in the opinion will be constrained to harvest rates in all fisheries combined of no greater than 5% for returns of spring chinook to the mouth of the Columbia River of less than 50,000 (as anticipated for 1999), or no greater than 7% for spring chinook returns greater than 50,000 so long as Snake River naturally-produced spring chinook returns exceed 5,000. Treaty Indian fisheries will additionally be constrained to a harvest rate of no greater than 5% on summer chinook salmon for all run sizes. Non-Indian fisheries are constrained to less than 1% harvest rate impacts on spring and summer chinook salmon, based on the run sizes reasonably expected to occur in 1999. Because non-Indian harvest impacts are likely to be appreciably below 1% for each of these run components, the resultant Snake River spring/summer chinook salmon total impacts are most likely to be around 5%.

No harvest impacts on Snake River sockeye are anticipated.

For most other ESUs considered in this opinion, the harvest impacts are as follows. For Lower Columbia River steelhead, Upper Columbia River steelhead, and Snake River steelhead, no more than 3.0%, 3.7%, and 4.2%, respectively of the estimated return to the Columbia River mouth will be taken. There is as yet no biological opinion on inriver harvest of fall chinook. However, it is anticipated that the exploitation rates will be similarly low.

E. Ocean fisheries

While impacts from ocean fisheries on sockeye and chinook salmon listed or proposed for listing are not within the action area of the proposed action, those impacts are summarized here to provide a more complete accounting of harvest impacts on these species.

Impacts from ocean fisheries on listed spring/summer chinook and sockeye salmon have been considered in recent biological opinions. NMFS (1996a) concluded that it is highly unlikely that any Snake River sockeye salmon are taken in salmon fisheries off the west coast and that, although Snake River spring/summer chinook may on occasion be taken, the overall ocean exploitation rate is likely less than 1%. NMFS (1998c) also reviewed the potential impacts to steelhead for ocean salmon fisheries. Since steelhead are only rarely caught in these fisheries, it is unlikely that any of the listed or proposed steelhead ESUs are significantly impacted.

F. Expected Future Performance

Most ESUs in the Columbia Basin will experience improved survivals as a result of improvements in FCRPS operations and configuration, habitat improvements on Federal lands, improvements in hatchery practices, and improvements in harvest measures. Notwithstanding these improvements, however, is the fact that environmental conditions are still generally quite poor with respect to salmonid survival in a number of their life phases. In fact, for many stocks, survivals must improve by an order of magnitude in order for the ESUs to survive and recover. Smolt-to-adult return rates in 1998 or Snake River spring/summer chinook, for example, were less than one-half of one percent–about one-tenth the rate needed for sustainability. The long-term survival of many ESUs from the Upper Columbia River Basin will depend upon improvements in ocean and habitat conditions and conditions in the hydropower corridor. For mid-Columbia Basin stocks, it will depend on improvements in ocean conditions and habitat, as well as improvements in the hydropower corridor. For Lower Columbia River Basin stocks, it will depend on improvements in ocean conditions and habitat. NMFS does not have information to suggest that harvest is a major factor limiting recovery of Columbia River Basin stocks, though harvest reductions have been and will continue to be an important contributor to survival through the current bottleneck.

For Snake River spring/summer chinook, life cycle modeling is available that assists in projecting population performance in the future. The life cycle modeling has been conducted by a multi-entity effort called the PATH. The primary PATH analysis assumed that ocean harvest rates would be zero and inriver harvest would reflect current harvest management as described for the proposed action. This analysis assumed a broad range of options such as: effects of factors influencing juvenile survival during passage through the hydropower system, post-Bonneville Dam mortality and its causes, future environmental conditions and their effects on survival, and the timing and effectiveness of proposed hydropower actions. The results were summarized with respect to the likelihood of the ESU surviving over 24 and 100 years, respectively, and recovering over 48 years. These results are summarized in Attachment 2 to NMFS (1995b).

Results of the PATH analysis indicate that, under some sets of assumptions, current harvest practices (which equate to the proposed action), coupled with any of the future hydropower actions, will lead to survival and recovery. Under other sets of assumptions, recovery will not occur unless some hydropower dams are removed. PATH also conducted a sensitivity analysis considering effects of changes in inriver harvest rates. A change from the proposed harvest rate to a rate of 1.5% made little difference in the probability of achieving survival or recovery (an increase of approximately 1% or less).

G. Hatchery Actions

The action area for this Opinion is that portion of the range of the listed salmon and steelhead that is directly and indirectly affected by hatchery operations. This includes the spawning/nursery areas, the Snake and Columbia River migration corridors, the Columbia River estuary, and ocean habitat.

The current hatchery system in the Columbia River Basin is made up of over 70 hatchery programs and associated satellite facilities, some of which were initiated more than 110 years ago, before the salmon and steelhead were listed pursuant to the ESA.

This Opinion evaluates the effects of the proposed hatchery actions in the context of the species' current status and likely population trends. The relative health of the listed salmon and steelhead is critical to determining whether or not the proposed hatchery actions are likely to jeopardize the species or adversely modify their critical habitat.

With this function of the environmental baseline in mind, NMFS does not attempt to quantitatively distinguish effects attributable to past operation of hatchery programs and other factors from the likely future effects. What follows is a summary of the listed ESUs prospects using their current status as the population component of the environmental baseline.

V. EFFECTS

A considerable body of literature has examined the beneficial and adverse effects of hatchery practices and production on natural populations of salmon (for example, Cross et al. 1991, Lichatowich and McIntyre 1987, Winton and Hilborn 1994). Within the action area for this Opinion, the Columbia Basin Fish and Wildlife Authority and U.S. Fish and Wildlife Service (USFWS) have summarized the history, development, and management of anadromous fish facilities in the Columbia River Basin (CBFWA 1990). More recently, artificial propagation programs and projects in the Columbia River Basin have been reviewed in *Upstream: Salmon and Society in the Pacific Northwest* (NRC 1996), *Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem* (ISG 1996) and *Review of Salmonid Artificial Production in the Columbia River Basin: As a Scientific Basis for Columbia River Production Programs* (ISAB 1998). Despite these reviews, it is still difficult to quantify the effects of these hatcheries on threatened and endangered salmon species in the Columbia River basin because long-term monitoring program that would allow us to quantify the beneficial and adverse effects of hatcheries have not been in place.

Nevertheless, it is possible to outline the effects of hatcheries qualitatively. This analysis of effects summarizes information provided in Federal action agencies' biological assessments (see Literature Cited section), which provide a lengthy discussion and review of the literature regarding hatchery programs' effects.

A. General Effects of the Proposed Actions

Artificial propagation programs adversely affect listed salmon and steelhead through operation of the hatchery facilities, interactions between hatchery and natural populations in the natural environment, and collection of broodstock. Hatchery actions may adversely affect listed fish through direct mortality (via predation, broodstock collection, and disease transmission) and indirectly through genetic and ecological interactions in the natural environment. The generalized effects of these actions are summarized below.

1. Operation of Hatchery Facilities

Potential adverse effects identified with the physical operation of hatchery facilities include impacts from water withdrawal and release of hatchery effluent. Water withdrawal for hatcheries located within the spawning and/or rearing areas can diminish stream flow from points of intake to outflow and, if great enough, can impede migration and affect spawning behavior. This impact does not occur in the migration corridor. Screening of hatchery intakes is critical to ensure that fish are not permanently removed from the stream.

Effluent from the hatchery may change water temperature, pH, suspended solids, ammonia, organic nitrogen, total phosphorus, and chemical oxygen demand in the receiving stream's mixing zone (Kendra 1991). Hatchery effluent may also transport pathogens (disease) out of the hatchery and infect natural-origin fish. The level of impact or the exact effect on fish survival is unknown, but is assumed to be very small and is probably localized at outfall areas as effluent is rapidly diluted in the receiving streams and rivers.

2. Broodstock Collection

Hatcheries that incidentally take listed salmon and steelhead when collecting broodstock typically incorporate a weir or barrier that forces migrating adults to enter a ladder and trap. This effectively blocks their upstream migration and the trapped salmon and steelhead are counted and either retained for use in the hatchery or released upstream of the weir to spawn naturally. Potential adverse effects on adults from operation of fish barriers and weirs include delaying upstream migration, rejecting the weir or fishway structure and spawning downstream of trap (displaced spawning), falling back downstream after passing upstream of the weir, being injured or killed as adults attempt to jump the barrier, and inducing stress by handling.

All hatchery chinook salmon released in the Snake River Basin have been marked since 1993, except for spring/summer chinook parr releases into the Clearwater River Basin, which began in 1998. Releases of hatchery salmon in other areas of the Columbia River Basin are marked or tagged for management, monitoring and evaluation, or research purposes, which may include only a percentage of the total fish released. As a result, incidental collection of listed salmon and steelhead in the Snake River Basin and the incorporation of those fish into hatchery populations should be minimal. All hatchery steelhead in the Columbia River Basin are adipose-clipped, while some hatchery release groups are double marked (ventral fin clip, coded-wire tagged etc.) to allow identification by specific hatchery program. However, hatchery steelhead that are double marked with coded-wire tags must be read with a hand held wand and the head dissected in order to determine hatchery origin. Hatchery programs that collect listed salmon and steelhead for broodstock would require a section 10 enhancement permit as collection would then be considered to be directed take. Directed take for broodstock collection is not part of the proposed action in this Opinion (See Table 1 for a list of section 10 directed take permits).

3. Genetic Introgression

The straying of non-native hatchery stocks causes concerns from the cumulative effects of unidirectional gene flow into the listed populations. This can be described by the following equation: $P=(1-x)^t$ where x is the proportion of foreign genes migrating into a population each generation, t is the number of generations, and P is the proportion of native genes in the final population. Cumulative genetic effects are thus a function of both the intensity and duration of straying. For example, if x=10% per generation, the population after five generations would contain 59% native genes and 41% non-native genes. After 10 generations, the figures would be 35% native and 65% non-native. These results apply to a neutral gene. However, selection for local adaptation might reduce the rate at which foreign genes replace native genes.

Straying of non-native salmon into the other areas and spawning with listed salmon and steelhead can potentially lead to outbreeding depression and reductions in fitness of natural populations. In addition, straying can contribute to the breakdown of population structure if the strays make permanent genetic contributions. The magnitude of the effect on listed salmon and steelhead depends on the degree and duration of the genetic interactions, the geographic extent of the populations affected, and genetic differences between the unlisted hatchery-produced fish and the listed natural populations. A number of examples of possible adverse effects of stock transfers of salmonids can be found in Hindar et al. (1991). Local adaption has been shown to be important for a number of phenotypic and life history traits in Pacific salmon (Taylor 1991a).

There is evidence that a number of phenotypic and life history traits in Pacific salmon are the result of local adaptation (Ricker 1972; Taylor 1991a). Circumstantial evidence for the importance of local adaptation is provided by Withler (1982) who found that stock transfers within the normal range of Pacific salmon have been unsuccessful in producing new anadromous stocks, except where natural colonization has been prevented by an obvious physical barrier.

Therefore, the BiOp (NMFS 1995e) recommends that straying of non-native hatchery fish may not exceed 5% of any naturally-produced salmon or steelhead population to minimize the effects of genetic introgression on natural populations. There are also well documented risks to natural populations from hatchery propagation (Hard et al. 1992, Cuenco et al. 1993, NRC 1996, and Waples 1996). Some of the genetic risks include: loss of genetic variability within and between populations, genetic drift, selection and domestication. Given these concerns, it is prudent to limit genetic introgression by non-native hatchery-produced fish into natural populations.

NMFS conducted a scientific workshop in 1995 which focused on the biological consequences of artificially elevated levels of straying into natural salmon populations. A key question addressed in the workshop was how much gene flow can occur above natural levels and still remain compatible with long-term conservation of local adaptations and diversity among populations. A value of 5% gene flow is much higher than what generally occurs between natural populations and non-local populations and would quickly lead to replacement of not only neutral genes, but locally-adapted ones too, based on what is known about selection in other animals (Grant 1997). NMFS notes that gene flow is expected to be much less than the percentage of out of basin strays. However, whenever feasible the percentage or number of non-native adult strays into a particular population should be as low as possible to minimize genetic introgression.

4. Hatchery Production: Density-Dependent Effects

Hatchery production in much of the Columbia River Basin is managed under the supervision of the United States District Court for the District of Oregon as specified in *U.S. v Oregon* (Case No. 68-513) and its consent decree, the Columbia River Fish Management Plan (CRFMP). The CRFMP's purpose is to provide a framework within which the parties may exercise their sovereign powers in a coordinated and systematic manner to protect and rebuild Columbia River fish populations while providing harvests for both Native American and non-treaty fisheries. However, the CRFMP expired on December 31, 1998, and is in the process of being renegotiated. Once the CRFMP is completed a new biological opinion will be needed to implement the new CRFMP. Although, a guarantee cannot be given in advance of detailed jeopardy analysis, NMFS believes its' Fed-1 Plan for Artificial Propagation (January 7, 1999), when considered in its totality and in the context of the other elements of a new CRFMP, will meet ESA requirements (NMFS and USFWS 1999).

Hatchery salmon smolt releases may cause displacement of rearing wild salmon and steelhead juveniles from occupied stream areas, leading to abandonment of advantageous feeding areas, or premature out-migration (Pearsons et al. 1994). The presence of large numbers of hatchery-produced fish may also alter wild fish behavior patterns, which may increase their vulnerability to predation (NMFS 1995e). Adverse effects of the release of hatchery pre-smolt salmonids as reviewed by Steward and Bjorn (1990) are discussed under competition.

Pearsons et al. (1994) reported displacement of juvenile wild rainbow trout from discrete sections of streams by hatchery steelhead released into an upper Yakima River tributary, but no large scale displacements of trout were detected. Small scale displacement and agonistic interactions that were observed between hatchery steelhead and wild trout resulted from the larger size of hatchery steelhead, which behaviorally dominated most contests. They noted that these behavioral interactions between hatchery steelhead did not appear to have significantly impacted the trout populations examined, however, and that the population abundance of wild salmonids did not appear to have been negatively affected by releases of hatchery steelhead.

Releases of smolts only from hatchery programs will minimize temporal overlap between hatchery salmon and juvenile wild steelhead in the individual rivers and in the Columbia River mainstem. The out-planting of only volitionally migrating smolts by the hatcheries will contribute to a decrease in density-dependant effects on wild fish, such as niche displacement and "pulling", leading to premature migration. Releases of hatchery smolts coincident with managed releases of water (flow augmentation) will also help accelerate downstream migration of hatchery salmon and steelhead, further reducing spatial and temporal overlaps with listed fish, and potential adverse behavioral effects.

The mainstem and estuarine ecology of the Columbia River Basin has profoundly changed from the time when it supported healthy anadromous salmonid populations. Access to major production areas has been eliminated, much of the riverine habitat has been transformed into reservoirs, runoff timing and food resources have been altered, the abundance of predators and potential competitors has increased enormously, and exotic species that prey on or compete with listed salmon and steelhead have flourished. These factors taken together make it very difficult to determine the capacity of the mainstem and estuarine ecosystems to sustain anadromous fish stocks. This has fueled an intense debate over the issues of carrying capacity and density-dependent effects on natural populations of salmon in the Columbia River Basin.

Because hatchery production may be exceeding the carrying capacity of the ecosystem on which natural populations depend, we have concluded that limiting hatchery production is prudent. Since 1995, the action agencies responsible for hatchery production, limited annual releases of anadromous fishes (for purposes other than Snake River salmon recovery) from Columbia River hatcheries to 1994 levels of approximately 197.4 million fish total, of which no more than 20.2 million fish may be produced in the Snake River Basin (Table 4). This production limit should remain in effect until management plans called for in NMFS's Proposed Recovery Plan are completed and unless justification is provided to modify production. Production to support Snake River salmon and Upper Columbia River steelhead recovery is exempt from this limit.

Hatchery production (anadromous) into the Columbia River Basin in 1999 from Federal hatchery programs considered in this Opinion total approximately 109.5 million fish. The projected total releases into the Columbia River Basin from Federal hatchery programs and non-Federal hatchery programs total 142.5 million (Table 3). Of this number, an estimated 19.5 million are identified for the Snake River Basin hatchery programs with the remaining number released throughout other portions of the Columbia River Basin. Releases in 1999 are within the production ceiling called for in the Proposed Recovery Plan. NMFS acknowledges that production programs at individual facility and agency programs may vary from year to year based on adult returns and changing management goals. This is appropriate as long as total releases remain within the overall production ceiling. Releases in excess of the ceiling will require reinitiation of consultation by the action agencies.

5. Disease

Interactions between hatchery fish and listed fish in the natural environment may be a source of pathogen transmission. This impact is probably occurring from headwater spawning and/or rearing areas and throughout the entire migration corridor. As the pathogens responsible for diseases are present in both hatchery and natural-origin populations, there is some uncertainty associated with determining the extent of disease transmission from hatchery fish (Williams and Amend 1976; Hastein and Lindstad 1991). However, hatchery populations are considered to be reservoirs of disease pathogens because of the high rearing densities and resultant stress. Under natural conditions, usually low density, most pathogens are held in check. When epizootics do occur, they are often triggered by increased population density and unusual changes in the environment (Saunders 1991). Consequently, it is likely that release of large numbers of hatchery fish may be responsible for some loss of listed salmon and steelhead from disease. Although hatchery populations can be considered reservoirs for disease pathogens because of their elevated exposure to high rearing densities and stress, there is little evidence to suggest that diseases are routinely transmitted from hatchery to wild fish (Steward and Bjornn 1990). Chapman et al. (1994) concluded that disease transmittal from hatchery to wild populations is probably not a major factor negatively affecting wild steelhead in the Columbia Basin. This effect may be occurring in spawning and/or rearing areas in addition to the entire juvenile migration corridor (Sanders et al. 1992).

Disease transmission between hatchery and natural-origin chinook may be one cause of mortality in the USACE's transportation program. The incidence of bacterial kidney disease (BKD) and the potential for transmission between wild and hatchery stocks of spring/summer chinook salmon collected for transport are being investigated in ongoing research conducted by USFWS. They are trying to determine whether BKD contributes to poor survival of spring/summer chinook salmon smolts (Elliott and Pascho 1993). The incidence of BKD in migrating juvenile sockeye salmon and fall chinook salmon has not been investigated.

To address concerns of potential disease transmission from hatchery to wild fish, the Pacific Northwest Fish Health Protection Committee (PNFHPC) has established guidelines to ensure hatchery fish are released in good condition, thus minimizing impacts to natural fish (PNFHPC 1989). Also, the IHOT (1995) developed detailed hatchery practices and operations designed to prevent the introduction and/or spread of any fish diseases with the Columbia River Basin. The majority of hatcheries in the Columbia River Basin follow fish health protocols in accordance with PNFHPC and IHOT recommended guidelines.

6. Competition

Direct competition for food and space between hatchery and listed fish may occur in spawning and/or rearing areas, the migration corridor, and ocean habitat. These impacts are assumed to be greatest in the spawning and nursery areas and at points of highest fish density (release areas) and to diminish as hatchery smolts disperse (USFWS 1994). Competition continues to occur at some unknown, but probably lower, level as smolts move downstream through the migration corridor. Release of large numbers of pre-smolts in a small area is believed to have greater potential for competitive effects because of the extended period of interaction between hatchery fish and listed species. Release of hatchery smolts that are physiologically ready to migrate is expected to minimize competitive interactions as they should quickly migrate out of the spawning and nursery areas.

Release of coho salmon have the potential to interact with listed spring/summer chinook salmon, fall chinook salmon and steelhead. Information suggests that juvenile coho salmon are behaviorally dominant in agonistic encounters with juveniles of other stream-rearing Pacific Northwest salmonid species, including chinook salmon, steelhead (*O. mykiss*), and cutthroat trout (*O. clarki*). Dominant salmonids tend to capture the most energetically profitable stream positions (Fausch 1984, Metcalfe et al. 1986), providing them with a potential survival advantage over subordinate fish. Stein et al. (1972) showed that coho salmon fry dominated fall chinook fry in laboratory raceways, which led to displacement of chinook fry from habitats they used when coho fry were not present. Taylor (1991b) suggested that coho fry are dominant in agonistic encounters with spring chinook fry; when the two species were reared sympatrically, coho displaced chinook from the pool habitats. Juvenile coho salmon have also been shown to behaviorally dominate juvenile steelhead (Allee 1974). Aggressive interaction between coho salmon and steelhead fry that result in competitive displacement of steelhead trout are well documented (Hartman 1965, Allee 1974). Fraser (1969) observed that the survival rate of steelhead living sympatrically with coho salmon declined slightly as coho salmon densities increase. However, where interspecific populations have evolved sympatrically, chinook salmon and steelhead have evolved slight differences in habitat use patterns that minimize their interactions with coho salmon (Nilsson 1967, Lister and Genoe 1970, Taylor 1991b). Along with the habitat differences exhibited by coho and steelhead, they also show differences in foraging behavior. Peterson (1966) and Johnston (1967) reported that juvenile coho are surface oriented and feed primarily on drifting and flying insects, while steelhead are bottom oriented and feed largely on benthic insects. However, Fraser (1969) stated that the instantaneous growth rate of steelhead declines with increasing coho salmon density during sympatry.

Steelhead and coho salmon share a common ancestry and similar habitat requirements. Recent research by Merz and Vanicek (1996) found that in a two year study of salmon and steelhead juvenile diets in the American River, California, the diets of the two species were substantially the same. Furthermore, in the mainstem Columbia River, Muir and Emmett (1988) found migrating chinook, coho, and steelhead juveniles all ate predominately the same food item - *Corophium salmonis*. Therefore, interspecific competition is expected to occur and may strongly influence the behavior, growth, and survival of the two species when they occur sympatrically in nature.

Coho salmon may have a competitive advantage over steelhead when they coexist. Juvenile coho salmon tend to emerge from the gravel earlier then steelhead, which allows them to establish territories and reach larger sizes than steelhead of the same age class (Berejikian 1995). Both laboratory and stream studies indicate that these species use different stream microhabitats. In the absence of coho salmon, steelhead use more of the water column and more pool habitat than when coho salmon are present (Hartman 1965, Allee 1974, Bugert and Bjorn 1991). In the presence of coho salmon, age-0 steelhead generally occupy the shallower, faster water of riffles and pool slopes, while coho salmon occupy the deeper water of pools (Bugert et al. 1991).

The segregation of these species appears to be both actively maintained and adaptive (Nilsson 1967). Their habitat segregation is consistent with interspecific morphological variation: juvenile steelhead are more fusiform in shape than coho salmon and therefore better able to cope with higher water velocities (Bisson et al. 1988). These differences may reduce competition and facilitate partitioning of stream resources during low summer flows in streams when competition is most intense (Hard 1996). Because of their different morphology and habitat use, it is expected that stream characteristics will be primary determinants of interactions between these species: steelhead are expected to thrive better in the presence of coho salmon in streams with higher gradients and velocities, while steelhead are likely to diminish in streams with lower gradients and velocities (Hard 1996, Stelle 1996).

Adult hatchery fish that may stray to natural spawning areas, rather than return to the hatchery, may also be competing for spawning gravel. However, since spawning populations are at depressed levels, the degree of this impact should be small: there is thought to be a relationship between high spawner density and greater egg loss in the natural environment (Chebanov 1991). Stray hatchery adults may also breed with native fish, potentially altering genetic fitness and influencing their ability to survive in the ecosystem. (See Genetic Introgression section above.)

7. Predation

Hatchery fish may prey upon listed fish. Due to their location, size, and time of emergence, newly emerged chinook salmon fry are likely to be most vulnerable to predation by hatchery released fish. Their vulnerability is believed to be greatest as they emerge and decreases somewhat as they move into shallow, shoreline areas (USFWS 1994). Emigration out of hatchery release areas and foraging inefficiency of newly released hatchery smolts may minimize the degree of predation on chinook salmon fry (USFWS 1994).

Predation by hatchery fish on natural-origin smolts is less likely to occur than predation on fry. USFWS (1994) presented information indicating salmonid predators are generally thought to prey on fish approximately 1/3 or less their length. Coho salmon and chinook salmon, after entering the marine environment, generally prey upon fish one-half their length or less and consume, on average, fish prey that is less than one-fifth of their length (Brodeur 1991). Consequently, predation by hatchery fish on listed salmon smolts in the migration corridor is believed to be low.

Chinook and coho salmon yearling smolts released from hatcheries may interact with one, two and three year old un-smolted wild steelhead that are rearing in the tributary and mainstem migration corridors. The Species Interaction Work Group (SIWG 1984) reported that there is an unknown risk of predation by enhanced chinook and coho salmon on wild steelhead juveniles where they interact in freshwater migrational areas. Steward and Bjorn (1990) referenced a report from California that estimated, through indirect calculations rather than actual field sampling methods, the potential for significant predation impacts by hatchery yearling chinook salmon on wild chinook and steelhead fry. They also reference a study in British Columbia that reported no evidence of predation by hatchery chinook smolts on emigrating wild chinook fry in the Nicola River. Although, rating the risk to wild fish as unknown, the SIWG (1984) noted that predation may be greatest when large numbers of hatchery smolts encounter newly emerged fry or fingerlings, or when hatchery fish are large relative to wild fish.

There is the potential for predation of wild steelhead by hatchery chinook and coho salmon smolts, if the steelhead are of a small enough size. Predators prey on food items less than or equal to one-third of their length (Witty et al. (1995) quoting Parkinson et al. (1989)). Chapman et al. (1994) reported a steelhead smolt size range at out migration of 160-175 mm (FL) in the Mid-Columbia Region. Naturally-produced steelhead smolts sampled at Rock Island Dam averaged between 163-188 mm (FL) for years 1986 through 1994 (Chapman et al. 1994).

Assuming that non-smolted age 2 and 3 steelhead are within the range recorded for smolts (160-175 mm), predation by hatchery smolts, which, upon release, are of nearly equal size to the wild fish, would be unlikely. Age 1 steelhead smolts have a mean FL of 156 mm at Rock Island Dam (1988-89 date from Peven et al. 1994). Age 1^+ non-smolts may be of a size smaller than that recorded for smolts that age. However, it is unlikely that age 1^+ wild steelhead non-smolts are less than 60 mm FL, which (assuming the 1/3 length "rule") would be vulnerable size for predation by hatchery salmon that are larger than 180 mm. Chapman et al. (1994) reported mean sizes of wild underyearling Wenatchee River steelhead of 72 mm to 78 mm in October. These wild fish would be larger as yearlings in April and May when hatchery smolts are released.

Spring chinook transition to a fish diet when they reach 120 mm or larger (BPA 1997a) and begin their seaward migration as yearling smolts. Muir and Emmett (1988) found chinook smolts actively feeding on invertebrate species such as cladocerans, chironomids and amphipods during their downstream migration. Larger smolts may eat smaller fish, but recent information indicates that fish are an insignificant fraction of the food consumed by migrating chinook salmon in the Snake and Columbia rivers (Muir and Coley 1995).

Large numbers of hatchery fish may attract predators (birds, fish, pinnipeds) and, consequently contribute indirectly to predation of listed fish. On the other hand, a mass of fish moving through an area may confuse or distract predators and may provide a beneficial effect. Both effects may be occurring to some extent. The presence of large numbers of hatchery fish may also alter the listed species' behavioral patterns, which may influence vulnerability and prey susceptibility (USFWS 1994).

8. Residualism

Resident trout and hatchery steelhead released into spawning and nursery areas, which fail to migrate (residualize), may prey upon listed salmon and steelhead fry. Steelhead residualism has been found to vary greatly, but is thought to typically average between 5% and 10% of the number of fish released (USFWS 1994). Releasing hatchery steelhead smolts that are prepared to migrate and timing the release to occur during high flow conditions may minimize impacts to listed fish from steelhead programs.

Coho salmon in most situations, do not have the same potential to residualize as steelhead, but approximately 6% of the coho planted as parr residualized in the outplanted stream for a year after release (Johnson and Sprague 1996). Coho salmon parr stocked in 1995, were observed two years after release in snorkel surveys and screw traps (BIA 1998) and about 2,000 age two coho smolts were counted at Snake River mainstem dams (FPC in BIA 1998). So far there does not appear to be any residualism of coho salmon smolts released into the Yakima and Methow rivers (T. Scribner, YIN, pers. comm.).

Acclimation ponds and volitional release strategies are currently the subject of active research in the Columbia River Basin. It is unclear at this time whether or not acclimating and volitionally releasing steelhead smolts can significantly reduce the proportion of residualized steelhead in all cases. WDFW appears to be able to significantly reduce the number of residualized steelhead released by using a combination of acclimation, volitional release strategies, and active pond management whereby remaining steelhead are not released when sampling indicates the majority of remaining fish in pond are males. This action is taken because preliminary WDFW research indicates that the majority of residualized steelhead are males. ODFW monitoring has not confirmed WDFW results (USFWS 1994). The ODFW saw no reduction in steelhead residualism rates in 1993 from acclimated fish in comparison to direct stream releases; however, they did not employ active pond management strategies (USFWS 1994). Providing juvenile holding facilities and acclimation ponds at sites with large release numbers may provide benefits even if residualism is not reduced. As an example, by having juvenile holding facilities at the release sites, the physiological condition of the smolts can be considered, volitional release strategies could be employed, and local environmental conditions could be used as indicators of when to release fish so they immediately begin migration. The level of smolt development exhibited by yearling spring/summer chinook has been shown to be an important factor affecting migratory behavior. Developmentally advanced yearling chinook migrate from Dworshak National Fish Hatchery to Lower Granite Dam significantly faster than less developed counterparts (Giorgi 1991; Smith et al. 1993). Current release strategies are influenced to a large extent by when transport vehicles are available and not necessarily when smolts are developmentally ready to migrate. As a result, adverse effects to listed fish from competition and predation may be exacerbated.

In the 1995-98 Biological Opinion, NMFS recommended that hatchery steelhead smolts be released at sizes between 170 and 220 mm total length (TL), approximately 163-212 mm fork length (FL), based primarily on the work of two IDFG researchers, Cannamela (1992, 1993) and Partridge 1985). The maximum size recommendation was based on reports of higher residualism among steelhead over 240 mm TL and higher predation rates by residual steelhead over 250 mm TL. New analysis by IDFG suggests that the 220 mm maximum size is less than the ideal size to release smolts (Rhine et al. 1997). In several tests, Rhine reports that residual steelhead are significantly smaller than smolts. Of steelhead smolts carrying PIT tags, 52.1% of fish released at 163-211 mm were detected at downstream dams, 66% of steelhead 212-250 mm TL were detected and 83.3% of steelhead greater than 250 mm TL were detected. Bigelow (1997) reported similar results in PIT tagged steelhead smolts released from Dworshak Hatchery. Over 70% of steelhead under 180 mm TL were not detected at downstream sites, while approximately 85% of smolts over 180 mm TL were detected.

This information suggests that release of juvenile steelhead less than 180 mm TL will contribute to residualism and the ideal release size may be larger than 220 mm TL. However, concern for both residualism and predation by very large smolts (over 250 mm TL) is still valid. Jonasson et al. (1996) reported predation on wild juvenile steelhead by residual hatchery steelhead as small as 189 mm FL, but in general the larger residual fish tended more toward predation. Overall, Jonasson et al. (1996) reports a low level of piscivory by residuals less than 230-250 mm TL.

Based on this information the recommended steelhead smolt size range should be 180 mm to 250 mm TL. Further, if predation increases as size of fish released from hatcheries increases, then hatchery managers should avoid release of larger smolts in waters that support rearing fry of listed species. Hatchery managers should continue to evaluate the impacts of size at release on predation and residualism along with other measures to increase smolt success.

9. Migration Corridor/Ocean

The hatchery production ceiling called for in the Proposed Recovery Plan is approximately 197.4 million anadromous fish. Although releases occur throughout the year, approximately 80 percent occur from April through June. A significant portion of these releases do not survive to the Snake and Columbia River migration corridors. As an example, the historical passage index of hatchery fish released into the Snake River Basin surviving to Lower Granite Dam shows a ratio of .23 for spring/summer chinook salmon and .60 for steelhead; for hatchery releases in the Columbia River above McNary Dam the ratio is .185 for spring/summer chinook salmon, .477 for sub-yearling chinook salmon, .093 for steelhead, and .215 for coho salmon (FPC 1992). While the actual number of hatchery fish entering the Columbia River migration corridor is unknown, it is significantly less than the release numbers summarized in Table 3.

Considerable speculation, but little scientific information, is available concerning the overall effects to listed salmon and steelhead from the combined number of hatchery fish in the Snake/Columbia River migration corridor. In a review of the literature, Steward and Bjornn (1990) indicated that some biologists consider density-dependent mortality during freshwater migration to be negligible; however, they also cited a steelhead study that indicated there may have been a density-dependent effect (Royal 1972, cited in Steward and Bjornn 1990). Hatchery and natural populations have similar ecological requirements and can potentially be competitors where critical resources are in short supply (Lower Granite Migration Study Steering Committee [LGMSC] 1993).

Feeding rates may be an indicator that food is a limiting factor in the migration corridor, which could decrease survival to adulthood. However, it may also be an indicator of poor health or stress even when food is not limited (Dawley et al. 1986). Increased flow, turbidity, gas supersaturation, temperature, and migration rate may also be factors affecting feeding efficiency. Bennett and Shrier (1986), cited by the LGMSC (1993) found that most migrating smolts sampled in Lower Granite Reservoir contained food items and numerous stomachs were full; however, some individuals lacked food. Giorgi (1991) indicated that there is contrasting information on the food habits of yearling chinook salmon at Lower Granite Dam. *Corophium spp.* was the predominant food item in samples collected at Lower Granite Dam in 1987, while guts were generally void of any food items in 1989.

Dawley et al. (1986) studied the migrational characteristics of juvenile salmonids entering the Columbia River estuary. In that study, yearling chinook salmon generally had low stomach fullness values from March through April, but in May and June, the aggregate fullness values of yearling chinook salmon increased and percentages of non-feeding fish for most groups decreased. However, the consumption values for yearling spring chinook salmon (but not in other species sampled) declined from maximum in May, the peak period of salmonid migration. Relatively low mean fullness and empty stomachs were correlated with close proximity of release to recovery site and/or short migration period prior to recovery, early March releases, high turbidity, and disease incidence.

Stomach content weights for sub-yearling and yearling chinook salmon captured at Jones Beach were less than similar sized fish examined at other estuarine and riverine locations; however, some of the comparisons were of fish residing in the estuary versus fish that were actively migrating when sampled at Jones Beach. In a 1980 and 1981 study of the Upper Columbia River estuary, Dawley et al. (1986) found that sub-yearling chinook salmon generally had about half-full stomachs. In a 1992 study involving Bonneville Hatchery fall chinook salmon, Ledgerwood et al. (1993) also found stomachs about half full, even though more hatchery fish are now produced than during the earlier study.

Carrying capacity depends on system productivity, which fluctuates. Variation in productivity is probably linked to climatic cycles as well as to human activities that have altered the habitat in the last 100 years. The difficulty of estimating a system's capacity to support salmon is probably further compounded by cycles of oceanic productivity and other ecological and human factors, effects that may be difficult to isolate from each other. Current carrying capacity estimates must be based on present conditions and may be lower than historical levels. However, a reasonable estimate of the current carrying capacity is not available and would be difficult to derive.

The limited information available concerning effects from changes in the historic carrying capacity to listed salmon is insufficient to determine definitive impacts. It is for this reason that NMFS has recommended a limitation of hatchery releases in the Columbia Basin. The effects of hatchery production on listed salmon and steelhead in the ocean would be speculative, since hatchery fish intermingle at the point of ocean entry with wild and hatchery anadromous salmonids from many other regions. Witty et al. (1995) assessing the effects of Columbia River hatchery salmonid production on wild fish stated:

> "We have surmised the ocean fish rearing conditions are dynamic. Years of limited food supply affect size of fish, and reduced size makes juveniles more subject to predation (quoted from Parker 1971). Mass enhancement of fish populations through fish culture could cause density-dependant affects during years of low ocean productivity. However, we know of no studies which demonstrate, or even suggest, the magnitude of changes in numbers of smolts emigrating from the Columbia River Basin which might be associated with some level of change in survival rate of juveniles in the ocean. We can only assume that an increase in smolts might decrease ocean survival rate and a decrease might improve ocean survival rate."

B. Effects of the Proposed Action on Juvenile Salmon

1. Snake River Basin

a. Snake River Fall Chinook Salmon

Most of the historic spawning and rearing habitat for Snake River fall chinook is upstream from the Hells Canyon Hydroelectric Complex and is no longer available to anadromous fish. The FCRPS dams on the lower Snake and Columbia rivers flooded much of the mainstem habitat. Snake River fall chinook salmon currently spawn primarily in the Snake River downstream from Hells Canyon Dam, with small spawning populations also occurring in the Lower Clearwater, Grande Ronde, Tucannon, Salmon, and Imnaha rivers. In addition, a small spawning population may also exist below Little Goose Dam. Fall chinook juveniles migrate to the ocean as sub-yearling fish, soon after emerging.

The only hatchery program currently operating that involves Snake River fall chinook is the Lyons Ferry Hatchery, in the Snake River Basin, located below Little Goose Dam along the Snake River migration corridor. The hatchery takes eggs from hatchery fish of the Snake River stock to maintain an egg bank program and to supply eggs and fry for supplementing the population. The Nez Perce Tribe also operates satellite facilities at two locations on the Snake River and one the Clearwater River to rear and release Snake River fall chinook smolts and subyearlings. Fall chinook from Lyons Ferry Hatchery are released on station and at the Big Canyon facility on the Clearwater River as well as the Captain Johns Rapids and Pittsburg Landing facilities on the Snake River. The potential competition and disease transmission from hatchery fall chinook salmon may pose risks to wild fish in the Snake River fall chinook salmon spawning and nursery areas.

In the future, fall chinook will be reared at the NPTH. The NPTH maximum production goals are 2,000,000 subyearling smolt fall chinook and 800,000 subyearling “early run” fall chinook. The fall chinook satellite facilities will be located on Cedar Flats, Luke’s Gulch and North Lapwai Valley. The effects from the NPTH fall chinook are discussed below.

Hatchery spring/summer chinook salmon and steelhead trout are released into the Snake River at Hells Canyon Dam and the tributaries where Snake River fall chinook salmon spawn. However, interactions between listed fall chinook salmon and hatchery fish primarily occur in the migration corridor because of the location of release sites.

In 1991, Snake River fall chinook salmon ranged in size from 40 mm on May 2 to 104 mm on July 14 (Fish Passage Center 1992) and were smaller than spring/summer chinook. Thus fall chinook may be more susceptible than Snake River spring/summer chinook salmon to predation in the migration corridor. However, there is substantial separation in migration timing between listed fall chinook salmon and hatchery spring/summer chinook salmon and steelhead (Fish Passage Center 1992; Figure 1). Consequently, listed fall chinook salmon migrate after most hatchery steelhead and spring/summer chinook salmon migrants have left the Snake River. Hatchery releases (for all species) outside the Snake River Basin typically occur March through June. As most Snake River fall chinook salmon pass Lower Granite Dam from mid-June through July, there appears to be at least a partial separation in migration timing between hatchery fish and listed fall chinook in the migration corridor. Nevertheless, there is some overlap in run timing and NMFS believes some competition, predation, and disease transmission impacts may be occurring.

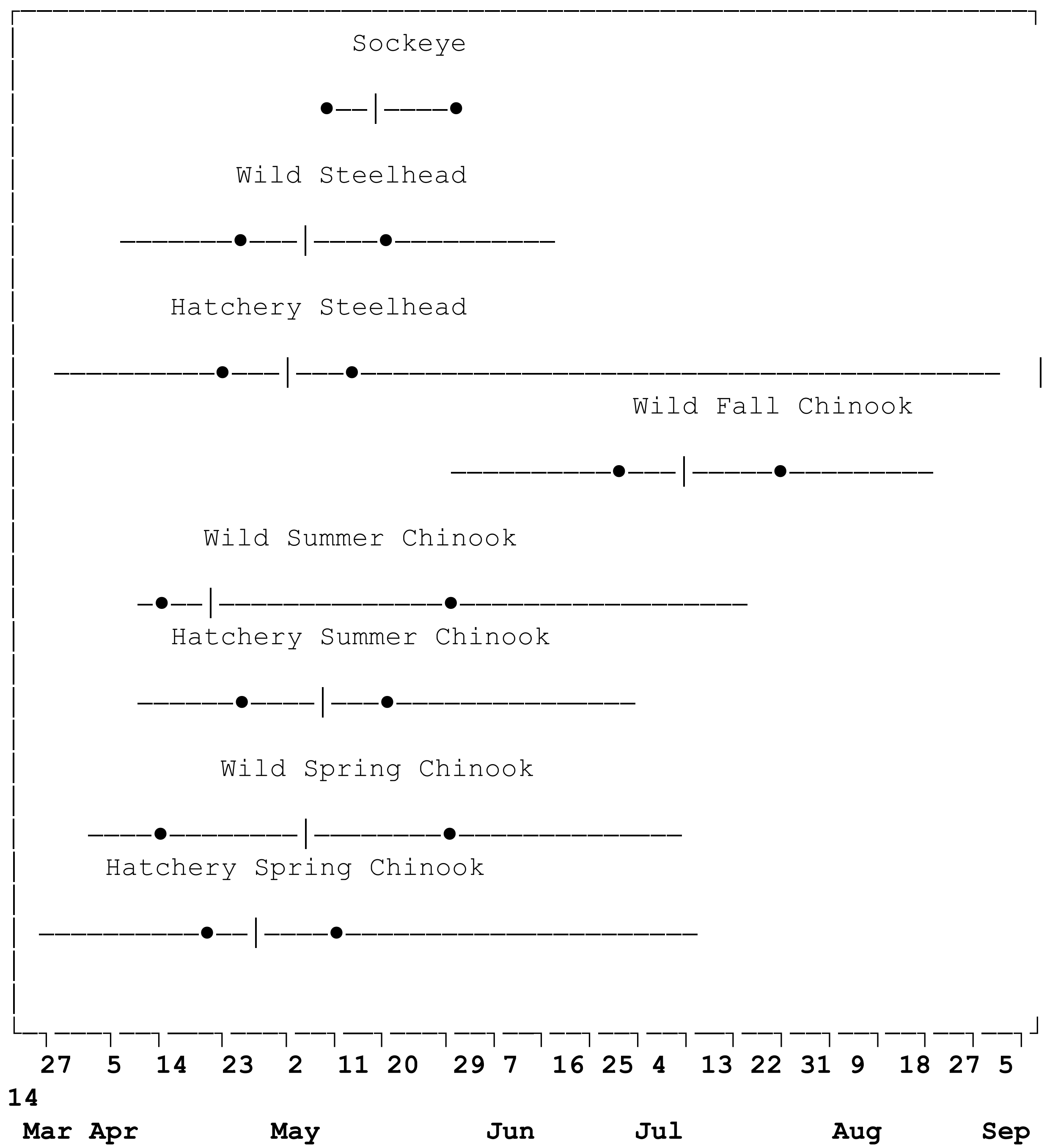
Fall chinook salmon may reside for an extended time in the estuary, with competitive interactions occurring primarily between fall chinook hatchery and listed fish (Van Hyning 1968). However, Dawley et al. (1986) found that fall chinook smolts from the Columbia River actively migrated through the estuary. Further, fall chinook salmon stocks that migrate long distances, such as Snake River fall chinook salmon, (> 250 kilometers) do not concentrate in near-shore estuary areas (Dawley et al. 1986).

1). Spawning and Rearing Areas

a. Salmon River Basin

For the past several years, during spawning ground surveys the Nez Perce Tribe has found 1-3 fall chinook redds in the Salmon River.

Figure 6. The 1991 migration timing of marked Snake River chinook salmon, steelhead, and sockeye salmon at Lower Granite Dam. Length of bar denotes duration between first and last marked fish recovered; solid circles denote dates of 10% and 90% passage, and vertical bar denotes date of 50% passage. (FPC 1992).



b. Clearwater River Basin

The spring chinook native to the Clearwater River Basin were mostly likely extirpated by impassible dams. Hatchery steelhead and spring/summer chinook smolts are released in and migrate through fall chinook habitat and the Clearwater River Coho Restoration project releases fish in Clearwater River tributaries, which may be occupied by listed fall chinook. These species all produce yearling smolts which are expected to use the mainstem habitat only as a migration corridor. Most of the yearling smolts will migrate in the months of March, April and May and will have left the habitat before the fall chinook emerge. However, there may be some predation on fall chinook fry by residual steelhead or coho juveniles and some competition for food and space and spawning overlap if coho reintroduction is successful (see discussion below). Rainbow trout fingerlings released in the Lower Clearwater River by IDFG to supplement resident tout fisheries may occupy the same habitat and could prey on juvenile fall chinook.

Construction and Operation of Facilities

Nez Perce Tribal Hatchery (NPTH)

Construction of the CIRF's and satellite facilities (including water intake, conveyance, and discharge structures) may disrupt the behavior and distribution of listed Snake River fall chinook and steelhead adjacent to and downstream of the sites. Listed fish could be displaced and a few might be killed in the construction areas. However, actual construction and channel structures placement are not expected to incur significant biological impacts to listed fall chinook or steelhead. Impacts are expected to be localized and of short duration.

General effects due to the physical operation of hatchery facilities include impacts from water withdrawal, unscreened water intakes and release of hatchery effluent. Water withdrawal for hatchery facilities located within the spawning and/or rearing areas can reduce stream flow from points of intake to outflow, and if great enough, can impede migration and affect spawning behavior (NMFS 1995e). All water intake, conveyance, and discharge structures would be screened to prevent fish from entering or leaving the facilities (BPA 1997a). Any non-hatchery fish, including wild juvenile fall chinook or steelhead that enter the hatchery by screen failure would either be reared along with hatchery fish or returned to the stream (BPA 1997a).

Other effects may result from the operation of collection facilities such as fish traps. Three rotary screw traps would be operated during the spring and fall on Upper Lolo, Lower Lolo and Meadow creeks to collect juvenile spring chinook. Fish collected would be held in live boxes until sampled. Traps are checked daily, unless a pulse of fish requires more frequent intervals. The capture efficiency typically ranges from 5% in the spring to 70% in the fall (BPA 1997a). The act of trapping, handling, weighing, measuring, and PIT tagging these spring chinook juveniles would cause some mortality.

The NPT has operated screw traps at these sites from 1994 through the present. During this time, total fish trapped was 50,124 and total mortality was 369 (BPA 1997a). Data from the spring of 1994 to fall of 1996, a total of 7,014 juvenile steelhead were trapped with 42 mortalities (D. Johnson, NPT, pers. comm.). This is less than a 1% mortality over two and half years of trapping. Twenty-four of the 42 juveniles were killed at the Lower Lolo Creek trap in 1995, when high flows caused debris to clog the live box (D. Johnson, NPT, pers. comm.). Normal mortality ranges from zero to four juvenile steelhead per trapping season.

No mortality estimates were made after fish were released, but information from PIT tag studies shows an additional 2% might be expected to die shortly after release (BPA 1997a). Assuming a 2% mortality rate and 6,972 juvenile steelhead were released alive, approximately 139 juvenile steelhead would be killed. Total estimated mortality from the trapping operations would be 181 juveniles or 2.6% of the total number of steelhead trapped from 1994 to 1996.

The following actions should minimize the effects of the proposed construction and operation of CIRF's and satellite facilities on listed Snake River fall chinook and Snake River steelhead juveniles:

- Most construction activities occur away from the river channel and would be mitigated by erosion control, only removing trees where necessary, re-vegetating the construction site and would only be temporary.

- Sediment input should be for a short duration and not exceed the streams' transport ability.

- The number of fish and amount of habitat affected by these changes would be small relative to the total number of fish and habitat available.

- Flow alterations caused by NPTH operations would not significantly affect the viability of the Snake River steelhead population. The location and the relatively small area affected by flow alterations should cause the fish to move out of the area and exist at fewer numbers within the impacted segment, especially during September.

- The thermal changes as a result of the hatchery discharge would be negligible because rapid mixing of hatchery and stream or river water downstream of production facilities should minimize temperature-related impact.

- All necessary Federal, state, and local water quality and water appropriation permits will be obtained (BPA 1997a). Effluent water quality will be monitored to ensure that all Federal and state standards will be met (BPA 1997a). The level of impact of hatchery effluent discharge on fish survival is unknown, but is presumed to be small and localized at outfall areas, as effluent is diluted downstream (NMFS 1995e).

- Any listed juvenile fall chinook or listed juvenile steelhead that happen to enter the hatchery by screen failure would either be reared along with hatchery fish or returned to the stream. The viability of the listed Snake River fall chinook and steelhead populations should not be significantly affected.

- Total estimated trapping mortality of juvenile steelhead is expected to be 2.6% of the captured fish. The NPT personnel will check the traps daily and more frequently if high flow occurs, which should reduce the observed mortality from the one incident in 1995. Juvenile steelhead trapped and released at the three sites would provide beneficial population abundance estimates over time.

Competition

Clearwater River Coho Restoration

The coho salmon released into the Clearwater River Basin in 1999 have the potential to interact with listed Snake River fall chinook. The majority of coho smolts released into the Clearwater River should have crossed Lower Granite Dam by the time fall chinook subyearlings cross in late July and August. Coho smolts would be expected to be passing through the lower mainstem Clearwater River when fall chinook are emerging from the gravel, thus potential predation on fall chinook could occur. However, information from smolt trapping studies indicates that migrating coho smolts tend to remain in the main current during high spring flow conditions, while emergent fall chinook reside primarily near the bottom substrate, along channel edges and out of the main current (R.E. Larson, pers. comm. in Stelle 1996). Stelle (1996) stated that spatial segregation between coho smolts and juvenile fall chinook would occur in the lower mainstem Clearwater River and reduce the likelihood of predation. Potential adverse interactions between fall chinook juveniles and coho parr could occur if parr move downstream into fall chinook critical habitat. However, fall chinook and coho parr typically use different habitats, parr release sites are 20-60 miles upstream of fall chinook critical habitat, and several studies indicate that coho are more likely to move upstream (Johnson and Sprague 1996, Spaulding et al 1989).

NMFS determined that there may be adverse effects on listed fall chinook as a result of competition in the Clearwater River Basin. The following measures are expected to minimize competition between hatchery coho salmon and listed fall chinook.

- Fish species (coho, chinook, steelhead) that evolved sympatrically have developed slight differences in habitat use that minimize their interactions.

- Coho smolts and juvenile fall chinook are temporally and spatially separated in the lower mainstem Clearwater and Snake rivers. Most coho smolts should have past Lower Granite Dam before the Clearwater River wild fall chinook begin their peak outmigration in late July and August.

- Competition between coho parr and juvenile fall chinook could occur if coho parr move downstream. However, these species use different habitat, parr releases are 20-60 miles upstream and most parr have been observed moving upstream.

- Coho parr will also be released over a large geographic area to avoid overwhelming local anadromous and resident fish populations and the estimated number of parr surviving to smolt (5%) ranges from 150 to 8,750.

- Monitoring and evaluation studies will be conducted to determine the ecological interactions between coho salmon and fall chinook in the Clearwater River Basin.

Nez Perce Tribal Hatchery

The NPTH fall chinook in the rearing habitat and the migratory corridor have the potential to interact with listed Snake River fall chinook. Wild fall chinook in the Clearwater River emerge from the gravel from mid-April through June and average 75-80 mm long by July (Arnsberg and Statler 1995). Juveniles migrate seaward during the summer as subyearlings, and pass Lower Granite Dam from mid-June through July (NMFS 1995e, NMFS 1995c). The FPC (1992) reported that in 1991, Snake River fall chinook ranged in size from 40 mm on May 2 to 104 mm on July 14.

Information collected on the Lyons Ferry Hatchery fall chinook program indicated that hatchery subyearlings and yearlings released from the hatchery arrived at Lower Monumental Dam within three days of release and peaked during the third week of June (Conner et al. 1992). Because of the differences in water temperature between Lyons Ferry Hatchery and the Snake River, Lyons Ferry Hatchery fall chinook develop sooner, smolt earlier, and have an earlier and compressed outmigration when compared to natural fall chinook in the Snake River (Conner et al. 1992) Also, hatchery fall chinook are released during the high flows (Water Budget), while natural fall chinook outmigrate during the summer when river flows are receding. The NPTH fall chinook would be released when they are ready to smolt in June at a size of approximately 90 mm. These fish would either join other outmigrants in the high flows or reside in the river for a while, and move downstream as water temperature warms (BPA 1997a). Giorgi (1991) reported that hatchery yearling fall chinook have extended residence time in the Lower Granite Reservoir and suffer high mortality on their way to Lower Granite Dam. Muir et al. (1988) and Zaugg et al. (1991) reported that the high mortality may be caused by hatchery fish being released in sub-optimal condition based on their physiological and behavioral development. Since the NPTH fall chinook program is similar to the Lyons Ferry Hatchery fall chinook with respect to rearing and release, it could be assumed that the NPTH fall chinook would outmigrate mostly in June before the wild fall chinook begin their peak outmigration in late July. This would reduce the potential for competition with listed wild fall chinook. However, applying this to the NPTH fall chinook program is speculative and needs to be monitored to determine if there are any difference between releases in the Snake and the Clearwater rivers.

The BA (BPA 1997a) describes the methods used to determine the carrying capacity and other factors taken into consideration with respect to spring chinook and steelhead interactions in the Clearwater River. Density dependent effects resulting from competition between two different species can still be severe at densities well below the carrying capacity of the habitat. However, estimating carrying capacity is extremely difficult, and even an abundant population may not be "fully seeded" for all life history stages (Lestelle et al. 1996, Moussalli and Hilborn 1986). Therefore, interactions between NPTH hatchery-produced spring chinook and listed Snake River steelhead should be carefully monitored and evaluated in all streams regardless of the estimated carrying capacity. In summary, the adverse effects of the proposed action on listed fall chinook as a result of competition in the Clearwater River Basin should be minimized because:

- NPTH fall chinook are expected to outmigrate mostly in June before the wild fall chinook begin their peak outmigration in late July. The stocking rates proposed will be controlled to keep densities at levels that match the receiving streams' habitat quality. Each targeted stream would be outplanted with a number of hatchery chinook that, when added to the wild fish, would be equal to 70-100% of the carrying capacity for that species (BPA 1997a). Also, as the fish move down farther in the system, potential interaction should decrease.

- Fall chinook will be released with a demonstrated propensity to smolt and releases from the acclimation ponds will be done in a controlled manner (prevent swamping by huge releases of hatchery fish in one location) to reduce potential competition with wild fall chinook and other species in the Clearwater River Basin.

- Monitoring and evaluation studies will be conducted to determine the ecological interactions between NPTH hatchery fall chinook and listed fall chinook in the Clearwater River Subbasin. This will allow NPT managers to modify hatchery releases to minimize competition using their adaptive management approach.

Predation

<u>Clearwater River Coho Restoration</u>

Hatchery fish may prey upon listed fish in the Clearwater, Snake and Columbia rivers. Newly emerged chinook salmon fry are likely to be most vulnerable to predation by hatchery fish due to their location, size, and time of emergence (NMFS 1995e). Vulnerability of these fry decreases as they move into shallow, shoreline areas (USFWS 1994). Predation by NPT coho salmon released into the Clearwater River Basin on listed Snake River fall chinook juveniles should be minimized because:

- Potential impacts to listed Snake River fall chinook are expected to be minimal because NPT coho salmon smolts would be released during high flows in the spring and are expected to migrate soon after release.

- Impacts to fall chinook from coho parr moving downstream in critical habitat could occur but is expected to be minimal. Coho parr will be released in early July, when most fall chinook would have already migrated downstream. Also, parr will be released in tributary streams ranging from 20 to 60 miles upstream and it is not expected that many coho would move that far downstream. Johnson and Sprague (1996) observed that most coho parr remained within the stream that they were outplanted or moved upstream. Spaulding et al. (1989) also indicated that coho are more likely to seek cooler water refuge upstream.

- Monitoring and evaluation studies will be conducted to determine the potential impacts of coho predation on fall chinook in the Clearwater River Basin.

<u>Nez Perce Tribal Hatchery (NPTH)</u>

Predation by NPTH hatchery spring and fall chinook released into the Clearwater River Basin is expected to minimal on listed Snake River fall chinook juveniles. Impacts to listed Snake River fall chinook are expected to be minimal because NPTH hatchery chinook would be released during favorable development of natural diets, feeding habits and at similar sizes as their natural cohorts. Also, chinook salmon usually don't eat other fish until they reach 120 mm or larger (BPA 1997a). Spring chinook transition to a fish diet when they begin their seaward migration as yearling smolts. Fall chinook leave at a smaller size and do not begin eating fish until they reach the ocean.

Residualism

<u>Clearwater River Coho Restoration</u>

Coho salmon in most situations, do not have the same potential to residualize as steelhead, but approximately 6% of the coho planted as parr residualized in the outplanted stream for a year after release (Johnson and Sprague 1996). Coho salmon parr stocked in 1995, were observed two years after release in snorkel surveys and screw traps (BIA 1998) and about 2,000 age two coho smolts were counted at Snake River mainstem dams (FPC in BIA 1998). In order to determine the potential impacts from residualized coho on fall chinook, NMFS applied the reported 6% residualism to all streams receiving coho parr in 1998. A total of 1,368 coho could be expected to remain in the release stream for another year before outmigrating.

In summary, the proposed action's adverse effects on listed fall chinook as a result of residualism in the Clearwater River Basin are expected to be minimized because:

- The estimated 1,368 residual coho are spread out over a large geographic area (five different streams) in the Clearwater River Basin. Plus, the small number of coho (range

9-525) estimated to remain another year in the release stream is far below the estimated coho carrying capacity of the release stream (BIA 1998).

- NPT personnel are currently authorized to beach seine (May, June, and mid-July) in the Lower Clearwater River for their fall chinook monitoring and evaluation activities. This monitoring activity has the potential to identify if any coho parr move downstream and interact with fall chinook.

c. Imnaha River Basin

Fall chinook only occupy the lower mainstem of the Imnaha River Basin. Hatchery chinook and steelhead programs located in the Imnaha are based on restoration of the indigenous stocks, which co-evolved with Snake River fall chinook and effects of the hatchery programs should be no different than those of wild fish.

d. Grande Ronde River Basin

Snake River fall chinook spawn and rear in the lower mainstem of the Grande Ronde River. Hatchery programs for spring/summer chinook and steelhead are generally located higher in the drainage and smolts from hatchery programs only use the area occupied by fall chinook as a migration corridor in the early spring. The Cottonwood Pond satellite steelhead facility releases steelhead in a tributary to the lower river. Residual steelhead smolts may prey on fall chinook. If coho restoration is successful there may be some spawning overlap and predation on fall chinook fry by coho parr.

e. Tucannon River

As in the other rivers in the Snake River Basin, fall chinook in the Tucannon River spawn at lower elevations and later in the year than do spring/summer chinook. Fall chinook fry emerge in late spring, after much of the migration of the yearling steelhead and spring chinook smolts. Shortly after emerging, fall chinook begin their migration toward the ocean. These differences in life history effectively partition habitat use in time and area to reduce interactions among the species. Hatchery programs in the Tucannon River Basin are evaluating the use local stocks to restore naturally reproducing indigenous populations of steelhead which evolved sympatrically with the fall chinook and, therefore, should have similar interactions as wild fish.

f. Snake River below Hells Canyon Dam

Hells Canyon Dam is the last dam constructed in a series of hydroelectric dams located on the mainstem of the Snake River which block access to over 350 miles of the river. This area once supported the majority of Snake River fall chinook runs, and a number of large tributaries probably also supported fall chinook. The remaining 100 miles of free-flowing river between Hells Canyon Dam and the slack water of Lower Granite Reservoir is the most important habitat remaining for fall chinook in the Snake River Basin. Hatchery programs funded by IPC as mitigation for the Hells Canyon hydroelectric complex release steelhead and spring chinook smolts below Hells Canyon Dam. Hatchery smolts released in the Imnaha, Salmon, Grande Ronde, and Clearwater rivers migrate through the corridor occupied by fall chinook.

2). Migration Corridor Impacts

The three races of chinook and steelhead evolved sympatrically in the Snake River Basin and adopted life histories that effectively partition the available habitat. Fall chinook generally spawn lower in the drainages and later in the year than do spring/summer chinook. Spring/summer chinook and steelhead juveniles rear in the smaller tributaries nearer the headwaters of the river system. These species make their smolt migration during the spring freshet. They rapidly travel toward the ocean, feeding little on the way. Fall chinook fry emerge in late spring, after many of the yearling (or 2-3 year old in the case of steelhead) smolts have migrated. Fall chinook smolts occupy the migration corridor in the main rivers through the summer, feeding and growing over a several-month migration.

Hatchery smolts of the separate species follow the behavior of their wild progenitors, thus reducing interaction with one another. There may be some predation or competition between residual hatchery smolts and fall chinook, however, it is much less than the intraspecific interaction with native and introduced species in the reservoirs of the FCRPS.

Clearwater River Coho Restoration

The NPT coho smolts (150 mm) would be released in mid-March and should migrate downstream shortly thereafter. The NPT coho parr will be released at 70 mm in size and should remain throughout the summer and winter before outmigrating as smolts in May of 2000. These smolts are predicted to be 113 mm in length during outmigration (Johnson and Sprague 1996). BIA (1998) reports that some coho may residualize in the outplanted streams and outmigrate in May of 2001 and 2002. Therefore, there could be minor co-occurrence of migrating Snake River fall chinook and NPT coho salmon in the Clearwater, Snake and Columbia rivers migration corridor.

b. Snake River Spring/Summer Chinook Salmon

Spring and summer chinook are considered together in the Snake River Basin ESU, because there is overlap in the run timing and spawning areas between the two groups. However, there is a general tendency for spring chinook to spawn in the highest tributaries and summer chinook to spawn in lower tributaries and the main streams of larger rivers. However, all spring/summer spawning and rearing areas are upstream from fall chinook spawning and rearing areas.

Snake River spring/summer chinook salmon are affected by the proposed hatchery actions in headwater spawning and/or rearing areas of the Salmon, Imnaha, and Grande Ronde rivers.

Listed and hatchery fish are also present together throughout the entire migration corridor. Hatchery spring/summer chinook salmon releases may compete with and transmit diseases to listed spring/summer chinook salmon, while steelhead and resident trout may also prey upon listed spring/summer chinook salmon fry and fingerlings in spawning and nursery areas. However, hatchery smolts that quickly migrate out of the release areas should have minimal opportunity to prey on listed fish.

1). Spawning and Rearing Areas

a. Salmon River Basin

The Salmon River Basin historically produced the largest runs of spring and summer chinook salmon in the Columbia River Basin. The indigenous fish are unique in the length and timing of spawning migrations. Important spawning areas are located over 900 miles inland at elevations over 6,000 feet above sea level. Few chinook salmon within the entire range of the species spawn farther from the ocean and none spawn at higher elevations. Large hatchery programs, designed to mitigate for fish, habitat and fisheries affected by hydropower development, are located in the Salmon River drainage.

Hatchery spring chinook salmon are released into listed spring/summer chinook salmon spawning and nursery areas in late March/April. These releases occur in the Salmon River Basin at Sawtooth Hatchery (Upper Salmon River), East Fork Salmon River, Pahsimeroi River and South Fork Salmon River (reared under section 10 directed take permits, Table 1). Juvenile chinook released from these facilities are similar in size and development to wild fish and programs are operated to reduce risks of adverse interactions. The Sawtooth Hatchery and Pahsimeroi River fish are released directly from rearing facilities. Releases from Sawtooth Hatchery are trucked to the East Fork Salmon River Facility and released directly into the river. There are fewer total juvenile salmon in spawning and rearing areas than historically, and the hatchery programs are not expected to increase competition or predation.

The Rapid River Hatchery, located on a tributary of the Little Salmon River, is based on a stock of spring chinook which originated in the Snake River and was transferred to the Lower Salmon River drainage when its habitat was blocked by Hells Canyon Dam. The Rapid River program produces large numbers of smolts, but releases them into waters that have few wild, listed smolts. Releases of unlisted fish into Rapid River occur below spawning areas. The Rapid River Hatchery fish are released directly from rearing facilities.

Steelhead are released at Sawtooth Hatchery and at East Fork Salmon River Facility. Both release sites are spawning and nursery areas for listed spring/summer chinook salmon and, consequently, the action agencies should address planning and implementation of acclimation/release facilities in the management plans called for in the Proposed Recovery Plan. In addition, steelhead releases outside the primary spawning/nursery areas occur in the lower Pahsimeroi River (river mile 1) and various locations of the lower Salmon River. Steelhead releases occurring at Sawtooth Hatchery are acclimated prior to release. The remaining releases are trucked from hatcheries located outside the Salmon River Basin and made directly into the receiving streams downstream of spring/summer spawning and nursery areas. Large numbers of steelhead smolts are released in salmon spawning and rearing areas.

Predation on spring/summer chinook salmon fry by steelhead may be occurring. Partridge (1985) examined stomach contents of 222 steelhead smolts and residuals collected in April, June, July, and August and found one unidentified salmonid. Viola and Schuck (1991) found no salmonids in 52 stomachs of residualized steelhead and unidentified salmonid remains in three out of 24 rainbow trout stomachs from fish captured from the Tucannon River in August and October, 1991. Bugert et al. (1990) examined 36 steelhead, all naturally-produced and less than 127 mm in length and found no fish in their stomachs. The IDFG (1993) found three out of the 6,762 hatchery steelhead smolt stomachs examined contained a total of ten chinook salmon fry in the upper Salmon River in 1992. Based on this information, competition between salmon and steelhead and predation by steelhead on smaller salmon juveniles likely is occurring at some small rate.

b. Clearwater River Basin

The indigenous chinook of the Clearwater River Basin were extirpated by impassable dams, and the chinook salmon presently occurring in this basin are the result of efforts to reintroduce the species and are not listed. The Clearwater Fish Hatchery and the NPTH spring/summer chinook programs are designed to reestablish naturally reproducing populations, while Dworshak and Kooskia NFH's spring/summer chinook programs are designed to mitigate for lost fisheries in the Clearwater River Basin. There is no interaction between hatchery and listed spring/summer chinook in spawning and rearing areas of the Clearwater River Basin drainage. These releases will have no effect on listed spring/summer chinook salmon until the smolts enter the Snake/Columbia rivers migration corridor.

c. Imnaha River Basin

Both the chinook and steelhead hatchery programs in the Imnaha River Basin are recently developed from and integrated with indigenous stocks and have a supplementation role as well as mitigation (see Table 1 section 10 directed take permits). The release site is located downstream of the listed spring/summer chinook primary spawning and nursery areas of the basin and consequently should have minimal impacts on listed fish rearing in the Imnaha River Basin. The total density of juvenile salmonids in most of the basin is lower than would occur naturally and interaction between hatchery and naturally produced fish is similar to what might occur with recovered populations of both species.

d. Grande Ronde River Basin

Chinook in the Grande Ronde River Basin have been impacted by habitat changes more than by artificial propagation. However, non-indigenous chinook and steelhead and put-and-take trout fisheries have released many non-native species in the drainage. Until recently, release of non-ESU hatchery chinook and steelhead has commonly occurred in spawning and rearing areas. The non-ESU hatchery stocks are being replaced with locally-derived fish and the mitigation hatcheries are assuming a conservation and restoration role (see Table 1 section 10 directed take permits).

Hatchery steelhead are released in several locations of the Grande Ronde River Basin. Releases into the upper basin occur at Wallowa Hatchery, Big Canyon Acclimation Facility, and directly into the Upper Grande Ronde River and Catherine Creek. Releases into Catherine Creek overlap approximately 2 % of the spring/summer chinook salmon redds identified in that tributary (USFWS 1994). The remaining releases all occur downstream of spring/summer chinook salmon spawning and nursery areas and should have minimal impacts to listed fish. Releases also occur in the Lower Grande Ronde River Basin at Cottonwood Acclimation facility and Wildcat Creek. Lower Grande Ronde River releases occur primarily into migration corridor areas and should have minimal impacts to listed fish in spawning and nursery areas. Spring/summer chinook salmon are released from Lookingglass Hatchery into Lookingglass Creek.

e. Tucannon River Basin

The spring chinook hatchery program in the Tucannon River Basin is based on native, indigenous fish and is primarily designed to restore naturally reproducing populations of listed fish (see Table 1 section 10 directed take permits). The steelhead hatchery program has been based on a composite stock from Lyons Ferry Hatchery with a fishery augmentation purpose. This program has been moved to the lower part of the basin, away from chinook spawning and rearing areas and a locally-adapted steelhead broodstock program is being investigated. These actions should significantly reduce impacts to listed Snake River spring/summer chinook salmon by reducing predation and competition. As the locally-adapted steelhead stocks are phased into the hatchery programs, interactions on spawning and rearing areas will be similar to that experienced with naturally produced fish at carrying capacity of the habitat. Approximately, 3,000 rainbow trout are annually released into the lower Tucannon River below primary listed salmon and steelhead production areas.

2). Migration Corridor Impacts

Spring/summer chinook smolts migrate in the spring freshet of the second year they are in streams. In April and May, when days become longer and water temperatures increase to approximately 5.5 degrees C., the migration begins. Hatchery chinook and steelhead programs also release smolts at the same time. Virtually all of the chinook and steelhead smolts, both natural and hatchery, leave the Snake River Basin within a few weeks. Hatchery spring/summer chinook salmon and steelhead smolts migrate rapidly through the free flowing sections of the migration corridor. Buettner and Nelson (1990) recorded hatchery spring/summer chinook salmon travel rates of 18.3 to 55 kilometers per day in the Clearwater River, with the majority of samples being measured in the high end of the range. Steelhead migration rates ranged from 38.3 to 55 kilometers per day in the Clearwater River (Buettner and Nelson 1990). Migration rates in the tributary and Snake River free flowing migration corridor ranged from 9.2 to 72.3 kilometers per day, with most samples falling in the middle of this range (Buettner and Nelson 1990). Because of this rapid rate of migration in free flowing sections of the migration corridor, it is believed that hatchery fish have few adverse effects on listed fish through competition, disease, and predation. This is due to the short amount of time these fish have to interact.

Hatchery spring/summer chinook salmon and hatchery steelhead run timing at Lower Granite Dam overlaps with the listed spring/summer chinook salmon run timing, although hatchery fish generally peak earlier. Listed Snake River spring/summer chinook salmon begin arriving at Lower Granite Dam in early April, peak in late April to early May, and continue through June (FPC 1992). Run timing of listed Snake River spring/summer chinook salmon (non-transported fish) at Bonneville Dam varies with flow rates, but it is assumed to peak about a month later than it does at Lower Granite Dam.

The primary potential impacts on Snake River spring/summer chinook salmon in the migration corridor are believed to be transmission of pathogens and competition for food and space. Predation in the migration corridor is believed to be very low, as hatchery fish generally lack sufficient size to successfully prey on listed spring/summer chinook salmon smolts.

c. Snake River Sockeye Salmon

Snake River sockeye salmon are not affected by the proposed action until they migrate out of Redfish, Alturas and Petitt lakes and enter the Upper Salmon River migration corridor as smolts. Listed and hatchery fish are then present together throughout the migration corridor. Thus, Snake River sockeye salmon are not directly affected by operation of hatchery facilities or hatchery fish during the early life stages when the majority of juvenile mortality occurs. The potential impacts on Snake River sockeye salmon in the migration corridor are assumed to include transmission of pathogens (disease), competition for food and space, and predation.

Hatchery spring/summer chinook salmon are released from Sawtooth Hatchery (into upper Salmon River and East Fork Salmon River) and Pahsimeroi Hatchery (into the Pahsimeroi River) in late March and early April. NMFS expects these hatchery fish to have already migrated out of the area prior to when Snake River sockeye salmon migrate out of Redfish Lake in late April and May. Hatchery steelhead released from the facilities listed above into the Upper Salmon River in April and May will be in the same area as juvenile migrating sockeye salmon. Sockeye salmon migrating out of Redfish Lake range in size from 60 to 117 millimeters (mm) (IDFG 1993) and the smallest sockeye smolts may be susceptible to predation from hatchery steelhead. Smolts greater than 80 mm are assumed to have little vulnerability to predation by steelhead that are less than 240 mm (see discussion on predation above). Steelhead releases addressed in this Opinion generally average 225 mm in size.

Sockeye salmon migrate past Lower Granite Dam between mid-May and early July, and 90%

(or more) of hatchery steelhead and spring/summer chinook salmon historically reached Lower Granite Dam by June 1 (FPC 1992). While overlap occurs, there appears to be some separation in run timing among sockeye salmon, hatchery spring/summer chinook salmon, and steelhead hatchery smolts, which should minimize effects to listed fish. NMFS believes that this partial separation in timing continues as listed fish pass Bonneville Dam.

Snake River sockeye salmon first commingle with hatchery fall chinook salmon below Little Goose Dam in years when zero age smolts are released from Lyons Ferry Hatchery in June. The number of hatchery fall chinook salmon in the migration corridor increases substantially below the Snake and Columbia River confluence. Releases of hatchery fall chinook salmon and coho salmon in the lower Columbia River occur from April through June, prior to and during Snake River sockeye salmon migration past Lower Granite Dam. The late May and June releases will commingle with listed fish in the lower Columbia River, with the primary effects assumed to be from competition and disease.

d. Snake River Summer Steelhead

1). Spawning and Rearing Areas

Snake River summer steelhead generally spawn high in the drainage in the upper mainstems of the larger rivers and in small tributaries. Summer steelhead in the Snake River Basin spawn in the spring months - February (Grande Ronde), March and through May - while spring/summer chinook in the basin spawn in August and September and fall chinook spawn in October and November. Steelhead will spawn in smaller and higher gradient tributaries than chinook generally choose. Also, as spring spawners, they spawn when stream flows are generally higher and smaller streams are more accessible. Most wild steelhead rear two or three years in their natal streams and become smolts at 150 to 200 mm total length. Steelhead fry emerge from the gravel later than chinook fry and are smaller than chinook during their first summer, then are larger than chinook as yearlings and two-year-old parr. This size differential and the propensity for steelhead to occupy shallower and swifter water while chinook prefer deep pools effectively partitions habitat between the two species (Everest and Chapman 1972).

Hatchery salmon, steelhead and trout released in spawning and rearing areas may not follow the same size and behavior patterns as naturally produced fish and there is potential for increased interaction. However, size and behavioral patterns of hatchery trout tend to separate them from naturally-produced anadromous fish (Pollard and Bjornn 1973). Hatchery steelhead smolts that residualize (fail to migrate) and remain in streams are similar in size and learning experience to hatchery rainbow trout that are planted for fishery enhancement and could be expected to exhibit similar behavior and habitat selection. Although, hatchery steelhead and rainbow trout are often the largest salmonids present in spawning and rearing areas, and predation on juveniles of listed species occurs, impacts are generally not large (Cannamela 1993). Hatchery chinook smolts are similar in size to wild smolts and do not have the tendency to residualize as do steelhead. Predation by yearling coho smolts on chinook fry has been identified as an issue in coastal streams (Hawkins 1998) and may be an issue where coho reintroduction and fall chinook restoration programs are proximal.

a. Salmon River Basin

The most important spawning and rearing areas for wild listed steelhead in the Salmon River Basin are the Middle Fork Salmon River, the Wilderness tributaries of the Salmon River between Middle Fork and South Fork, and the South Fork Salmon River (IDFG 1997). These waters have been reserved for natural production only, and no hatchery steelhead are released. A chinook salmon program is located in the South Fork Salmon River that is based on the indigenous, listed, chinook stock and focused in habitat that favors chinook. Hatchery steelhead releases are located in the Upper Salmon River, Pahsimeroi River, Salmon River mainstem and Little Salmon River.

Most potential natural rearing and spawning habitat in the Little Salmon River Basin is either blocked by natural waterfalls or has been severely degraded by floods in a canyon that is constricted by highway construction. Hatchery steelhead releases are made in an area that has easy highway access and supports a popular fishery. The only substantial natural production area in the Little Salmon River Basin is in the Rapid River drainage above a salmon weir and trap where wild steelhead are released and any hatchery strays can be removed. Steelhead are released in the Pahsimeroi River near the mouth. Returning hatchery steelhead are removed at a trap at the release site and wild steelhead returns are passed above the weir. There is little interaction between hatchery and natural fish.

Large releases of hatchery steelhead are made at Sawtooth Hatchery near the headwaters of the Salmon River. The natural steelhead population of the Upper Salmon River has been much reduced for many years. Most of the Salmon River Drainage upstream from the Pahsimeroi River is better known as chinook salmon producing waters than for steelhead. There are also non-acclimated releases of steelhead smolts at Hammer Creek in the Lower Salmon River and acclimated releases from a pond located on Squaw Creek in the Upper Salmon.

IDFG releases catchable-size (average length 25 cm), sub-catchable (average length 15 cm) and fingerling (average length 10 cm) hatchery rainbow trout in sections of the Salmon River and in lakes and ponds tributary to these waters. The release of hatchery trout is to provide recreational fisheries. The fish are generally released in areas and at times where contact with listed species is less likely to occur. Sub-catchable and fingerling releases are made only in mainstem areas where sampling has indicated very little rearing by wild steelhead. Catchable releases are made during summers, near campgrounds and popular tourist areas in the Stanley Basin. Catchable trout are all are marked with an adipose fin clip to identify them as hatchery fish (anglers must release unmarked, wild fish) and are not expected to survive beyond the fishery.

b. Clearwater River Basin

The most important spawning and rearing areas for wild, listed steelhead in the Clearwater River Basin are in the Lochsa and Selway rivers and their tributaries. Most of the hatchery programs are located either low in the drainage or in the South Fork Clearwater River, where native anadromous fish were extirpated by an impassable dam. Large releases of steelhead from Dworshak and Clearwater hatcheries that are located near the confluence with the main Clearwater about 40 miles upstream from its mouth, do not impact fish rearing in the headwater tributaries. Chinook releases from the Powell River Satellite facility on the Lochsa River are intended, in part, to restore naturally spawning populations as are releases in the Selway Drainage. These releases of spring chinook are designed to closely follow the life cycle of the native chinook that were extirpated by impassable dams. Therefore, the impacts of chinook releases should not be detrimental to the listed steelhead (see specific discussion below).

Snake River ESU fall chinook spawn and rear in the lower 60 miles of the main Clearwater River. Fall chinook may be impacted by predation or competition with hatchery fish from the spring chinook, steelhead and coho reintroduction programs and from rainbow trout released in this same section of the Clearwater River Basin.

Competition

Clearwater River Coho Restoration

Coho salmon fry and parr releases have the greatest potential to compete with listed steelhead in the Clearwater River Basin. Steelhead are present in all streams proposed for outplanting coho salmon. Fry and parr would interact with steelhead from time of release in March and early July respectively, through the summer, fall, winter and during the spring outmigration.

The BA (BIA 1998) describes the methods used to determine the carrying capacity and other factors taken into consideration with respect to coho salmon and steelhead interactions in the Clearwater River Basin. Density dependent effects resulting from competition between two different species can still be severe at densities well below the carrying capacity of the habitat. However, estimating carrying capacity is extremely difficult, and even an abundant population may not be "fully seeded" for all life history stages (Lestelle et al. 1996, Moussalli and Hilborn 1986). Therefore, interactions between coho salmon and listed Snake River steelhead should be monitored and evaluated in all streams regardless of the estimated carrying capacity. Hence, there would be substantial co-occurrence of migrating Snake River steelhead and NPT coho salmon in the Clearwater, Snake and Columbia rivers migration corridor.

Competition involving coho salmon parr and young steelhead will probably occur due to the extended time for interaction. The stocking rates and release locations proposed will be controlled to keep densities at levels that match the receiving streams habitat quality. Density dependent effects may still occur well below carrying capacity, but it is unknown at this time to what degree it may happen when coho parr are released into the Clearwater River Basin.

In summary, the proposed action's adverse effect on listed steelhead as a result of competition in the Clearwater River Basin are expected to be minimized because:

- Fish species (coho, chinook, steelhead) that evolved sympatrically have developed slight differences in habitat use that minimize their interactions.

- Competition involving coho salmon parr and young steelhead will probably occur due to the extended time for interaction. The stocking rates and release locations proposed will be controlled to keep densities at levels that match the receiving streams habitat quality. Density dependent effects may still occur well below carrying capacity, but it is unknown at this time to what degree it may happen when coho parr are released into the Clearwater River Basin.

- Steelhead densities are very low in the receiving streams and therefore potential adverse interactions should be minimized. On the basis of the estimated carrying capacity for the Clearwater River and its tributaries, the stream resources (food and space) are not limited, thus competition is expected to be minimal.

- Coho parr will also be released over a large geographic area to avoid overwhelming local anadromous and resident fish populations and the estimated number of parr surviving to smolt (5%) ranges from 150 to 8,750.

- Monitoring and evaluation studies will be conducted to determine the ecological interactions between coho salmon and fall chinook and steelhead in the Clearwater River Basin.

Nez Perce Tribal Hatchery (NPTH)

Spring chinook parr and pre-smolt releases have the greatest potential to compete with listed steelhead in the Clearwater River (BPA 1997a). Steelhead are present in all streams proposed for outplanting spring chinook. Parr would interact with steelhead from time of release in June, through the summer, fall, winter and during the spring outmigration (BPA 1997a). Presmolts would interact with steelhead through the fall, winter and during the spring outmigration (BPA 1997a).

Competition involving spring chinook and young steelhead will probably occur due to the extended time they have the opportunity to interact. The stocking rates proposed will be controlled to keep densities at levels that match the receiving streams habitat quality. Each targeted stream would be outplanted with a number of hatchery chinook that, when added to the wild fish, would be equal to 70-100% of the carrying capacity for that species (BPA 1997a). Density dependent effects may still occur well below carrying capacity, but it is unknown at this time to what degree it may happen when hatchery fish are released into the Clearwater River. Interactions between hatchery spring chinook and steelhead will be monitored and evaluated in all streams to reduce the potential density dependent effects. On the basis of the estimated carrying capacity for the Clearwater River and its tributaries, the stream resources (food and space) are not limited, thus competition is expected to be minimal. In summary, the proposed action's adverse effect on listed steelhead as a result of competition in the Clearwater River

Basin are expected to be minimized because:

- The NPTH will attempt to release spring chinook at sizes that mimic those of their naturally raised counterparts, which should minimize competition with steelhead because these species successfully exist in many rivers and streams. Fish will also be released over a large geographic area to avoid overwhelming local anadromous and resident fish populations.

- Juvenile chinook and steelhead tend to occupy habitat areas with different depths and velocities, thus limiting their direct competition for food or space.

- Monitoring and evaluation studies will be conducted to determine the ecological interactions between NPTH hatchery spring chinook and listed steelhead in the Clearwater River Subbasin. This will allow NPT managers to modify hatchery releases to minimize competition using their adaptive management approach.

Predation

<u>Clearwater River Coho Restoration</u>

Hatchery fish may prey upon listed fish in the Clearwater, Snake and Columbia rivers. Predation impacts by BIA coho salmon released into the Clearwater River Basin on listed Snake River steelhead juveniles are expected to minimized because:

- Potential impacts to listed Snake River steelhead are expected to be minimal because NPT coho salmon smolts would be released during high flows in the spring and are expected to migrate soon after release.

- Coho salmon smolts and steelhead smolts are similar in size, which should minimize potential predation on steelhead during outmigration. Coho salmon would have to be much larger (perhaps more than 180-200 mm fork length) than the steelhead to really impact juvenile steelhead due to predation (Hard 1996).

- Monitoring and evaluation studies will be conducted to determine the potential impacts of coho predation on steelhead in the Clearwater River Basin.

<u>Nez Perce Tribal Hatchery (NPTH)</u>

Predation by NPTH hatchery spring and fall chinook released into the Clearwater River Basin is expected to have minimal affects on listed Snake River steelhead juveniles. Impacts to listed Snake River steelhead are expected to be minimal because NPTH hatchery chinook would be released during favorable development of natural diets, feeding habits and at similar sizes as their natural cohorts. Also, chinook salmon usually don't eat other fish until they reach 120 mm or larger (BPA 1997a). Spring chinook transition to a fish diet when they begin their seaward migration as yearling smolts. Fall chinook leave at a smaller size and do not begin eating fish until they reach the ocean.

Residualism

<u>Clearwater River Coho Restoration</u>

In order to determine the potential impacts from residualized coho on steelhead, NMFS applied the reported 6% residualism to all streams receiving coho parr in 1998 (BIA 1998). A total of 1,368 coho could be expected to remain in the release stream for another year before outmigrating. In summary, the proposed action's adverse effect on listed steelhead as a result of residualism in the Clearwater River Basin are expected to minimized because:

- The estimated 1,368 residual coho are spread out over a large geographic area (five different streams) in the Clearwater River Basin. Plus, the small number of coho (range 9-525) estimated to remain another year in the release stream is far below the estimated coho carrying capacity of the release stream (BIA 1998).

- Densities of steelhead in the release streams are well below expected densities under fully seeded habitat conditions, thereby minimizing potential adverse interactions between steelhead and residualized coho salmon. Also, there is considerable scientific literature that reports that coho and steelhead use different stream microhabitats.

- Snorkel surveys will be conducted upstream and downstream of coho release sites in each stream to determine any potential adverse interactions on steelhead. The BIA (1995) describes the snorkel survey design to be conducted by the NPT in 1998.

c. Imnaha River Basin

Listed Snake River summer steelhead spawn and rear throughout the Imnaha River Basin. The primary spawning and rearing areas include the Upper Imnaha river and tributaries, Big Sheep Creek and tributaries, Grouse Creek, Horse Creek, Lightening Creek, and Cow Creek. No hatchery trout are stocked in the drainage. Steelhead and chinook hatchery programs are based on broodstocks that are recently derived from indigenous fish and the programs are operated with strong conservation goals. The hatchery steelhead program in the Imnaha Drainage has been mostly limited to releases at the Little Sheep Creek satellite facility (330,000 programmed). The Imnaha stock is recently derived from native stock and is only released in a single drainage to reduce hatchery influence in other areas. However, some straying has been reported in the basin. Proposed elimination of the Upper Grande Ronde and Catherine Creek releases, overall reduction in hatchery programs and measures taken to improve smolting behavior are intended to reduce impacts on listed fish in spawning and rearing areas.

If hatchery production does not exceed carrying capacity of rearing habitats and broodstocks continue to be integrated with the indigenous population there should be no adverse effects.

d. Grande Ronde River Basin

The Grande Ronde River Basin is a large and complex basin with habitat varying from desert canyons at less than 1,000 feet above sea level to alpine valleys at over 5,000 feet and from pristine Wilderness rivers to extensively channelized streams adjacent to highways.
Primary steelhead spawning and rearing areas in the Grande Ronde Basin include the Upper mainstem Grande Ronde and tributaries, Joseph Creek and tributaries, Wenaha River and tributaries, and tributaries to the Lower and Middle Grande Ronde (Lookingglass, Indian, Catherine, Wildcat, Mud and Courtney Creeks). Hatchery facilities are located on the Wallowa River, Lookingglass Creek and Cottonwood Creek. These facilities are located upstream from the most important spawning and rearing areas. In the past, steelhead releases in the Grande Ronde have been acclimated smolts released from Wallowa Hatchery (725,000 programmed) and the Big Canyon satellite pond (365,000 programmed) with direct unacclimated releases in the Upper Grande Ronde (200,000 programmed) and Catherine Creek (62,500 programmed). Large drainages, including Joseph Creek, Wenaha River, Minam and Lostine Rivers are not stocked with hatchery fish. Biologists working for ODFW in evaluating LSRCP programs have identified stray hatchery steelhead adults returning to a number of tributary streams in the Upper Grande Ronde drainage (USFWS 1997). Residual smolts from the stream releases in the Upper Grange Ronde and returning adults in these spawning and rearing areas may impact listed steelhead.

e. Tucannon River Drainage

Steelhead primary spawning and rearing areas in the Tucannon River Basin are in the mainstem upstream from RM 21 and tributaries. Hatchery steelhead are released for fishery enhancement are now released below RM 21 to reduce interactions with wild fish and both the steelhead and chinook hatchery programs are in the process of developing locally-derived broodstocks for use in restoring natural spawning populations in the drainage. NMFS believes future hatchery operations in the Tucannon River drainage should be integrated with natural production and therefore, impacts to listed fish should not be adverse.

2). Migration Corridor Impacts

Evidence for adverse ecological interactions in the migration corridor/ocean between hatchery fish and wild salmon is limited and equivocal (see section IV.A.9). There would be substantial co-occurrence of migrating Snake River steelhead and hatchery steelhead, spring chinook and coho salmon in the Clearwater, Snake and Columbia rivers migration corridor.

<u>Clearwater River Coho Restoration</u>

The NPT coho smolts (150 mm) would be released in mid-March and should migrate downstream shortly thereafter. The NPT coho parr will be released at 70 mm in size and should remain throughout the summer and winter before outmigrating as smolts in May of 2000. These smolts are predicted to be 113 mm in length during outmigration (Johnson and Sprague 1996).

BIA (1998) reports that some coho may residualize in the outplanted streams and outmigrate in May of 2001 and 2002.

2. Upper Columbia River Basin

a. Upper Columbia River Summer Steelhead

There are 14 hatchery programs that operate in the Upper Columbia River Basin (Table 2) that may affect Upper Columbia River steelhead. However, all the hatcheries in the Upper Columbia River Basin that rear listed Upper Columbia River steelhead are covered under section 10 permit 1094, issued to WDFW on February 4, 1998 and section 10 permit 1118, issued to USFWS on July 30, 1998 (Table 1). The remaining hatcheries that rear summer/fall chinook, spring chinook, and sockeye are covered in this Opinion.

1). Spawning and Rearing Areas

Upper Columbia River steelhead spawn in the Wenatchee, Entiat, Methow, and Okanogon rivers. They also rear in the four major basins, plus the mainstem of the Upper Columbia River. Interactions that may lead to (competition, predation, disease transfer) between hatchery salmon and listed Upper Columbia River steelhead may potentially occur in the juvenile rearing and outmigration areas where hatchery fish are released.

To address the potential interactions from WDFW salmon hatcheries, WDFW (1997b) proposes several actions to minimize impacts to listed steelhead in spawning and rearing areas in the Upper Columbia River Basin. These actions are consistent with the Proposed Recovery Plan (NMFS 1995c) and therefore, NMFS expects WDFW programs to have minimal affect on listed juvenile steelhead.

The USFWS operates three hatcheries in the Upper Columbia River that would have similar impacts to listed steelhead as the WDFW salmon hatcheries. USFWS also proposes actions to minimize impacts to listed steelhead that are consistent with the Proposed Recovery Plan (NMFS 1995c), therefore NMFS expects these actions to have minimal affect on listed juvenile steelhead.

2). Migration Corridor Impacts

Evidence for adverse ecological interactions in the migration corridor/ocean between hatchery fish and wild salmon is limited and equivocal (see section IV.A.9). The WDFW and USFWS salmon releases could potentially interact with listed steelhead in the Upper Columbia River tributaries downstream through the Columbia River migration corridor, estuary and ocean. There could be substantial co-occurrence of migrating Upper Columbia River steelhead smolts and salmon smolts in Upper Columbia River tributaries and Columbia River migration corridor.

3. Lower Columbia River Basin

a. Lower Columbia River Steelhead ESU's

1). Spawning and Rearing Areas

NMFS

Eagle Creek NFH, Bonneville, Clackamas, and Big Creek hatcheries in Oregon and Grays River, Beaver Creek (including Coweenman and Gobar Ponds), North Toutle, and Skamania hatcheries in Washington all release hatchery steelhead into Lower Columbia River tributaries that have populations of listed steelhead. Releasing hatchery steelhead in these tributaries creates the potential for the hatchery steelhead to adversely affect listed Lower Columbia River steelhead through competition in both the spawning and nursery areas of these tributaries and in the freshwater migration areas. It also creates the possibility of predation by hatchery steelhead on rearing listed steelhead fry or fingerlings prior to the time the hatchery steelhead migrate to the ocean or, if some of the hatchery steelhead residualize, during the period of time the residualized fish are rearing. The potential also exists for similar impacts on listed Lower Columbia River steelhead caused by the releases of other anadromous salmonids from NMFS hatcheries in Lower Columbia River tributaries.

The releases of hatchery steelhead in the Lower Columbia River are expected to adversely affect the survival of listed salmon and steelhead in the Columbia River Basin.

ODFW Non-Federally Funded Programs

Oak Springs Hatchery and the Roaring River Hatchery

ODFW steelhead production from the Oak Springs and the Roaring River hatcheries has the potential to adversely effect listed Lower Columbia River steelhead through the mechanisms addressed in sections IV. A. 1-9. The affects associated with those ODFW steelhead production programs that are not part of the section 10 application, are expected to adversely affect the survival of listed salmon and steelhead in the Columbia River Basin.

Competition

Oak Springs Hatchery

SIWG (1984) reported a high risk of ecological resource competition between hatchery steelhead and wild steelhead juveniles where they overlap in freshwater occurrence. Impacts from competition are assumed to be greatest in the spawning and nursery areas and at release locations where fish densities are highest (NMFS 1995e). Oak Springs Hatchery releases of Skamania derived summer steelhead smolts will be limited to direct releases into the Sandy River below Marmot Dam and through acclimation at Sandy Hatchery. Releases of hatchery summer steelhead smolts into headwater basins ended in 1998. Oak Springs Hatchery also rears and releases Skamania derived summer steelhead smolts into the Hood River below Powerdale Dam.

The proposed release of steelhead from these hatchery programs may adversely affect listed Lower Columbia River steelhead as result of competition in the Lower Columbia River, but these impacts are expected to be minimized because:

a. The release of hatchery summer steelhead smolts in the Sandy River and Hood River will be downstream of natural production areas.

b. The production and release of only smolts through fish culture practices fosters rapid seaward migration with minimal rearing of delay in the rivers, limiting interactions with naturally produced steelhead juveniles.

c. The capture and removal of hatchery summer steelhead at Marmot Dam on the Sandy River and Powerdale Dam on the Hood River, will further minimize interactions between naturally produced steelhead and summer steelhead juveniles produced by hatchery adults.

WDFW Non-Federally Funded Programs

Cowlitz Salmon Hatchery and Lewis River Hatchery

There is a high risk of ecological resource competition between hatchery chinook and coho and wild steelhead juveniles where they interact in freshwater migrational areas (SIWG 1984). Interaction and impacts from competition are assumed to be greatest in the spawning and nursery areas and at release locations where fish densities are highest (NMFS 1995e). For more information see the discussion addressing competition under section IV.A.6 in this opinion.

To address the potential impacts associated with competition, WDFW salmon hatchery programs have taken a number of steps to minimize these impacts. The measures taken to minimize competition between hatchery chinook salmon and coho and listed wild steelhead include release size (smolts only, size uniformity criteria), release methods (volitional releases) and release timing practices (April-May, to concur with high flows). These measures minimize the interactions between listed steelhead and hatchery salmon which tend to emigrate seaward soon after liberation (Steward and Bjornn 1990) and thus potential impacts decrease as hatchery smolts disperse. Pearsons et al. (1994) indicated that the decrease in spatial and temporal overlap between hatchery salmon and wild steelhead will minimize potentially adverse interactions. In addition, if the fish do interact, Steward and Bjornn (1990) concluded that fish kept in the hatchery for extended periods before release as smolts (e.g. yearling salmon) may have different food and habitat preferences than wild fish and that the hatchery fish would be unlikely to out-compete wild fish. Because of the above measures the proposed action is may adversely affect listed Lower Columbia River steelhead as result of competition in the Lower Columbia River.

Cowlitz Trout Hatchery and Merwin Fish Hatchery

SIWG (1984) reported a high risk of ecological resource competition between hatchery steelhead and wild steelhead juveniles where they overlap in freshwater occurrence. Impacts from competition are assumed to be greatest in the spawning and nursery areas and at release locations where fish densities are highest (NMFS 1995e). Pearsons et al. (1994) reported that competition experiments in small enclosures within the North Fork Teanaway River suggested that competition between hatchery steelhead and juvenile naturally produced rainbow trout adversely impacted rainbow trout growth. Results from four successive annual experimental releases of 33,000 hatchery steelhead into a tributary of the river, however, showed no impacts to the sizes or densities of sympatric wild trout (Pearsons et al. 1994).

Liberations of winter and summer steelhead smolts and sea-run cutthroat smolts from the Cowlitz Trout and Merwin hatcheries are planned to occur between April 15 and May 15 each year. Most of the Cowlitz winter steelhead are volitionally released on-station, but a significant proportion are transported to Cowlitz Salmon Hatchery for acclimation to that site prior to release. Steelhead smolts produced at Merwin Hatchery are either volitionally released on-station or collected as volitionally-migrating smolts and truck-planted at down-river locations on the Lewis River (WDFW 1997b).

In a salmonid out-migration and predation study on the Lewis River, the majority of hatchery steelhead released through the Merwin Hatchery program exited the river within a few weeks. Steelhead smolts were released from the Merwin program between April 20 and May 14 in 1997. Beach seine sampling during spring 1997 showed that few hatchery steelhead remained in the study sites by the end of May, indicating that most of the fish had out-migrated within 2-5 weeks. (WDFW 1997b).

Steward and Bjornn (1990) observed that hatchery smolts emigrate seaward soon after liberation, minimizing the potential for competition with wild fish. The magnitude and duration of any interaction between hatchery smolts and wild fish is dependent on the location of the hatchery release in the watershed, the number of fish released, their migration speed, flow conditions at the time of release (driven by weather or water budget release practices at hydroelectric facilities), and the actual presence of listed wild fish in areas downstream of the point of release. Because most wild juvenile steelhead rearing occurs in the upper portions of the watersheds in this region, WDFW releases hatchery smolts in the lower portions of the rivers to further minimize the potential for interaction.

In summary, the proposed release of steelhead and cutthroat trout from these hatcheries may adversely affect listed Lower Columbia River steelhead as result of competition , but these impacts are expected to minimized because:

a. The production and release of only smolts through fish culture and volitional release practices fosters rapid seaward migration with minimal rearing of delay in the rivers, limiting interactions with naturally produced steelhead juveniles.

b. WDFW uses acclimation and release of hatchery steelhead smolts in lower river reaches where possible, this in an areas where few wild fish spawn.

c. WDFW collects volitionally migrating steelhead produced at Merwin Hatchery for truck-planting downstream of the city of Woodland, to promote homing of returning hatchery fish to the lower area where wild fish are not likely to spawn. This reduces competition and predation on wild steelhead that generally rear in up-river areas.

d. WDFW proposes to continue monitoring, research and reporting of hatchery smolt migration performance behavior, and intra and interspecific interactions with wild fish to assess, and adjust if necessary, hatchery production and release strategies to minimize effects on wild fish.

WDFW salmon production at the Cowlitz Salmon Hatchery on the Cowlitz River and at the Lewis River and Speelyai hatcheries on the Lewis River has the potential to adversely affect listed Lower Columbia River steelhead through the mechanisms addressed in sections IV. A. 1-9.

Predation

Oak Springs

Predation by hatchery steelhead, as addressed in section IV.A.7, can have adverse effects on listed steelhead. The SWIG (1984) noted that predation may be greatest when large numbers of hatchery smolts encounter newly emerged fry or fingerlings, or when hatchery fish are large relative to wild fish. In the Sandy and Hood rivers predation by hatchery smolts on listed Lower Columbia River steelhead as result of predation may be minimized because: wild steelhead are found in the upper portions of the drainages and emerge at a later time (late spring through August). The yearling smolts from the hatcheries that, due to their relatively large size at release, have the greatest potential to impact juvenile wild fish through predation, are predominantly planted in lower river areas in April and May, which separates them spatially and temporally to a significant degree from newly emerging steelhead fry.

Preliminary results from research by WDFW on the Lewis River, indicates low levels of hatchery steelhead smolt predation on salmonids. In a total sample of 153 out-migrating hatchery steelhead smolts captured through seining in the Lewis River between April and June 24, 12 fish (7.8%) were observed to have consumed juvenile salmonids (WDFW 1997a). The juvenile salmonids contained in the steelhead stomachs appeared to be chinook fry. Sampling through this study indicated that no emergent naturally produced steelhead or trout fry (30-33 mm FL) were present during the first two months of sampling.

Cowlitz Salmon Hatchery and Lewis River Hatchery

Predation by hatchery salmon, as addressed in section IV.A.7, can have adverse affects on listed steelhead. The SWIG (1984) noted that predation may be greatest when large numbers of hatchery smolts encounter newly emerged fry or fingerlings, or when hatchery fish are large relative to wild fish. In the Cowlitz and Lewis rivers impacts from predation by hatchery smolts on listed Lower Columbia River steelhead as result of predation are likely to minimized because: 1) wild steelhead are found in the upper portions of the drainages and emerge at a later time (late spring through August). The yearling smolts from the hatcheries that, due to their relatively large size at release, have the greatest potential to impact juvenile wild fish through predation, are predominantly planted in mainstem river areas in April and May, which separates them spatially and temporally to a significant degree from newly emerging steelhead fry; and 2) steelhead smolts tend to be 1/3 longer than hatchery chinook and coho smolts and thus would not be susceptible to predation by hatchery chinook and coho smolts.

Cowlitz Trout Hatchery and Merwin Fish Hatchery

Predation by hatchery steelhead and cutthroat smolts from the Cowlitz Trout and Merwin hatcheries are expected to have impacts to listed steelhead similar to those of salmon smolts. Preliminary results from research by WDFW on the Lewis River, indicates low levels of hatchery steelhead smolt predation on salmonids. In a total sample of 153 out-migrating hatchery steelhead smolts captured through seining in the Lewis River between April and June 24, 12 fish (7.8%) were observed to have consumed juvenile salmonids (WDFW 1997a). The juvenile salmonids contained in the steelhead stomachs appeared to be chinook fry. Sampling through this study indicated that no emergent naturally-produced steelhead or trout fry (30-33 mm FL) were present during the first two months of sampling. Merwin Hatchery steelhead smolts had been released and the vast majority had likely migrated from the river prior to the emergence of wild steelhead fry in 1997 (WDFW 1997a).

Residualism

Oak Springs Hatchery

Predation of residualized hatchery fish on wild salmonids may be a concern regarding the health of wild steelhead populations (Pearsons et al. 1994). The rate of steelhead residualism has been found to vary greatly, but is thought to typically average between 5% and 10% of the number of fish released (USFWS 1994). Martin et al. (1993) reported a residualism rate of 8.6% for a mid-April release group of steelhead in the Tucannon River. Piscivorous behavior of steelhead and trout is reported to increase markedly when the fish exceed a size of 250 mm total length, which is a size commonly exceeded by residual steelhead in the Columbia River Basin migration corridors (Witty et al. 1995). Although residual steelhead of this size are present in migration corridors, they are not considered to be major predators of juvenile salmonids, as most that are observed are in poor condition and are thought not to survive long enough to become piscivorous (Witty et al. 1995). Releasing hatchery steelhead smolts that are prepared to migrate and timing the release to occur during high flow conditions may minimize impacts to listed fish from steelhead programs.

Acclimation ponds and volitional release strategies are currently the subject of active research in the Columbia River Basin. It is unclear at this time whether or not acclimating and volitionally releasing steelhead smolts can significantly reduce the proportion of residualized steelhead in all cases. WDFW appears to be able to significantly reduce the number of residualized steelhead released by using a combination of acclimation, volitional release strategies, and active pond management whereby remaining steelhead are not released when sampling indicates the majority of remaining fish in pond are males. This action is taken because preliminary WDFW research indicates that the majority of residualized steelhead are males. ODFW monitoring has not confirmed WDFW results (USFWS 1994). The ODFW saw no reduction in steelhead residualism rates in 1993 from acclimated fish in comparison to direct stream releases; however, they did not employ active pond management strategies (USFWS 1994).

The ODFW should evaluate the use of acclimation/release facilities and active pond management for the Oak Springs Hatchery releases. In addition, research should be conducted to determine if release times can maximize the rate of migration and consequently, minimize the potential for interactions between hatchery juveniles and naturally produced steelhead.

Cowlitz Salmon Hatchery and Lewis River Hatchery

Chinook and coho salmon smolts in most situations, do not have the same potential to residualize as steelhead, so NMFS does not expect any chinook or coho salmon smolts to residualize in the Cowlitz or Lewis rivers.

Cowlitz Trout Hatchery and Merwin Fish Hatchery

The ODFW should evaluate the use of acclimation/release facilities and active pond management for the Cowlitz Trout and Merwin hatchery releases. In addition, research should be conducted to determine if release times can maximize the rate of migration and consequently, minimize the potential for interactions between hatchery juveniles and naturally produced steelhead.

2). Migration Corridor Impacts

ODFW Non-Federally Funded Programs

Oak Springs Hatchery, Roaring River Hatchery, CEDC and Round Butte Hatchery

Evidence for adverse ecological interactions in the migration corridor/ocean between hatchery fish and wild salmon is limited and equivocal (see section IV.A.9). Migrational rate information presented by Dawley et al. (1986) indicates that salmon and steelhead smolt movement through the estuary is quite rapid - an average of three days transit time. Salmon smolts have been shown to travel downstream in the estuary at rates ranging from 1 to >59 km/day for sub-yearling chinook, 5 to >59 km/day for yearling chinook and 12 to >59 km/day for coho (Dawley et al. 1986). The minimal duration of hatchery salmon - wild steelhead overlap due to the rapid movement of steelhead smolts through the estuary diminishes the chances for adverse interactions through competition, predation, and disease transmission. The reduced possibility for adverse interactions in the estuary is supported further by Chapman et al. (1994) who observed that migrating steelhead smolts tend to have an offshore distribution in the estuary and this along with their rapid movement, means that the opportunity for estuarine density-dependent growth depression is less for steelhead that slower migrating summer-migrant species. Another factor minimizes competition in the estuary is that the average size of steelhead smolts in the estuary is approximately 200 mm FL. This is more than 1/3 longer than the average length of coho or chinook yearlings in the estuary (130-180 mm release size) and would suggest different food sources for the larger steelhead than the commingled hatchery salmon smolts (WDFW 1998).

As addressed in Section IV.A.9, Dawley et al. (1986) reported that movement rates of steelhead through the estuary and into the ocean are accelerated when compared to migration rates observed from release sites to the estuary. They reported that this finding indicates, in general, that the use of the Columbia River estuary by juvenile salmonids originating from upstream areas is limited in duration compared to use documented for other west coast estuaries. Chapman et al. (1994) also reported that steelhead smolts move rapidly through the Columbia River estuary.

The minimal duration of hatchery-wild steelhead overlap due to the rapid movement of steelhead smolts through the estuary diminishes the likelihood for adverse hatchery fish effects through competition, predation, or disease transmission. In evaluating the potential impacts due to competition, Witty et al. (1995) determined that increasing the number of hatchery steelhead in or just upstream of the estuary is unlikely to affect natural populations of anadromous fish. Therefore, the proposed action’s adverse effects listed steelhead through interactions within the migration corridor are likely to be minimal.

The Oak Springs Hatchery steelhead are released as active smolts directly into the lower sections of the Sandy and Hood rivers, or are acclimated then released. Round Butte Hatchery and CEDC produced smolts are released on site. The CEDC smolts are released near the mouth of the Columbia River minimizing the opportunity for interactions in the migration corridor and estuary (see BPA funded SAFE program). The Roaring River Hatchery summer steelhead are released off site but above Willamette Falls. All the production of hatchery fish under these programs are included in the NMFS production cap.

The proposed release of steelhead from these hatchery programs may have minimal impacts to the listed Lower Columbia River steelhead as result of ecological interactions in the migration corridor and the estuary of the Lower Columbia River because hatchery fish are released as full term smolts, directly from the hatchery or acclimation site, released into locations below natural spawning areas, or in tributaries where listed fish are not present.

WDFW Non-Federally Funded Programs

Cowlitz Salmon Hatchery and Lewis River Hatchery

Evidence for adverse ecological interactions in the migration corridor/ocean between hatchery fish and wild salmon is limited and equivocal (see section IV.A.9). The minimal duration of hatchery salmon - wild steelhead overlap due to the rapid movement of steelhead smolts through the estuary diminishes the chances for adverse interactions through competition, predation, and disease transmission. The reduced possibility for adverse interactions in the estuary is supported further by Chapman et al. (1994) who observed that migrating steelhead smolts tend to have an offshore distribution in the estuary and this along with their rapid movement, means that the opportunity for estuarine density-dependant growth depression is less for steelhead that slower migrating summer-migrant species.

Cowlitz Trout Hatchery and Merwin Fish Hatchery

The minimal duration of hatchery-wild steelhead overlap due to the rapid movement of steelhead smolts through the estuary diminishes the likelihood for adverse hatchery fish effects through competition, predation, or disease transmission. In evaluating the potential impacts due to competition, Witty et al. (1995) determined that increasing the number of hatchery steelhead in or just upstream of the estuary is unlikely to affect natural populations of anadromous fish. Therefore, the proposed action may have minimal impacts to the listed Lower Columbia River steelhead through interactions within the migration corridor.

NMFS

The proposed releases of hatchery fish from the NMFS facilities are released as full term smolts, directly from the hatchery or acclimation site, and for the most part are released into locations below natural spawning areas. However, some releases are still made into tributaries where listed fish are present. The proposed release of salmon and steelhead from NMFS Mitchell Act Hatcheries may adversely impact the listed Lower Columbia River steelhead as result of ecological interactions in the migration corridor and the estuary of the Lower Columbia River.

C. Effects of the Proposed Action on Adult Salmon

1. Snake River Basin

Listed Snake River salmon have generally not been marked. Consequently, there is no direct information on the frequency of their straying and entering hatcheries outside the Snake River Basin. However, large numbers of hatchery origin fish from the Snake River Basin have been marked and many of these hatchery stocks originated from local indigenous salmon populations. NMFS used this indirect information from marked Snake River hatchery salmon in assessing broodstock collection impacts. It is unclear if there is a direct relationship between stray rates of hatchery fish from Snake River hatcheries and stray rates of the three listed Snake River salmon, but this relationship represents the best available information.

Straying occurs to some degree in natural populations and is essential for colonizing new habitat (Milner and Bailey 1989) or for recolonizing degraded habitat (Leider 1989). Adults may also temporarily wander out of the migration corridor, and may or may not eventually home to the natal stream. Broodstock collection at hatcheries may interrupt this natural tendency to wander and then home. However, locally adapted populations may have greater homing fidelity than transplanted populations (McIsacc and Quinn 1988). Consequently, locally adapted natural populations in the Snake River Basin may stray less than hatchery populations that have been transferred or moved around.

Quinn et al. (1991) studied homing and stray patterns of fall chinook salmon originating from lower Columbia River hatcheries and found many of the stray hatchery adults on spawning ground at various distances from the hatchery. This may indicate that at least some of the Snake River hatchery fish trapped in Columbia River hatcheries probably would not return to the Snake River Basin even if they are not trapped.

a. Broodstock Collection Outside the Snake River Basin

Hatchery broodstock are collected outside the Snake River Basin at 21 NMFS hatcheries, four USFWS hatcheries, one BPA hatchery, six USACE hatcheries, and the BIA facility. Proposed actions are generally similar to those occurring in previous years. There are several Snake River Basin hatchery programs that have fish collected outside the Snake River Basin. These programs are discussed below.

1). Snake River Fall Chinook Salmon

Marked Snake River fall chinook salmon hatchery adults have seldom been collected at hatcheries outside the Columbia River Basin (NMFS 1995e; USFWS 1994; USACE 1994; BPA 1994). Since the late 1970s, only one marked Snake River fall chinook salmon hatchery fish has ever been collected at Bonneville Hatchery (February 25, 1993, letter from R. Willis, USACE, to M. Tuttle, NMFS); only one has ever been trapped at Spring Creek Hatchery (Diggs 1992); and only two have ever been trapped at WDFW hatcheries (one at Priest Rapids Hatchery and one at either Priest Rapids or Wells Hatcheries) (Ross Fuller, WDF, May 27, 1993, pers. comm.). Based on the marked Snake River hatchery fish, it appears that straying of wild Snake River fall chinook salmon is merely an isolated occurrence, if it occurs at all.

2). Snake River Spring/Summer Chinook Salmon

Snake River spring/summer chinook salmon hatchery adults have been collected at hatcheries outside the Snake River Basin. There are several hatchery programs that have had hatchery spring chinook collected outside the basin. These programs are the Warm Springs Hatchery operated by USFWS, Round Butte Hatchery operated by ODFW, both located in the Deschutes River subbasin of Oregon, and the Clearwater River Basin programs.

<u>Warm Springs Hatchery</u>

Warm Springs Hatchery has collected an average of 2.33 marked Snake River hatchery spring/summer chinook salmon per year from 1987 to 1992 (Table 5). It is unknown if any of these adults would have eventually returned to the Snake River had they not been trapped and retained at the hatchery. The hatchery is located along Warm Springs River at river mile 9. Snake River spring/summer chinook salmon would have to stray nearly 93 miles off the Columbia River migration corridor (CBIAC 1963) to be trapped. It is unknown if listed Snake River spring/summer chinook salmon are collected.

Round Butte Hatchery

Adult spring/summer chinook salmon are collected at Pelton Dam for ODFW's Round Butte Hatchery program. Since 1988, an average of 13.6 (range of nine to 19 annually) marked Snake River hatchery spring/summer chinook salmon have been trapped and retained for hatchery broodstock (April 7, 1994 Biological Opinion on 1994 Hatchery Actions). These trapped adults have strayed approximately 103 miles off the Columbia River migration corridor.

Clearwater River Basin Hatcheries

In 1995, 1996 and 1997, hatchery adult spring chinook from hatcheries in the Clearwater River were collected outside the Clearwater and Snake River basins (Table 6). Please note that the numbers in Table 6 are preliminary and estimates of the actual stray rates are not yet available. A total of 89 adult spring chinook from Clearwater River hatcheries have been collected in the Upper Columbia River Region between 1995 and 1997. Of the 89 adults recovered 46 fish (51.7%) were from Dworshak, 18 fish (20.2%) were from Powell Pond, 16 fish (18.0%) were from Kooskia, 4 fish (4.5%) from Clearwater and 5 fish (5.6%) were from Crooked River. A total of 45 fish (50.6%) were collected at Wells Dam, followed by 20 fish (22.1%) at Leavenworth, 11 (12.3%) fish at Entiat, 4 fish (4.5%) at Winthrop (Bartlett 1997, Roseberg 1997, Carie and Hamstreet 1999, Carie 1999) and, 3 fish (3.4%) at Tumwater Dam (K. Petersen, Washington Dept. of Fish and Wildlife, pers. comm.) in the Upper Columbia River. The remaining 7.9% of the strays were collected on the spawning grounds in the Chewuch River - 3 fish (3.8%), a tributary to the Methow River (Bartlett 1997), and on the spawning grounds in the Nason Creek - 3 (3.8%) fish, a tributary to the Wenatchee River (K. Petersen, Washington Dept. of Fish and Wildlife, pers. comm.), and the Entiat River - 1 fish (1.1%) recovered by WDFW personnel (Carie 1999).

Potential straying of NPTH Rapid River stock spring chinook outside the Clearwater River Basin into natural spawning areas for listed spring/summer chinook may occur based on the experience with current hatcheries operating in the Clearwater River Basin. However, NPTH operations are designed to reduce straying (gene flow) into other areas by acclimating hatchery fish on their return stream, and all fish will be marked. This will allow identification of any stray NPTH fish on spawning grounds or at other hatchery broodstock collection facilities. The potential for NPTH spring chinook straying into listed Snake River spring/summer chinook salmon spawning should be minimized because: 1) the NPTH spring chinook will be acclimated for several months prior to volitional release. Also, NATURES rearing techniques would be used to produce a more natural hatchery fish that should aid adults in returning to their release stream; 2) all hatchery spring chinook juveniles would be marked prior to release, allowing identification of any stray NPTH fish arriving at other hatcheries or at the Lower Snake River dams, or on the spawning grounds. This would provide an estimate of the straying rate and allow NPT managers to take corrective action under their adaptive management approach; and spawning ground and carcass recovery surveys are conducted by IDFG and NPT in many tributaries of the Salmon and Clearwater rivers. ODFW conducts spawner ground carcass recovery programs in tributaries of the Grande Ronde River. These surveys provide the monitoring and evaluation necessary to identify potential genetic introgression of NPTH hatchery fish with listed spring/summer chinook outside the basin.

Based on the marked hatchery fish, the potential exists that listed Snake River spring/summer chinook salmon may also be trapped and retained for hatchery broodstock at the above facilities. This assumes that wild listed Snake River spring/summer chinook have the same tendency to stray as hatchery spring/summer chinook. The number of Snake River spring/summer chinook salmon trapped is unquantified, but is probably no more than a few individuals.

3). Snake River Sockeye Salmon

Upper Columbia River Basin sockeye salmon are proposed to be collected at Wells Dam for Cassimer Bar Hatchery program. For listed Snake River sockeye salmon to be collected at this site, they would have to stray approximately 190 miles upstream of the Snake and Columbia rivers confluence and pass four Columbia River hydroelectric dams. It is unknown if Snake River sockeye salmon have strayed to the Upper Columbia Basin. But based on the distance a Snake River sockeye salmon would need to stray before encountering the trap, NMFS concludes that trapping operations at Wells Dam should have no effect on Snake River sockeye salmon.

4). Snake River Summer Steelhead

Adult hatchery summer steelhead from Snake River hatchery programs are trapped in hatcheries throughout the Columbia Basin, most particularly in the Deschutes River, where up to 70% of steelhead taken at the Warm Springs NFH and at Round Butte Dam are hatchery steelhead from sources outside the basin. However, coded-wire tag recoveries indicate that not all hatchery

Table 5. Marked Snake River hatchery origin spring/summer chinook salmon individual adult recoveries at Warm Springs National Fish Hatchery operated by the USFWS, 1987 to 1992.

Return Year	Brood Year	Agency	Snake River Hatchery	Release Site

1987	1984	IDFG	McCall	S.F. Salmon River
1988	1983	ODFW	Lookingglass	Lookingglass Creek
1988	1983	IDFG	Rapid River	Rapid River
1988	1984	IDFG	Rapid River	Rapid River
1989	NONE			
1990	1986	ODFW	Lookingglass	Imnaha River
1990	1988	ODFW	Lookingglass	Imnaha River
1991	1986	ODFW	Lookingglass	Imnaha River
1991	1986	ODFW	Lookingglass	Imnaha River
1991	1987	ODFW	Lookingglass	Imnaha River
1991	1987	ODFW	Lookingglass	Imnaha River
1991	1988	ODFW	Lookingglass	Imnaha River
1991	1988	ODFW	Lookingglass	Lookingglass Creek
1991	1988	IDFG	McCall	S.F. Salmon River
1992	1988	ODFW	Lookingglass	Imnaha River

Annual average 2.33

programs stray equally; some hatcheries, notably Wallowa Hatchery stock steelhead reared at Irrigon Hatchery are present in large numbers while fish from other hatcheries are rarely found.

NMFS is not aware of any data that indicates wild listed steelhead from the Snake River stray at a high rate. Hatchery steelhead of the Imnaha Hatchery stock, which is recently derived from the wild, stray at one-fourth the rate as do Wallowa Hatchery stock, which is a composite stock maintained by hatchery returns. This bit of information suggests that wild fish and hatchery fish based on local stocks probably have more accurate homing ability and behavior than domesticated or composite hatchery stocks.

b. Broodstock Collection Within the Snake River Basin

Based on the apparent separation in run timing, NMFS concludes that collection of steelhead broodstock at hatcheries and satellite facilities from the end of February to early May is not likely to adversely affect any of the listed Snake River salmon. However, steelhead broodstock collection in the fall months may result in incidental take of Snake River fall chinook salmon.

All chinook salmon smolts released from hatcheries located in the Snake River Basin have been 100% marked. However, some spring chinook parr releases into the Clearwater River Basin and fall chinook subyearlings above Lower Granite Dam have only a representative sample marked. Thus, the majority of adults returning to the Snake River Basin should be identifiable as hatchery or natural origin. Consequently, the incidental incorporation of listed fish into the hatchery populations should be practically eliminated in the Snake River Basin.

1). Snake River Fall Chinook Salmon

Snake River fall chinook salmon may be collected at three hatcheries. Lyons Ferry Salmon Hatchery, Dworshak Hatchery and Nez Perce Tribal Hatchery. Lyons Ferry Salmon Hatchery is the only facility rearing fall chinook salmon in the Snake River Basin at this time. Fall chinook salmon have been trapped at Dworshak Hatchery (located in the Clearwater River Basin) and potentially could be reared and trapped at several NPTH facilities. Also, fall chinook are trapped at Lower Granite Dam to prevent straying of Klickitat and Umatilla hatchery fall chinook into the Snake River Basin.

a. Lyons Ferry Salmon Hatchery

Adult fall chinook salmon are collected for the Lyons Ferry Hatchery by trapping adults that voluntarily enter the hatchery and from hatchery adults removed from the Lower Granite Dam fish trap. The hatchery is located along the Snake River at river mile 59 and is the only facility in the Snake River Basin that rears fall chinook salmon. Hatchery broodstock are collected from September to December.

Both marked and unmarked fall chinook salmon adults voluntarily enter the hatchery. In recent years, a large number of hatchery adults have strayed into the Snake River from the Klickitat and Umatilla hatcheries fall chinook programs. Fall chinook salmon strays in 1994 and 1995 were dominated by Umatilla Hatchery fall chinook salmon released into the Umatilla River in (LaVoy 1994, Mendel 1998, PAC 1998). However, beginning in 1996, the Umatilla Hatchery fall chinook straying problem was dramatically reduce, while the Klickitat Hatchery fall chinook strays increased (Mendel 1998). For example in 1996 and 1997, Klickitat Hatchery fall chinook accounted for approximately, 13% of the escapement above Lower Granite Dam (PAC 1998). No unmarked strays from the Umatilla Hatchery are anticipated after 1997, but unmarked strays from the Klickitat River are expected.

Table 6. Recovery of stray adult spring chinook hatchery fish from the Clearwater River hatcheries (Clearwater, Dworshak and Kooskia). Preliminary data from R. Roseberg, USFWS, H. Bartlett, WDFW, and K. Petersen, WDFW. 1997 recoveries at Leavenworth, Entiat and Winthrop from Carie and Hamstreet 1999.

Facilities	Year recovered	Broodyear	Number	Site recovered
Dworshak	1995	1991	1	Leavenworth rack
	1995	1992	1	Leavenworth rack
	1996	1991	1	Leavenworth rack
	1996	1992	2	Leavenworth rack
	1996	1993	3	Leavenworth rack
	1996	unknown	2	Entiat rack
	1996	1992	7	Wells Dam
	1997	1992	1	Wells Dam
	1997	1993	18	Wells Dam
	1997	unknown	1	Tumwater Dam
	1997	unknown	2	Nason Creek
	1997	1993	1	Chewuch River
	1997	1993	2	Leavenworth rack
	1997	1993	4	Winthrop rack
Powell Pond	1996	1992	4	Wells Dam
	1997	1993	8	Wells Dam
	1997	1993	2	Chewuch River
	1997	1993	1	Leavenworth rack
	1997	unknown	1	Entiat River
	1997	1993	2	Entiat rack
Kooskia	1995	1992	1	Leavenworth rack
	1996	1992	2	Enitat rack
	1996	1992	1	Wells Dam
	1996	1992	3	Leavenworth rack
	1997	unknown	1	Nason Creek
	1997	1993	2	Wells Dam
	1997	1993	2	Leavenworth rack
	1997	1993	4	Enitat rack
Clearwater	1996	unknown	3	Leavenworth rack
	1997	unknown	1	Tumwater Dam
Crooked River	1997	1993	4	Wells Dam
	1997	unknown	1	Tumwater Dam
Total			**89**	

b. Dworshak Hatchery

Fall chinook salmon have been incidentally collected at Dworshak Hatchery in the fall months during collection of steelhead broodstock. From 1988 to 1991, zero to three adult fall chinook salmon were trapped per year. One of these fish was identified as a stray adult originating from a release into the Umatilla River of Oregon. In 1992, none of 14 adults trapped were marked. Based on genetic analysis, at least some, and perhaps most, of the adult fall chinook salmon collected in 1992 were strays from the Columbia River (May 14, 1993, letter from M. Tuttle, NMFS, to W. Miller, USFWS). Adult fall chinook salmon should be released back into the Clearwater River to spawn naturally.

c. Nez Perce Tribal Hatchery

Fish ladders would be operated at Cherrylane, Luke's Gulch, and Cedar Flats facilities to collect returning hatchery fall chinook adults in Phase II. Listed fall chinook may comingle with hatchery spawners and ascend the fish ladder (BPA 1997a). Depending on the mating protocols to be developed for fall chinook, these fish may be kept in the facility to be spawned or released to the river.

Adult holding and spawning activities may affect Snake River fall chinook. Since most hatcheries experience a pre-spawning mortality rate in the range of 10-15% of all adult fish captured (BPA 1997a), unmarked fall chinook (strays) could be killed if they enter the facilities. Very few listed fall chinook are expected to stray into NPTH facilities through the fish ladders (BPA 1997a). In summary, operation of fish ladders and fish weirs and adult holding and spawning activities should not capture or adversely impact listed Snake River fall chinook adults because: 1) assuming that the NPTH fall chinook salmon supplementation program will provide a net benefit to listed Snake River fall chinook, the relatively small number of listed fall chinook salmon adults that may be killed during hatchery operations should be offset by the increase in natural fall chinook abundance produced by the program. The assumption of a net benefit has not been rigorously tested, however, and needs to be more carefully evaluated prior to initiation of the proposed NPTH fall chinook salmon program; and 2) all returning hatchery adult fall chinook will be marked, so identification and release of natural fall chinook should reduce any potential mortality in the adult holding facilities. However, if some fish enter the adult holding facilities, pre-spawning mortality rates should be reduced by the higher flow through the ponds. Also, listed fall chinook that do enter the facilities will either be used as broodstock or released, depending upon the broodstock collection protocols that will be developed with other Columbia Basin fish managers and authorized in a subsequent section 10 direct take permit.

2). Snake River Spring/Summer Chinook Salmon

Spring/summer chinook salmon hatchery broodstock are collected at four hatcheries and four satellite facilities in the Snake River Basin. Two hatcheries (Dworshak and Kooskia) and three satellite facilities (Red River, Crooked River, and Powell River satellites) are located within the Clearwater River subbasin. One hatchery (Lookingglass) is located within the Grande Ronde River Basin, one hatchery (Rapid River) is located within the lower Salmon River Basin, and one satellite facility is located on the Snake River at Hells Canyon Dam. Broodstock collection at facilities rearing listed fish (Sawtooth Hatchery, Pahsimeroi Hatchery, McCall Hatchery, Lyons Ferry Hatchery [spring/summer chinook salmon], and Lookingglass Hatchery [Imnaha spring/summer chinook salmon]) was previously assessed and authorized in direct take permits issued by NMFS.

a. Clearwater River Hatcheries

USFWS assessed effects of broodstock collection at their facilities in the Clearwater River as part of their biological assessment hatchery operations and determined that these actions would have no effect on listed Snake River salmon (USFWS 1994; Dan Herrig, USFWS, June 2, 1993, pers. comm.) as spring/summer chinook salmon originating from the Clearwater River Basin are not part of the listed Snake River spring/summer chinook salmon (57 FR 23458, Corrections, June 3, 1992).

b. Lookingglass Hatchery

The Lookingglass Hatchery is located in the Grande Ronde River subbasin of northeast Oregon and is located on Lookingglass Creek, 2.2 miles above its confluence with the Grande Ronde River. The historic spawning area of Lookingglass Creek is located above the hatchery weir that forces most adults to enter the hatchery. Broodstock trapping on the creek began in 1982 with 20 to 40 indigenous Lookingglass Creek stock adults collected per year during the first three years. Eggs collected from these fish were mixed with the imported Carson stock brought in from hatcheries outside the Snake River Basin (March 1, 1993, letter from W. Shake, USFWS, to M. Tuttle, NMFS). Large numbers of Rapid River stock eggs have also been imported to this facility in recent years.

Approximately 400 to 2,500 Carson and Rapid River stock adults have returned each year since 1985 (USFWS 1994; March 1, 1993, letter from W. Shake, USFWS, to M. Tuttle, NMFS). Few adults have escaped above the hatchery weir as determined by redd counts. Analysis of marks and scale samples in 1988 and 1989 showed natural origin fish made up 8.3 % to 22.2 % of carcasses recovered from the spawning grounds (USFWS 1994). Insufficient carcasses were recovered for analysis in 1990. In 1991, all carcasses collected on the spawning grounds were identified as hatchery origin. Estimates of adult escapement above the hatchery weir ranged from 17 to 127 fish between 1986 and 1992 (July 8, 1993, fax to Mike Delarm, NMFS, from Joe Krakker, USFWS). A range of zero to 10 adults per year are estimated to have originated from natural production using the analysis of scales and marks described above. These natural origin adults will likely be composed primarily of the imported Rapid River and/or Carson stocks which have spawned naturally.

c. Clearwater River Basin Hatcheries

Spring chinook (Rapid River and Carson stocks) may potentially stray into areas inhabitated by listed Snake River spring/summer chinook and interbreed. In order to evaluate straying of spring chinook from hatcheries in the Clearwater River Basin, all hatchery fish are marked/tagged (adipose clipped and/or coded wire tagged) to differentiate them from wild fish. All hatchery smolts released into the Clearwater River Basin have been 100% adipose fin clipped since 1993 releases.

IDFG and NPT have been conducting spawning ground and carcass recovery surveys in areas of known listed spring/summer chinook spawning habitat for many years. Areas that are surveyed include: Lower Salmon River (Chamberlain, Lemhi, North Fork Salmon River, and West Fork Chamberlain creeks); Upper Salmon River (Alturas Lake Creek, East Fork Salmon River, Yankee Fork, Herd, Pole and Valley creeks; and the Middle Fork Salmon River (Bear Valley, Beaver, Big, Camas, Capehorn, Elk, Knapp, Loon, Marsh and Sulphur creeks) and South Fork Salmon River (Johnson Creek, Secesh River, and Lake Creek). To date there have not been any hatchery adult spring chinook from hatcheries in the Clearwater River collected on the spawning grounds for listed Snake River spring/summer chinook.

3). Snake River Sockeye Salmon

Snake River sockeye salmon are not collected at the hatcheries in the Snake River Basin that are assessed in this Opinion. Capture of Snake River sockeye salmon at Sawtooth Hatchery is covered by a separate ESA section 10 direct take permit (Table 1).

4). Snake River Summer Steelhead

Snake River Basin steelhead adults may potentially be trapped at any of the 15 hatchery weirs designed for steelhead and chinook. Because all hatchery steelhead adults are clearly marked with an adipose-fin clip, wild fish may be sorted and passed above weirs to spawn naturally. At this time only the Imnaha River broodstock collection intentionally incorporates wild spawners into their annual egg take. At other facilities hatchery fish are retained while wild fish are passed above the weir to reproduce naturally.

Nez Perce Tribal Hatchery

The operation of fish weirs may block, delay, or otherwise disrupt the movements and distribution of the late run of steelhead (BPA 1997a). Fish weirs that are improperly designed and operated can stress, injure, or kill fish. The majority of steelhead are expected to have spawned by the time the weirs begin operation in late May. However, in some years and streams later spawning steelhead may be affected. The proposed weirs would add effects to the late steelhead run in the Clearwater Subbasin. Currently, weirs are operated on several streams in the Clearwater River Subbasin to conduct research and collect hatchery broodstock for existing facilities. These include Big Canyon Creek, Clear Creek, Crooked River, Red River, Walton Creek, Fish Creek, Running Creek, and historically, the upper Lochsa, and Brushy Fork Creek (BPA 1997a). Impacts caused by eight additional weirs under the NPTH would spread impacts over a wider geographical range. In summary, operation of fish ladders and fish weirs and adult holding and spawning activities should minimize adverse impacts to listed Snake River steelhead adults because: 1) the fish weirs will be staffed with NPT fishery technicians around the clock, seven days a week. Adult steelhead that are trapped will be released immediately by NPT personnel (D. Johnson, NPT, pers. comm.). In addition, areas downstream of the weirs will be snorkeled to determine if steelhead adults are holding up or spawning downstream. To increase survival of naturally spawning adults corrective actions will be immediately applied should problems occur with the weirs.; and 2) based on the apparent separation in run timing, collection, handling and release of a few listed adult steelhead at NPTH hatcheries and satellite facilities in late May may adversely affect listed Snake River steelhead.

c. Genetic Introgression

When hatchery anadromous fish return as adults they are expected to return to the stream or hatchery facility where they are released. However, in some hatchery stocks, the homing ability is less prevalent than in natural fish and a propensity to stray into waters far from the release sites has been observed. There is concern that domestication or other effects of artificial propagation reduces the ability of hatchery fish to successfully reproduce and that hatchery fish straying into natural spawning areas may reduce the spawning success of wild fish, (Chilcote 1998) or introduce undesirable genetic material into the natural population (Grant 1997).

In the Proposed Recovery Plan, NMFS proposed that the aggregate of hatchery fish strays in a spawning population not exceed 5% of any Snake River salmon. This 5% standard is considered an interim level until information on natural fish stray rates justifies some different standard that would still protect natural population integrity. NMFS hosted a scientific workshop titled "Genetic Effects of Straying of Non-Native Hatchery Fish into Natural Populations"on June 1-2, 1995, in Seattle, Washington. The stray fish workshop focused on the biological consequences of artificially elevated levels of straying into natural salmon populations.

The panel summarizing the stray fish workshop results concluded that salmon have evolved so that genetic differences, both neutral and adaptive, exist between populations in the presence of natural levels of gene flow. Three possible reasons were given for the observed population structure:

1. Natural levels of gene flow are very low. Low levels of gene flow may be due to strong homing behavior, or to the lack of reproductive success of stray fish in local populations, or to a combination of both factors.

2. Natural gene flow occurs only sporadically and therefore has much less potential to swamp genetic diversity within or between natural populations.

3. Stray fish tend to be exchanged among geographically nearby populations, and this stepping stone mode of gene flow to more distant populations results in: a) efficient natural selection against disadvantageous genes, and b) retardation of the introgression of neutral alleles into distant populations. This latter factor leads to large scale regional differentiation among populations, even for neutral traits such as allozymes.

Some natural or base rate of gene flow occurs across natural populations through natural straying or pioneering. The straying of non-native hatchery fish into natural populations may elevate the rate of gene flow above the natural level. It is difficult to predict the outcome of increased gene flow that results from straying of genetically dissimilar populations. If the reproductive success of strays is high or the proportion of non-native strays in the spawning population is high, a significant amount of gene flow could occur. Conversely, if the reproductive success of strays is low, gene flow would likely be negligible. The degree of genetic introgression may also be related to the genetic dissimilarity between the natural and stray population.

The panel further concluded that there are no “safe” levels of hatchery fish straying. Any level of long-term straying will change local populations. While the genetic effects of straying at any given level cannot be reliably predicted, some of the effects of gene flow are predictable. Based on estimates of gene flow from allozyme frequencies in natural populations, a value of 5% is much higher than that generally occurring between non-local populations. Also, based on what is known about the strength of selection in other animals, this amount of gene flow would quickly lead to the replacement of not only neutral genes, but also of locally-adapted ones. Most genes in natural populations probably have selection coefficients less than 5% and thus would be subject to loss, if gene flow occurred at this level. The panel found no genetic justification for allowing gene flow from non-native fish at levels as high as 5% (Grant 1997). However, NMFS has chosen a stray rate of 5% as a surrogate measure of the maximum allowable rate of gene flow, based on assumptions that hatchery strays will be less successful than natural fish in spawning and reproductive rates will be lower.

This information supports the direction that NMFS and other recent reviews of hatchery programs recommend in reforming hatcheries to protect, conserve and enhance natural populations. Specifically, this includes the development of locally-adapted broodstocks, improving homing and reducing the level of stray hatchery fish, and limiting the proportion of hatchery fish allowed to spawn naturally.

1). Snake River Fall chinook

There are three programs (Klickitat, Umatilla and NPTH) that release fall chinook that may potentially impact listed Snake River fall chinook. These programs are discussed below.

a. Klickitat Hatchery fall chinook

NMFS is concerned about the straying and potential introgression of Klickitat Hatchery fall chinook has on listed Snake River fall chinook. Since 1995, approximately 96 to 182 Klickitat Hatchery fall chinook have been straying past Lower Granite Dam (PAC 1998). This data is based on preliminary analysis of coded-wire tag recoveries at Lower Granite Dam. Information collected in 1996, indicates approximately, 13% of the total number of fall chinook salmon (adults and jacks) escaping above Lower Granite Dam were Klickitat Hatchery strays (PAC 1998). See PAC (1998) for more details.

Beginning in 1999, 100% of the Klickitat Hatchery fall chinook will be tagged (R.Z. Smith, pers. comm.). This should assist NMFS in protecting listed Snake River fall chinook above Lower Granite Dam, by allowing removal of Klickitat fall chinook strays.

b. Umatilla Hatchery Fall Chinook

Straying of Umatilla Hatchery fall chinook continues to occur but has been dramatically reduced since 1994-1995. The estimated number of Umatilla Hatchery fall chinook (adult and jack) escaping above Lower Granite Dam in 1994, 1995, and 1996 was 185 fish, 194 fish, and 5 fish respectively (PAC 1998). Actions taken at Umatilla Hatchery since 1996, have minimized the potential genetic introgression of listed Snake River fall chinook above Lower Granite Dam.

c. Nez Perce Tribal Hatchery Fall Chinook Salmon

NMFS is concerned that the "early run" fall chinook program could potentially interbreed with natural fall chinook in the lower Clearwater River if they do not imprint and return to the South Fork Clearwater and the Selway rivers. Intentional selection for an "early run" fall chinook might potentially change the run timing of natural fall chinook and impact long term fitness and survival if they interbreed with natural fall chinook in the Clearwater and Snake rivers. These areas to which "early run" fall chinook will be imprinted and released appear to be areas (Luke's Gulch and Cedar Flats) outside the normal range of fall chinook (Waples et al. 1991), and there is only anecdotal evidence that suggests fall chinook were native to the Upper Clearwater River Basin (BPA 1997b). The anecdotal evidence that is available comes from R.W. Schoning, a biologist who had conversations with local residents in Lewiston, Idaho. Schoning (1940) reported that the Clearwater historically supported runs of fall chinook and that Lewiston residents observed chinook trying to ascend Lewiston Dam as late as mid-October or remember spearing fall chinook in the Selway River just before the river would freeze prior to dam construction (BPA 1997b). Unfortunately, the biological characteristics of the Upper Clearwater fall chinook population are not known because of Lewiston Dam, the effects of the commercial fishery downriver, and lack of research.

The BA (1997a) and EIS (1997b) state that in Phase I, fall chinook eggs would be obtained from the Lyons Ferry Hatchery. Since it is an egg bank for listed Snake River fall chinook, there should not be any adverse genetic effects. Even though Lyons Ferry fish are within the fall chinook ESU, there still are risks to the natural fall chinook population from NPTH. For example, the incorporation of wild fall chinook trapped at Lower Granite Dam during Phase II into the broodstock might reduce potential domestication selection and loss of genetic diversity, but the broodstock protocol and use of wild Snake River fall chinook has not been developed or approved by the Columbia River Basin fish managers or NMFS. Without a well defined broodstock protocol for the fall chinook program, it is difficult to determine the potential risks and benefits to the natural population.

On the basis of these concerns, NMFS believes that a risk/benefit analysis for the fall chinook program would provide a sound foundation for determining the risks and benefits to the natural fall chinook populations in the Clearwater and Snake rivers for both Phase I and II programs.

2). Snake River Spring/Summer Chinook Salmon

NMFS has identified the Nez Perce Tribal Hatchery (NPTH) spring chinook program as potentially impacting Snake River spring/summer chinook due to hatchery fish straying. Potential straying of NPTH Rapid River stock spring chinook outside the Clearwater River Basin into natural spawning areas for listed spring/summer chinook may occur based on the experience with current hatcheries operating in the Clearwater River Basin. However, NPTH operations are designed to reduce straying (gene flow) into other areas by acclimating hatchery fish on their return stream, and all fish will be marked. This will allow identification of any stray NPTH fish on spawning grounds or at other hatchery broodstock collection facilities. Currently, IDFG and NPT conduct spawning ground and carcass recovery surveys in many tributaries of the Salmon and Clearwater rivers. ODFW conducts spawner ground carcass recovery programs in tributaries of the Grande Ronde River. NMFS believes these surveys provide the monitoring and evaluation necessary to identify potential genetic introgression of NPTH hatchery fish with listed spring/summer chinook outside the basin. If straying becomes a problem, BPA will need to reinitiate consultation with NMFS.

3). Snake River Summer Steelhead

Hatchery steelhead in the Grande Ronde Basin (Wallowa Hatchery stock) originated from fish trapped at Lower Snake River dams in the 1970's. Although the fish are from the Snake River ESU, they are a composite of unknown genetic makeup that very likely included fish destined for the Salmon or Clearwater rivers or other tributaries of the Snake River. Adult steelhead are trapped at two release sites on the Wallowa River. The eggs are hatched and incubated at Irrigon Hatchery, then returned to the Grande Ronde Basin where they are released from acclimation ponds or directly released into streams. A high rate of hatchery fish spawning naturally has been reported in some sections of the Grande Ronde River (USFWS 1998a).

Of greater concern is that a large number of Wallowa Hatchery stock steelhead have been reported spawning in other rivers. The number of hatchery steelhead strays of Snake River origin appearing in the Deschutes River has steadily increase since the late 1980's (Table 7). In 1996, 1997, and 1998, ODFW has estimated that about 70% of the steelhead in the Deschutes River were hatchery strays. At Warm Springs NFH, located on a Deschutes River tributary, between 70 and 100% of the hatchery steelhead that could be identified by coded-wire tags in these three years were Wallowa Hatchery stock steelhead reared at Irrigon Hatchery. Imnaha Hatchery stock steelhead are also reared at Irrigon Hatchery with very similar protocols, but appear to stray at a much lower rate. (Rich Carmichael, ODFW, pers. comm.). The major difference between these stocks is that the Imnaha Hatchery stock was recently derived from indigenous fish and they are released in their native waters, while the Wallowa Hatchery stock is a composite stock with a longer history of artificial propagation.

Table 7. Estimated summer steelhead escapement in the Deschutes River upstream from Shearer's Falls (River mile 44) comparing numbers of wild steelhead, Deschutes Hatchery stock steelhead from Round Butte Hatchery, and the increasing number and percentage of stray fish from hatcheries outside the Deschutes River Basin.

Run Year	Wild Steelhead	Round Butte	Stray Hatchery	Total Steelhead
1990-91	3,653	1,990	2,852 (33.6%)	8,495
1991-92	4,862	3,778	8,409 (49.3%)	17,049
1992-93	904	2,539	4,261 (55.3%)	7,704
1993-94	1,487	1,159	4,293 (61.9%)	6,939
1994-95	482	1,781	4,391 (66.0%)	6,654
1995-96	1,662	2,708	11,855 (73.1%)	16,225
1996-97	3,458	5,932	23,618 (71.6%)	33,008

Oregon Department of Fish and Wildlife Data

2. Upper Columbia River Summer Steelhead

All hatchery summer steelhead smolts released into the Upper Columbia River are externally marked to allow future identification.

a. Broodstock Collection Outside the Upper Columbia River Basin

No Upper Columbia River steelhead (wild or hatchery)have been collected outside the Upper Columbia River Basin. Therefore, inclusion of listed Upper Columbia River steelhead (wild or hatchery) into hatchery program outside the Upper Columbia River Basin is not expected to occur.

b. Broodstock Collection Within the Upper Columbia River Basin

Migrating adult listed Upper Columbia River steelhead may be incidentally collected at several hatchery facilities operating in the Upper Columbia River Basin. All WDFW adult broodstock collection traps are monitored continuously during operation or at least checked daily (WDFW 1997b).

The Priest Rapids Hatchery collects up to 10 listed steelhead during fall chinook broodstock operations between early September and mid-November (WDFW 1997b). Trapping operations at Eastbank Hatchery capture and release listed steelhead at the Chiwawa River spring chinook broodstock trapping operations (July and August). A total of seven steelhead were collected from 1993 to 1996, at the Chiwawa River weir, which is an average of two steelhead per year (WDFW 1997b). Spring chinook broodstock collection (late July to late October) at Dryden Dam and sockeye broodstock collection (mid-July) at Tumwater Dam, on the Wenatchee River trap, handle and release listed steelhead. The average number of steelhead at Dryden Dam from 1992-1996 was 11 (range 2-18) and at Tumwater Dam 23 were collected in 1996 (WDFW 1997b). At the Wells Salmon Hatchery trap and the Wells Dam left and right bank ladder traps from early May through November during spring chinook, summer chinook and fall chinook broodstock operations, WDFW (1997b) estimates less than 20 listed steelhead are trapped and released upstream from the hatchery trap and that 30-40 listed steelhead move through the Wells Dam ladders annually with no significant handling or delay. Collection of listed steelhead at the Methow Salmon Hatchery and satellite facilities during spring chinook broodstock trapping is expected to zero. Beginning in 1998, WDFW traps all spring chinook at Wells Dam and does not expect to operate the Chewuch or Twisp river traps. Even if the traps were operated, the average number of listed adult steelhead collected from 1992-1994 was 0.5 steelhead (WDFW 1997b). Only one steelhead was captured at Fulton Dam in 1993.

Listed Upper Columbia River steelhead are only incidentally collected at Leavenworth fish ladder. On average 15-20 adult steelhead are trapped and released back into the river annually (B. Cates, USFWS, February 8, 1999). USFWS (1998b) has applied for a section 10 direct take research permit from NMFS to evaluate the biological and economic feasibility of restoring listed Upper Columbia River steelhead to Icicle Creek. Fish passage has been blocked by several instream structures used by Leavenworth NFH since 1940. Then in 1979, the hatchery ceased using the instream structures. Restoring passage in Icicle Creek above the hatchery would provide 21 miles of relatively pristine habitat for listed steelhead (USFWS 1998b). There is still some question whether or not steelhead could ascend a natural boulder falls/cascade three miles above the man-made instream structures. The habitat in the three mile section does not appear to have significant spawning areas. Therefore, USFWS (1998b) proposes to radio-tag up to 20 listed adult steelhead collected at Leavenworth fish ladder. The tagged adults will be released above the instream structures in Icicle Creek and their distribution, habitat use and spawning success will be evaluated. For details see USFWS (1998b).

The low number of listed steelhead collected during broodstock operations for spring chinook, summer chinook and fall chinook salmon at WDFW and USFWS facilities and the minimal holding and handling are not expected to adversely impact listed Upper Columbia River steelhead.

c. Genetic Introgression

There will be genetic effects on listed Upper Columbia River steelhead from releases of hatchery spring, summer, and fall chinook and coho in the Upper Columbia River Basin. Effects from the Wells Trout Hatchery steelhead releases are discussed in the biological opinion (NMFS 1998a) and in WDFW section 10 permit 1094 (Table 1).

3. Lower Columbia River Basin Steelhead

a. Broodstock Collection Outside the Lower Columbia River Basin

Other steelhead ESUs listed under the ESA in the Columbia River Basin are not likely to be affected, as Lower Columbia River steelhead are not known to stray above Bonneville Dam (NMFS 1999b). Two Mitchell Act facilities in the Lower Columbia River Basin have the potential to adversely affect listed Lower Columbia River steelhead through steelhead broodstock collection programs. Big Creek Hatchery in Oregon and Beaver Creek Hatchery in Washington, both have production programs that involve on-station release of juvenile steelhead and the resultant hatchery returns which serve as broodstock for future generations. Even though these hatcheries are located outside the Lower Columbia River ESU, their location downstream from the ESU increases the potential for listed steelhead to be trapped during broodstock collection operations. All NMFS steelhead releases are marked which allows hatchery adult steelhead to be identified from natural steelhead in the Lower Columbia River Basin. Therefore, all unmarked steelhead are immediately released, and thus, hatchery operations outside the Lower Columbia River Basin are not expected to adversely impact Lower Columbia River steelhead ESUs.

b. Broodstock Collection Within the Lower Columbia River Basin

<u>Cowlitz Salmon Hatchery and Lewis River Hatchery</u>

WDFW salmon production at the Cowlitz Salmon Hatchery on the Cowlitz River and at the Lewis River and Speelyai Hatcheries on the Lewis River has the potential to adversely effect listed Lower Columbia River steelhead through broodstock collection operations. The operation of hatchery traps in both the Cowlitz and Lewis Rivers have the potential to handle both lower Columbia River listed steelhead as well as up-river listed steelhead that stray into the basins. The Cowlitz Salmon Hatchery trap handled 16,160 summer and winter steelhead during the 1996-97 salmon broodstock collection operations. In that total were 203 unmarked winter steelhead. These unmarked fish may have been either wild steelhead, or hatchery steelhead that were released without removal of the adipose fin. One of these unmarked steelhead was recorded as a mortality, with the remaining 202 unmarked steelhead returned to the river. Trapping levels of naturally-produced adult steelhead populations are expected to continue to be low (WDFW 1997a).

The Lewis Salmon Hatchery trap handled 2,498 summer and 899 winter steelhead in 1996-97 during salmon broodstock collection operations. In addition 69 sea-run cutthroat were collected for broodstock at the Lewis Salmon Hatchery. Returns of unmarked fish indicated that a total of eight possibly naturally-produced winter run and eight naturally-produced summer run steelhead were captured incidental to broodstock collection operations (WDFW 1997a).

To ensure that those few wild steelhead that are handled during salmon broodstock collection operations are not adversely impacted, WDFW has taken a number of actions to minimize the potential adverse effects. These actions include spawning protocols at the Cowlitz and Lewis River salmon complexes that call for minimal holding, handling and careful release of any wild steelhead encountered incidentally. Traps at the two complexes are continuously monitored, ensuring that the duration of time that steelhead are retained is minimal. The NMFS has determined based on the above analysis that the broodstock collection operations of the Cowlitz Salmon and Lewis River hatcheries will not significantly impact listed steelhead populations.

Cowlitz Trout Hatchery and Merwin Fish Hatchery

Adult winter steelhead originating from Cowlitz Trout Hatchery releases migrate into the freshwater from late October through May, with a peak in December and January. Early maturing fish (spawning in December and January) have historically been selected for use as the hatchery steelhead broodstock. Wild-origin, naturally-produced winter steelhead are considered a late run population in the Cowlitz River, returning to the river between December and May, with peak spawning occurring in April and May (WDFW 1997a). Hatchery summer steelhead are recovered in the Cowlitz from May through December. Summer steelhead are collected as broodstock in summer and fall, and spawned at the hatchery from December through January. Sea-run cutthroat enter the river from July through October, with broodstock collected at the hatchery from August through January (WDFW 1997a). The Cowlitz wild winter steelhead migration overlaps with the time periods when hatchery winter and summer steelhead broodstock are collected at the Cowlitz Trout Hatchery trap. Listed steelhead straying from Columbia River mainstem river migration and up-river tributary spawning areas also have the potential to be encountered at the hatchery trap during steelhead broodstock collection (WDFW 1997a).

During the 1996-97, return year 5,517 summer and 9,820 winter-run hatchery steelhead were collected at the Cowlitz Trout Hatchery trap. All of these steelhead were of Cowlitz Trout Hatchery stock origin. WDFW staff also trapped 812 sea-run cutthroat this year. Hatchery records indicate that no wild summer or winter steelhead were captured incidental to hatchery steelhead and sea-run cutthroat broodstock collection operations. Assuming that all unmarked steelhead were naturally-produced, they accounted for only 0.64% (203 out of 31,700) of the total number of steelhead encountered during salmon and steelhead broodstock collection operations (WDFW 1997a).

Wild summer steelhead indigenous to the Lewis River system commence migration into freshwater in April and complete migration into the Lewis drainage by October (Busby et al. 1996). Early spawning winter steelhead have been selected for hatchery broodstock so that spawning time of hatchery fish precedes wild fish. Adult hatchery winter steelhead are collected and spawned from December through February. Naturally-produced Lewis River steelhead may be encountered during summer and winter steelhead broodstock collection at Merwin Hatchery, Merwin Dam and at the Lewis River Salmon Hatchery. Wild steelhead strays from other listed Columbia and Snake River basin populations may also potentially be taken incidentally in Merwin broodstock collection operations.

During the 1996-97 return year, 754 summer and 1,141 hatchery winter steelhead were handled at the Merwin Hatchery and Merwin Dam traps broodstock collection operations. Only a few wild steelhead are handled during the Lewis River salmon and steelhead broodstock collection operations. All the wild steelhead trapped were carefully passed upstream after capture and holding with no mortalities reported in 1996-97 (WDFW 1997a, 1997b).

Spawning protocols at the Cowlitz and Merwin hatcheries call for minimal holding, handling and careful release of any wild steelhead encountered incidentally in broodstock collection operations. Traps at the two complexes are continuously monitored, ensuring that the duration of time that steelhead are retained is minimal. The NMFS has determined based on the above analysis that the broodstock collection operations of the Cowlitz Trout and Merwin hatcheries will not significantly impact listed steelhead populations.

NMFS Mitchell Act Hatcheries

Of the Mitchell Act hatcheries in the Columbia River Basin, three have the potential to adversely affect listed Lower Columbia River steelhead through steelhead broodstock collection operations. Clackamas Hatchery, and Eagle Creek NFH in Oregon and Skamania Hatchery in Washington, all have production programs that involve the on-station release of juvenile steelhead and the resultant hatchery returns which serve as the broodstock for future generations. In the process of taking adult hatchery returns, returning listed steelhead also have the potential of being trapped. All NMFS hatchery steelhead releases are marked which allows hatchery adult steelhead to be identifiable from natural steelhead in the Lower Columbia River Basin. Therefore, all listed steelhead are immediately passed upstream.

The Kalama Falls Hatchery also has the potential of trapping listed steelhead adults during the process of collecting adult salmon at both the Mondrow Trap in the Lower Kalama River and at the hatchery trap that captures all returning adult salmonids. Listed steelhead are released at the Mondrow Trap and are passed above the barrier weir at the hatchery.

The remaining Mitchell Act hatcheries within the Lower Columbia River ESU have the potential to adversely effect listed Lower Columbia River steelhead through salmon broodstock collection operations. These facilities include Carson NFH, North Fork Toutle River, Lewis River, and Washougal hatcheries in Washington, and Bonneville, Cascade and Oxbow hatcheries in Oregon. The occurrence of trapping wild steelhead varies from facility to facility, but the frequency is very low. Any trapped steelhead are returned to the river immediately. The NMFS has determined the broodstock collection operations at Mitchell Act hatcheries will not significantly impact listed steelhead populations.

c. Genetic Introgression

Oak Springs Hatchery and Sandy River Hatchery

Currently Skamania stock summer steelhead are reared at Oak Springs Hatchery and directly released into the Sandy River as well as being acclimated and released from the Sandy Hatchery. The last year summer steelhead were released into the upper tributaries of the Sandy River was 1998. Starting in 1999, all summer steelhead releases will occur below Marmot Dam. Chilcote (1997) in an analysis of Clackamas River winter steelhead found that the introduction of non-native summer steelhead may have caused a 27% reduction in the productivity of the naturally-produced winter steelhead population, and postulates that similar impacts may have occurred with Sandy River winter steelhead. The current program calls for the release of non-native hatchery summer steelhead smolts below Marmot Dam. Adult hatchery returns are then trapped and removed at a fish trap at Marmot Dam.

The current trapping facility at Marmot Dam needs to be evaluated for potential impacts to listed steelhead, and other salmonids passing the facility. In the future the trapping facility could be used to develop hatchery broodstocks using naturally-produced summer steelhead from the Sandy River similar to the program for late winter steelhead on the Clackamas River. The potential is also there for developing a hatchery broodstock from naturally-produced winter steelhead from the Sandy River. In addition to these releases in the Sandy River, Oak Springs Hatchery rears and releases Skamania derived summer steelhead below Powerdale Dam to support local fisheries. Currently, no Skamania summer steelhead will be passed above the trap at Powerdale Dam.

Both of these programs can adversely effect listed Lower Columbia River steelhead, either through introgression into the broodstock or from spawning with naturally-produced adults below the traps. To prevent introgression into the natural spawning areas above the traps hatchery summer steelhead are removed and recycled at Marmot Dam and Powerdale Dam on the Sandy and Hood rivers respectively. The sorting and removal of adults hatchery steelhead at these traps will require the handling of all steelhead destined for above the traps. Potential adverse effects from the trapping include, delay in and below, avoidance of ladder, and direct and delayed mortality due to handling. The level of these potential adverse effects will depend on the number of fished handled, the number of fish present, and other environmental factors such as flow and water temperature. The ODFW has not estimated the level of incidental take associated with the operation of the traps.

Cowlitz Trout Hatchery and Merwin Fish Hatchery

Genetic introgression by hatchery steelhead may be a factor affecting wild steelhead health in the Lower Columbia River ESU, although the precise level of incidental take of listed steelhead in the region that may result is unknown. Phelps et al. (1997) reported apparent gene flow from hatchery steelhead through electrophoretic analysis of wild stocks from a tributary to the Cowlitz River and the North Fork Lewis River. In contrast, wild steelhead from the East Fork Lewis were found to have little indication of hatchery gene flow. They concluded from the analysis of allelic characteristics that some Lower Columbia Region wild populations have had sufficient isolation from hatchery steelhead, but others exhibited allelic profiles indication hatchery introgression (Phelps et al. 1997). WDFW (1997a) concludes that the hatchery steelhead planted through the Cowlitz and Merwin programs can be genetically different than the indigenous wild fish and there is a potential for interbreeding between the hatchery and wild fish.

Differing spawning times between hatchery and wild steelhead within and between summer and winter races in the Lower Columbia Region complicate assessment of genetic risks to wild stocks that may result from hybridization with hatchery steelhead. Wild summer steelhead are more vulnerable to interbreeding with hatchery summer and hatchery winter steelhead because of their more variable spawning times that are temporally similar to hatchery stocks. Interbreeding between wild winter steelhead and hatchery steelhead is less likely because wild steelhead spawn later and their spawning time is temporally separated from hatchery stocks to a significant degree (WDFW 1997a). The conclusion that there is little overlap in spawning between wild and hatchery stocks of winter steelhead within the Lower Columbia ESU is generally supported by available evidence (Busby et al. 1996). However this evidence is largely based on models and assumptions regarding run timing rather than empirical data (Busby et al. 1996).

Table 8 may be misleading as an indicator of interbreeding between hatchery and naturally adult steelhead. Impacts through interbreeding may be reduced as a result of a short survival span for returning hatchery adults. Radio-tagging data for hatchery adult Cowlitz winter steelhead captured, released and tracked in the Cowlitz suggests that the duration of freshwater life for hatchery winter steelhead is short - generally less than a month (WDFW 1998). If this relatively short life span shown for captured and released hatchery fish applies for all returning hatchery winter steelhead, the duration of interaction between straying hatchery steelhead and later-returning wild steelhead in spawning areas would be lower than previously assumed. The short hatchery fish life span would suggest further temporal separation between hatchery winter steelhead and wild steelhead in freshwater, further minimizing the risk of hatchery/wild fish interbreeding (WDFW 1998).

To reduce the number of hatchery steelhead that could potentially interbreed with listed steelhead WDFW uses a wild steelhead management strategy calling for the removal of returning hatchery steelhead from tributaries through fisheries harvest and/or trapping programs. Hatchery steelhead captured in hatchery or dam traps have been recycled downstream, for re-exposure to and continued harvest within intercepting fisheries. WDFW studies on the Cowlitz River have shown that winter steelhead that are recycled through fisheries are harvested at rates from 12% to 24.2% of the total number of adults returned to the river (Tipping 1980, 1994 in WDFW 1998). Hatchery fish captured in traps are also culled to prevent spawning with wild fish. In the future, WDFW proposes to recycle surplus hatchery steelhead captured at Merwin Dam, Washougal Hatchery, and the Cowlitz hatcheries into lakes to improve sport fishing opportunity and to reduce the risk of interbreeding with wild fish (WDFW 1998).

WDFW's current management approach to reduce the risk of hatchery introgression on wild fish in the Lower Columbia River Region employs three strategies, designed to separate hatchery and wild steelhead spatially and temporally in the Lower Columbia Region rivers (WDFW 1997a, 1997b):

1. Maintain earlier spawn time of hatchery fish so that most fish will have completed spawning prior to wild fish.

2. Acclimate and release hatchery steelhead smolts in lower river reaches where possible, where few wild fish spawn and to which returning adults would be expected to home and have a tendency to hold prior to migrating upstream for spawning.
3. Remove hatchery fish at sufficiently high harvest and/or trapping rates so that minimal number remain to potentially spawn with wild fish.

Table 8. Recent year average estimated proportions of hatchery fish of total escapements, and of escapements observed during wild steelhead spawning periods (WDFW 1998).

Watershed	Race	Year span	Average % Hatchery Fish in Total Escapement	Average % Hatchery Fish during Wild Fish Spawning Period
Coweeman River	Winter	1987-95	52%	22%
SF Toutle River	Winter*	1984-95	36%	15%
Green (Toutle) River	Winter*	1991-95	52%**	15%**
NF Toutle River	Winter	1991-97	0%	0%
EF Lewis River	Winter	1986-95	51%	21%
EF Lewis River	Summer	1996-98	67%	23%

* Hatchery fish are summer steelhead.
** Percent hatchery spawners assumed to be the same as observed in the Toutle River for the 1991-1995 time span.

Other strategies that WDFW has on-going to reduce the risk of hatchery introgression include:

1. The evaluation of the use of native Kalama River winter and summer steelhead as hatchery broodstocks with the intent to supplant non-indigenous stocks now used for fisheries enhancement.

2. Recent modification of the fish passage barrier at Kalama Falls, excluding the majority of hatchery-produced fish from up-river wild steelhead spawning areas.

3. Exclusion of hatchery steelhead from up-river wild steelhead productions are through removal of hatchery fish at trapping sites on Cedar Creek (tributary to the N.F. Lewis River), Trout Creek (Wind River tributary), and the Green River (at the North Toutle Fish Collection Facility).

4. Direct releases of hatchery steelhead from acclimation sites located in small tributaries and from major hatcheries with off channel fishways to draw returning adults away from natural steelhead production areas in river mainstems.

5. Collection of volitionally-migrating steelhead produced at Merwin Hatchery for truck-planting downstream of the city of Woodland, to promote homing of returning hatchery fish to the lower area where fish are not likely to spawn. This strategy also reduces the risk of predation on wild steelhead that generally rear in up-river areas (WDFW 1998).

In addition to the above strategies WDFW will continue the mass-marking of all hatchery steelhead and cutthroat trout populations released into anadromous waters to allow for monitoring of hatchery fish migration, fisheries contribution, and survival, and to allow for ready differentiation between hatchery and wild fish (WDFW 1997a).

The NMFS is concerned with the overlap in spawning time between hatchery and natural summer steelhead in the Lewis River, that can contribute to introgression. WDFW needs to evaluate this risk and adjust the current hatchery programs. Adjustments that have been proposed include the evaluation of Kalama River natural summer steelhead for purposes of replacing the current hatchery summer steelhead in the Cowlitz and Lewis rivers, and to evaluate the possibility of developing a summer steelhead program that incorporates natural summer steelhead into the broodstock (converting the current program into a supplementation program). These two actions could reduce the risk of genetic introgression of hatchery summer steelhead into the natural population.

<u>NMFS Mitchell Act Hatcheries</u>

Eagle Creek NFH, Bonneville, Clackamas, and Big Creek hatcheries in Oregon, and Grays River, Beaver Creek (including Coweeman and Gobar Ponds), North Toutle, and Skamania hatcheries in Washington ,all release hatchery steelhead into Lower Columbia River tributaries that have populations of wild steelhead. NMFS has adopted management approaches to reduce the risk of hatchery introgression on wild fish. The first involves the manipulation of spawning times to provide a temporal separation between spawning listed and hatchery steelhead. The second involves the acclimation and release of hatchery steelhead smolts in lower river reaches where possible, to encourage the returning hatchery steelhead to home on these areas instead of returning to the spawning and rearing habitat of the listed steelhead. The third is an effort to remove hatchery fish through high harvest rates and at barriers or traps, such that as few as possible remain to potentially spawn with listed steelhead. The external marking of all hatchery steelhead for the visual separation of natural and hatchery produced fish is required for the removal of hatchery fish through harvest and trapping. Another option that NMFS supports is the development of hatchery programs based on locally-adapted hatchery broodstocks, that if allowed to spawn with naturally-produced fish will not adversely effect the genetic integrity of the listed steelhead. This option is complementary to the above management approaches.

D. Summary of Effects

For all the listed salmon and steelhead, quantitative information on the level of impact to the listed salmon and steelhead from hatchery actions is not available. Consequently, NMFS used a qualitative analysis and its best scientific judgement to determine the risk proposed hatchery actions pose to threatened and endangered salmon in the action area.

1. Snake River Fall Chinook Salmon

Straying of Klickitat Hatchery fall chinook salmon into the Snake River above Lower Granite Dam is expected to be significantly reduced from levels that occurred in the early 1990's by tagging 100% of the fall chinook released into the Klickitat River. The releases of Klickitat fall chinook may not exceed 5% of any naturally-produced salmon or steelhead population. If the 100% tagging strategy does not reduce the proportion of Klickitat Hatchery fall chinook strays above Lower Granite Dam, NMFS Mitchell Act program should investigate other alternatives to be in compliance with NMFS stray fish policy. The Umatilla Hatchery fall chinook stray rates have been significantly reduced by actions taken since 1996. The incidental take of listed Snake River fall chinook salmon adults for hatchery broodstock is very small and is not expected to adversely affect listed Snake River fall chinook. Total juvenile releases from Columbia River Basin hatcheries in 1999 are less than the production ceiling recommended in the Proposed Recovery Plan (NMFS 1995c).

NMFS is also concerned that the "early run" fall chinook program could potentially interbreed with natural fall chinook in the lower Clearwater River if they do not imprint and return to the South Fork Clearwater and the Selway rivers. A risk/benefit analysis will be conducted on the listed fall chinook population in the lower Clearwater River to determine the impacts from the "early run" fall chinook program in the South Fork Clearwater and Selway rivers before any fish are released.

The hatchery actions described above are expected to improve survival of Snake River fall chinook salmon relative to the environmental baseline.

2. Snake River Spring/Summer Chinook Salmon

Proposed hatchery actions should minimize impacts on juvenile Snake River spring/summer chinook salmon because the number of hatchery steelhead and spring/summer chinook salmon released into the spawning/nursery areas has been reduced. The majority of hatchery juvenile releases are now downstream of the primary spawning/nursery areas. Total juvenile releases from Columbia River Basin hatcheries in 1999 are less than the production ceiling recommended in the Proposed Recovery Plan (NMFS 1995c).

The incidental take of listed Snake River spring/summer chinook salmon adults for hatchery broodstock should be minimal because all hatchery smolts that return as adults to the Snake River Basin will be identifiable (marked). The only hatchery spring chinook adults not 100% marked are from the eggs/fry and parr releases made into the Clearwater River Basin from the Nez Perce Tribal Hatchery.

The hatchery actions described above are expected to improve survival of Snake River spring/summer chinook salmon relative to the environmental baseline.

3. Snake River Sockeye Salmon

Snake River sockeye salmon are not affected by hatchery actions in the egg to smolt period of development (when the majority of juvenile mortality occurs). In addition, Snake River sockeye salmon adults are unlikely to be collected for hatchery broodstock in the actions assessed in this Opinion. As sockeye salmon smolts migrate out of Redfish Lake from late April through May, they begin to be affected by hatchery programs as they migrate downstream. The majority of hatchery steelhead and spring/summer chinook salmon will have already migrated out of the Upper Salmon

River by May, which should minimize potential adverse impacts. Adverse effects will primarily occur in the migration corridor and will include predation, competition, and disease. The smallest Snake River sockeye salmon smolts are believed to be potential prey for the largest hatchery steelhead. However, as Snake River sockeye salmon generally migrate later than hatchery fish, the adverse effects from predation, competition, and disease are believed to be relatively small.

4. Snake River Summer Steelhead

The proposed artificial propagation actions are expected to adversely effect listed Snake River summer steelhead. The release of hatchery steelhead into natural production areas are expected to result in predation and competition with the listed steelhead juveniles. The incidental take of listed Snake River summer steelhead adults for hatchery broodstock is expected to minimal because all hatchery adults returning to the Snake River Basin are marked, thus allowing identification. Any unmarked steelhead would be released immediately back into the water. A few listed steelhead may be collected outside the Snake River Basin, based on the level of straying of the Snake River Basin hatchery steelhead, specifically the Wallowa and Irrigon stocks. This is assuming that the listed steelhead have the same likelihood to stray as the two hatchery stocks. NMFS believes that the two hatchery stocks, which are a composite broodstock, do not reflect typical behavior of listed steelhead in the Snake River Basin.

The biggest potential impact from artificial propagation programs on Snake River summer steelhead is the continued use of non-endemic steelhead stocks in the Snake River Basin. Non-endemic stocks have the potential to impact listed summer steelhead through genetic introgression. NMFS current stray fish policy states that straying of non-native hatchery fish may not exceed 5% of any naturally-produced salmon or steelhead population.

The hatchery actions described above are expected to decrease survival of Snake River summer steelhead relative to the environmental baseline.

5. Upper Columbia River Summer Steelhead

Proposed hatchery actions should minimize impacts on juvenile Upper Columbia River summer steelhead because the number of hatchery salmon released into the spawning/nursery areas has been reduced. Total juvenile releases from Columbia River Basin hatcheries in 1999 are less than the production ceiling recommended in the Proposed Recovery Plan (NMFS 1995c).

Interactions (competition, predation, disease transfer) between hatchery salmon and listed Upper Columbia River steelhead would likely occur in the juvenile rearing and outmigration where hatchery fish are released. The low number of listed steelhead collected during broodstock operations for spring chinook, summer chinook and fall chinook salmon at WDFW and USFWS facilities in the Upper Columbia River Basin and the minimal holding and handling is not expected to have adverse impacts to listed Upper Columbia River steelhead.

The hatchery actions described above are expected to improve survival of Upper Columbia River summer steelhead relative to the environmental baseline.

6. Lower Columbia River Steelhead

The proposed actions are expected to adversely effect listed Lower Columbia River steelhead. The release of hatchery steelhead into natural production areas are expected to result in predation and competition with the listed steelhead juveniles. The incidental take of listed Lower Columbia River steelhead adults for hatchery broodstock is expected to minimal because all hatchery adults returning to the Lower Columbia River Basin are marked, thus allowing identification. All unmarked steelhead would be released immediately back into the water. NMFS does not expect listed steelhead to be collected outside the Lower Columbia River Basin because not many marked hatchery steelhead stray above Bonneville Dam.

The greatest potential impact to Lower Columbia River steelhead is the continued use of non-endemic steelhead stocks in the Lower Columbia River Basin. Non-endemic stocks have the potential to impact listed steelhead through genetic introgression. NMFS current stray fish policy states that straying of non-native hatchery fish may not exceed 5% of any naturally-produced salmon or steelhead population.

The hatchery actions described above are expected to decrease survival of Lower Columbia River steelhead relative to the environmental baseline.

E. Consistency of Proposed Action with Proposed Snake River Salmon Recovery Plan

Chapter V, Section 4, of the NMFS Proposed Recovery Plan lists the proposed Artificial Propagation Recovery Tasks which NMFS deems necessary for the recovery of listed Snake River salmon. The actions proposed by the action agencies for 1999 are consistent with the recovery tasks found in the Proposed Recovery plan and the 1999 releases are consistent with the proposed production ceiling for the Columbia and Snake rivers.

There are two actions that are not consistent with the Proposed Recovery Plan. One is IDFG's proposed release of resident trout into spring/summer chinook, sockeye and steelhead primary spawning and rearing areas. The Proposed Recovery Plan recommends termination in those areas and reprogramming to other areas. The second action is the release and return of non-native hatchery fish on listed salmon and steelhead spawning grounds. NMFS interim standard states that the aggregate of non-native hatchery strays shall not exceed 5% of any listed salmon or steelhead population. NMFS determined that these provisions (as currently defined in the proposed Recovery Plan and subject to revision in the final recovery plan), are critical to meet the biological requirements of the species.

VI. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they will require separate consultation pursuant to section 7 of the ESA. For the purposes of this analysis, the action area encompasses the tributary spawning and rearing habitats, Snake and Columbia rivers, Columbia River estuary, and ocean environment. Future State, tribal, local, or private actions that may affect threatened or endangered salmonids in the action area would require authorization under section 10 of the ESA and would, therefore, also be evaluated under section 7 consultations (Table 1). Therefore, these actions are not considered cumulative to the proposed action.

VII. CONCLUSIONS

NMFS' general approach to determining whether a proposed action is likely to jeopardize the continued existence of listed salmon and steelhead or destroy or adversely modify designated critical habitat is discussed in Appendix B. NMFS then takes the risk assessment, the consistency of the proposed action with the Proposed Recovery Plan for Snake River salmon and the likelihood of survival and recovery under the environmental baseline to make its jeopardy determination.

After reviewing the current status of listed Snake River sockeye salmon, Snake River spring/summer chinook salmon, and Snake River fall chinook salmon, the environmental baseline for the action area, the effects of the proposed artificial propagation programs in the Columbia River Basin, and cumulative effects, it is NMFS' biological opinion that the proposed artificial propagation programs in the Columbia River Basin are not likely to jeopardize the continued existence of listed Snake River sockeye salmon, Snake River spring/summer chinook salmon, and Snake River fall chinook salmon.

After reviewing the current status of steelhead ESU's (Snake River, Upper Columbia and Lower Columbia River), the environmental baseline for the action area, the effects of the proposed artificial propagation programs in the Columbia River Basin, and cumulative effects, it is NMFS' biological opinion that the proposed artificial propagation programs in the Columbia River Basin are not likely to jeopardize the continued existence of listed Upper Columbia River steelhead. However, based on the same considerations, it is NMFS' biological opinion that the proposed artificial propagation programs in the Columbia River are likely jeopardize the continued existence of listed Snake River steelhead and Lower Columbia River steelhead.

VIII. REASONABLE AND PRUDENT ALTERNATIVES

Regulations (50 CFR §402.02) implementing section 7 of the Act define reasonable and prudent alternatives as alternative actions, identified during formal consultation, that: (1) can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; (3) are economically and technologically feasible; and (4) would, NMFS believes, avoid the likelihood of jeopardizing the continued existence of listed salmon and steelhead or result in the destruction or adverse modification of critical habitat.

The reasonable and prudent alternatives contained in this Opinion identify actions that will remove jeopardy on listed Snake River and Lower Columbia River steelhead ESU's from the proposed actions. The actions remove jeopardy on the listed steelhead by: 1) immediately reducing numbers and restricting release locations of non-endemic steelhead stocks; 2) transitioning to locally-adapted stocks while phasing-out the non-endemic stock, and eventually eliminating the use of the non-endemic stock entirely. These reasonable and prudent alternatives consist of the following changes from the proposed action:

1. The action agencies shall restrict the use of non-endemic hatchery steelhead and begin planning the transition to locally-adapted stocks.

   a. Grande Ronde River Basin, Snake River:

      Beginning immediately the Wallowa stock steelhead program shall be modified to reduce straying and genetic introgression problems in the Grande Ronde River Basin and Deschutes River Basin. The USFWS shall:

      1) Develop a Hatchery and Genetic Management Plan (HGMP) for summer steelhead in the Grande Ronde River Basin by December 15, 1999. A suggested outline for the HGMP is provided in Appendix C. The HGMP shall address the transition to endemic steelhead stocks in the lower Grande Ronde, upper Grande Ronde and Lostine/Wallowa, and phasing-out the Wallowa stock summer steelhead program.

      1) Terminate all direct stream releases (Catherine Creek, Wildcat Creek and Upper Grande Ronde) and reprogram the releases to areas below hatchery racks beginning in 1999.

      2) Reduce Grande Ronde Basin releases of Wallowa stock steelhead by approximately 33% in the year 2000. This will result in a total reduction of approximately 544,500 Wallowa stock steelhead smolts and result in a release of 1.1 million smolts.

      3) Eliminate direct stream releases of Wallowa Hatchery stock steelhead in Catherine Creek (62,500 smolts), Wildcat Creek (50,000 smolts) and Upper Grande Ronde (200,000 smolts) by the year 2000.

      4) Reduce Wallowa stock steelhead releases by approximately 66% in the Grande Ronde River Basin by 2005; and phase-out the Wallowa steelhead stock entirely by 2008. Beginning in 2005, Wallowa stock releases would be limited to approximately 560,000 smolts.

      5) Manage the Minam River, Wenaha River and Joseph Creek as wild stock control areas and assess the need for hatchery intervention to prevent extinction.

   b. Tucannon River, Snake River Basin:

Beginning immediately the Lyons Ferry Hatchery summer steelhead stock shall be modified to reduce genetic introgression in the Tucannon River. The USFWS shall:

1) Develop a HGMP using locally-adapted summer steelhead for use in the Tucannon River by June 15, 2000. The USFWS shall phase-out the release of Lyons Ferry Hatchery summer steelhead as locally-adapted steelhead become available.

2) Restrict releases of Lyons Ferry Hatchery summer steelhead stock to the Lower Tucannon River beginning in 1999 and continuing until the HGMP is implemented.

3) Determine the origin of existing naturally spawning steelhead in Tucannon River. If the existing naturally spawning steelhead is within the Snake River summer steelhead ESU, begin phasing in the new broodstock.

c. Lower Salmon River, Snake River Basin:

Beginning immediately the Oxbow stock steelhead program shall be modified to reduce genetic introgression in the Lower Salmon River. The IDFG shall:

1) Develop a HGMP for summer steelhead in the Lower Salmon River. The HGMP shall address the transition to locally-adapted steelhead stocks in the Lower Salmon River, and phasing-out the non-endemic Oxbow stock steelhead program

2) Terminate Oxbow stock steelhead releases in all areas except the Little Salmon River by the year 2000.

3) Develop a time line for transitioning to a locally-adapted broodstock in the HGMP and phasing-out the Oxbow stock entirely.

d. Salmon Creek, Lower Columbia River Basin:

Beginning immediately the Skamania stock winter steelhead program shall be modified to reduce genetic introgression in Salmon Creek. The NMFS and WDFW shall:

1) Develop a HGMP for Salmon Creek by June 15, 1999. The HGMP shall address the transition to a locally-adapted winter steelhead stock and phasing-out the non-endemic Skamania (Beaver Creek) stock winter steelhead program.

2) Restrict releases of Skamania (Beaver Creek) stock winter steelhead in Salmon Creek to below the Highway 99 Bridge beginning in 1999. Complete design

and installation of fish ladder and trap at the Highway 99 Bridge in 1999.

3) Determine the origin of existing naturally spawning steelhead in Salmon Creek. If the existing naturally spawning steelhead is within the Lower Columbia River steelhead ESU, begin phasing in the new broodstock.

e. Lower Clackamas River, Lower Columbia River Basin:

Beginning immediately the Big Creek winter steelhead program shall be modified to reduce genetic introgression in the Lower Clackamas River. The NMFS, USFWS and ODFW shall:

1) Develop a HGMP for the winter steelhead in the Lower Clackamas River by September 15, 2000. The HGMP shall address the transition to a locally-adapted winter steelhead stock in the Lower Clackamas River, and phasing-out the non-endemic Big Creek stock winter steelhead program.

2) Restrict releases of Big Creek stock to the Lower Clackamas River below River Mill Dam beginning in 1999 and continuing until the HGMP is implemented.

3) Determine the origin of existing naturally spawning steelhead in the Lower Clackamas River. If the existing naturally spawning steelhead is within the Lower Columbia River steelhead ESU, begin phasing in the new broodstock.

f. Sandy River, Lower Columbia River Basin:

Beginning immediately the Big Creek winter steelhead program shall be modified to reduce genetic introgression in the Sandy River. The NMFS shall:

1) Develop a HGMP for the winter steelhead in the Sandy River by December 15, 1999. The HGMP shall address the transition to a locally-adapted winter steelhead stock in the Sandy River, and phasing-out the non-endemic Big Creek stock winter steelhead program .

2) Restrict releases of Big Creek stock winter steelhead in the Sandy River below Marmot Dam beginning in 1999 and continuing until the HGMP is implemented.

3) Determine the origin of existing naturally spawning steelhead in the Sandy River. If the existing naturally spawning steelhead is within the Lower Columbia River steelhead ESU, begin phasing in the new broodstock.

2. NMFS shall terminate releases of Skamania stock summer steelhead into the Wind River. The Skamania stock summer steelhead is not endemic to the Wind River.

3. All action agencies shall manage adult hatchery stray rates to the lowest level achievable. For non-indigenous salmon and steelhead, stray rates shall not exceed 5% of the annual natural population size in the receiving stream. For within ESU-origin stocks outplanted for fishery augmentation/mitigation programs steelhead stray rates shall be managed between 5-30% of the annual natural population

4. All action agencies shall restrict the size at release of hatchery steelhead to minimize predation and competition with listed salmon and steelhead. The action agencies shall release hatchery steelhead that range in total length from 180 mm to 250 mm, with a target size of 220 mm total length. This will minimize predation and competition with listed salmon. Recent research (Rhine et al. 1997, Bigelow 1997) indicates steelhead smaller than 180 mm are more prone to residualize, while larger smolts (< 250 mm) appear to outmigrate better. In addition, steelhead greater than 250 mm may be more capable of predation on chinook salmon juveniles (Cannamela 1993).

Because this Opinion has found jeopardy, the action agencies are required to notify the NMFS of its final decision on the implementation of the reasonable and prudent alternatives.

IX. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or develop information. NMFS believes the following conservation recommendations are consistent with these obligations, and therefore should be implemented.

A. All Action Agencies (BIA, BPA, NMFS, USACE, USFWS, IDFG, ODFW, and WDFW).

1. The action agencies should minimize inter-basin stock transfers in any waters that support listed fish.

2. The action agencies should operate artificial propagation programs for fishery augmentation/mitigation in the Columbia River Basin in a manner that emphasizes the production and release of juveniles that are ready to migrate to the ocean and spend a minimum amount of time in the fresh water environment. This should minimize interactions with, and thus impacts to listed salmon and steelhead, and unlisted natural fish in the migration corridor.

3. The action agencies should adopt measures to improve homing and reduce straying of all hatchery fish releases.

4. Action agencies should evaluate the use of NATURES type rearing designs and strategies, to

increase survival and minimize impacts to listed salmon and steelhead.

5. The use of acclimation ponds and volitional release strategies should be considered to reduce potential straying and minimize potential competition between hatchery fish and listed salmon and steelhead.

6. All action agencies should consider monitoring and evaluating ecological interactions between listed salmon and steelhead and hatchery releases in nursery and rearing areas. Evaluating the affects of hatchery fish is prudent because density dependent effects may occur even when the streams' estimated carrying capacity is not limited.

7. The action agencies should support studies designed to assess carrying capacity and density-dependent effects on listed salmon and steelhead in the migration corridor.

8. The action agencies should consider monitoring and evaluating predation by residualized hatchery steelhead in the Columbia River Basin. Alternative methods/schemes to reduce steelhead residualism should be explored to minimize impacts to listed salmon and steelhead.

9. Spawning ground carcass surveys should be conducted to determine the composition of listed and hatchery fish on the spawning grounds of listed salmon and steelhead.

10. Action agencies should consider using excess hatchery adult returns for instream carcass distribution to increase nutrients, where necessary in the freshwater environment.

11. The action agencies should use the most appropriate broodstock for re-introduction of salmon and steelhead into historical or vacant habitat. Broodstock selection should be coordinated through the *U.S. v OR* process.

12. The action agencies should implement a program to develop a cost-effective externally distinguishable mark(s), which can be applied to all hatchery fish released into the Columbia River Basin. This would allow the discrimination between hatchery fish and those of wild/natural origin, including listed salmon and steelhead. This should assist the action agencies in minimizing adverse effects and assist NMFS in evaluating the effects of hatchery programs on listed salmon and steelhead and unlisted natural fish.

13. When hatchery programs are located in an area where wild fish are listed, the hatchery program should be modified to adopt a conservation role along with an enhancement role.

14. Action agencies should adopt management strategies to separate returning hatchery fish from listed naturally spawning fish including, but not limited to, releasing hatchery fish outside primary spawning and rearing areas and dead-ending returns at weirs.

B. Specific Agency Conservation Recommendations

1. BIA

Clearwater River Coho Restoration

a. The BIA, USFWS, and appropriate co-managers should consider the effects of all the current and proposed hatchery programs in the Clearwater River Basin on species not listed under the ESA. A comprehensive and coordinated management plan for all species in the Clearwater River Basin should be developed by all appropriate co-managers to protect, mitigate and enhance fish and wildlife resources.

b. The BIA should consider using temporary acclimation ponds for future coho smolt releases. Extended acclimation rearing should be beneficial to getting adult coho salmon to return.

c. The BIA should design future coho salmon releases to allow determination of the most efficient and effective strategies for the restoration of coho into the Clearwater River Basin. Marking techniques (internal and external) should be developed to differentially mark each type of release in order to determine origin of adult returns from overlapping brood years. Development of future coho salmon programs in the Clearwater River Basin would benefit by incorporating a proper experimental design.

2. BPA

a. The BPA and WDFW should develop a HGMP for the Cowlitz Falls Restoration Program that take listed Lower Columbia River steelhead for broodstock.

b. The BPA and ODFW should develop a HGMP for the Hood River summer steelhead programs that take listed Lower Columbia River steelhead.

Nez Perce Tribal Hatchery

a. The proposed "early run" fall chinook production in the South Fork Clearwater and Selway rivers should be given a lower implementation priority and phased in slowly, assuming the risk/benefit analysis demonstrates a benefit to the listed fall chinook population. The NMFS believes that this is prudent because it appears that these areas are outside the normal range of Snake River fall chinook (Waples et al. 1991) and only anecdotal information is available that suggests fall chinook historically inhabitated those areas.

b. The BPA should consider using temporary acclimation ponds at the Luke's Gulch and Cedar Flats sites until it can be demonstrated that "early run" fall chinook will return to those sites. Extended acclimation rearing and imprinting using chemicals should be beneficial to getting adult fall chinook to return to the Luke's Gulch and Cedar Flat, but it is no guarantee that any or all the fish will return.

c. The BPA should fund the monitoring and evaluation program to full implementation or Level III. This would include all 83 performance variables to address the high-risk critical uncertainties within an ecosystem management framework.

Umatilla Hatchery

a. The BPA should continue the implementation of the Umatilla Hatchery Master Plan for summer steelhead (150,000 yearling smolts). BPA should continue to use adaptive management and implement results from the monitoring and evaluation program.

3. NMFS

a. NMFS should consider the termination of non-endemic steelhead releases into Abernathy Creek, Coal Creek, Germany Creek, Mill Creek, and Skamokawa River in the state of Washington. If stocking will continue, NMFS should determine the origin of existing naturally spawning steelhead in the creeks and river above. If an appropriate locally-adapted steelhead stock exists, NMFS should develop a HGMP for the transition to the locally-adapted stock.

b. NMFS should consider the termination of non-endemic steelhead releases into Big Creek and Clatskanine Creek in the state of Oregon. If stocking will continue, NMFS should determine the origin of existing naturally spawning steelhead in the creeks above. If an appropriate locally-adapted steelhead stock exists, NMFS should develop a HGMP for the transition to the locally-adapted stock.

c. The NMFS and WDFW should develop a HGMP using locally-adapted summer and winter steelhead for use in the Kalama River. NMFS and WDFW should phase-out the non-endemic winter and summer steelhead stocks as locally-adapted steelhead become available.

d. The NMFS should develop a HGMP using locally-adapted summer steelhead for use in the Klickitat River. The NMFS should phase-out the release of Skamania Hatchery summer steelhead as locally-adapted steelhead become available. NMFS should mark all hatchery steelhead populations released into anadromous waters to allow for monitoring of hatchery fish migration, fisheries contribution, and survival, and to distinguish between hatchery and wild fish.

4. USFWS

a. The USFWS should develop a HGMP for the Imnaha River summer steelhead program. The HGMP should address the current summer steelhead program in Little Sheep Creek and investigate expanding the program into the Big Sheep drainage. The HGMP should list areas that should be managed as wild fish controls.

b. USFWS should investigate the feasibility of transitioning to locally-derived A-run steelhead broodstocks for use in the Salmon River. A HGMP should be developed to address the transition.

c. The USFWS and IDFG should develop a HGMP using locally-adapted B-run summer steelhead in the Salmon River. The USFWS and IDFG should phase-out the release of Dworshak B-run summer steelhead as locally-adapted summer steelhead become available.

d. USFWS should maintain the Dworshak NFH summer steelhead population in the Lower Clearwater River to preserve the genetic resource from the North Fork Clearwater River.

e. USFWS should develop a HGMP for the South Fork Clearwater River and Middle Fork summer steelhead B-run program. USFWS should continue to supplement the South Fork Clearwater River with Dworshak summer steelhead B-run using later spawning steelhead and investigate other locations. The fish should be differentially marked to identify hatchery fish from natural fish. USFWS should investigate a two year rearing program at Clearwater Fish Hatchery. USFWS should determine the feasibility of developing a locally-adapted broodstock, and if possible transition to locally-adapted populations.

f. The USFWS should develop a HGMP using locally-adapted summer steelhead for use in the Walla Walla River. The USFWS should phase-out the release of Lyons Ferry Hatchery summer steelhead as locally-adapted steelhead become available. The USFWS shall assess the need for and potential reduction of 300,000 yearling summer steelhead smolts to achieve the adult return goal.

g. The USFWS should continue adaptive management changes to improve smolt quality to reduce residualism and enhance returns to fisheries.

h. The USFWS should continue to coordinate hatchery programs and fishing regulations to target fisheries on hatchery surpluses, reduce impacts to wild, listed fish and reduce straying of hatchery fish into natural spawning areas.

5. IDFG Non-Federally Funded Programs

a. The IDFG should continue the Oxbow Hatchery summer steelhead program in the mainstem Snake River to preserve the genetic resource from the Upper Snake River.

6. ODFW Non-Federally Funded Programs

a. The ODFW should work with other fisheries managers to address the problem of Snake

River steelhead straying into the Deschutes River. Large numbers of Snake River hatchery strays have been recovered in the Deschutes River and may be spawning in natural production areas. In addition, if wild Snake River steelhead stray at rates similar to Snake River hatchery steelhead, there is the potential for genetic introgression into the Round Butte Hatchery broodstock.

7. WDFW Non-Federally Funded Programs

a. The WDFW should evaluate the potential for adverse effects on naturally-produced winter steelhead, by hatchery summer steelhead spawning in areas occupied by naturally-produced winter steelhead in the Cowlitz River Basin. Decreased production of naturally-produced winter steelhead has been reported in rivers where summer steelhead are introduced (Chilcote 1998).

b. The WDFW should evaluate the potential for incorporating naturally-produced summer steelhead into the broodstock at the Cowlitz Trout and Merwin hatcheries. Presently, total temporal separation of hatchery and naturally-produced steelhead is not possible and interbreeding does occur.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed salmon and steelhead or their habitats, NMFS requests notification of the implementation of any conservation recommendations.

X. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the USFWS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the USFWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.

Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary; and must be undertaken by the action agencies so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. The action agencies have a continuing duty to regulate the activity covered in this incidental take statement. If the action agencies (1) fail to assume and implement the terms and conditions or (2) fail to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the agencies must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize impacts and sets forth terms and conditions with which the action agency must comply in order to implement the reasonable and prudent measures.

A. Amount or Extent of the Take

The proposed actions are expected to result in the incidental take of listed salmon and steelhead in the Columbia River Basin. Because of the inherent biological characteristics of aquatic species such as listed salmon and steelhead, the dimensions and variability of the Snake and Columbia river systems, and the operational complexities of hatchery actions, determining precise (or even quantifiable) levels of mortality for juveniles and adults attributable to the proposed actions are not possible at the present time.

In absence of the exact numbers of listed salmon and steelhead expected to be taken, NMFS has relied on a qualitative analysis to determine the consistency of the proposed actions with that of the Proposed Recovery Plan (NMFS 1995c) and the risk assessment. However, this qualitative assessment does not provide quantitative estimates. In the absence of quantitative estimates of other incidental take, NMFS will monitor release numbers and locations, and broodstock collection to monitor compliance with the following reasonable and prudent measures and terms and conditions.

B. All Agencies Reasonable and Prudent Measures

The following reasonable and prudent measures are provided to minimize and reduce the anticipated level of incidental take associated with all the agencies artificial propagation programs:

1. All action agencies shall provide projected hatchery fish releases for the coming year to NMFS by December 15, of the current year.

2. All action agencies shall manage their programs to minimize the potential interbreeding of hatchery fish and listed salmon and steelhead in the Columbia River Basin.

3. The action agencies shall monitor and evaluate their respective artificial propagation programs in the Columbia River Basin.

4. All action agencies shall reduce potential negative impacts to listed salmon and steelhead in the

Columbia River Basin from operation of their respective artificial propagation facilities.

5. All action agencies shall terminate resident trout stocking into listed chinook salmon, listed sockeye salmon and listed steelhead primary spawning and nursery areas.

C. All Agencies Terms and Conditions

To carry out these reasonable and prudent measures, the following terms and conditions shall be implemented by the action agencies (BIA, BPA, NMFS, USACE, USFWS, IDFG, ODFW, and WDFW) and their contractors:

1a. All action agencies shall update and provide to NMFS, Hatchery/Inland Fisheries Branch, 525 NE Oregon Street, Suite 500, Portland Oregon 97232-2737, by December 15 of each year this BiOp is in force, the projected hatchery releases for the coming year. This information will be used to determine if total releases will remain within the production ceiling summarized in Table 3. Annual release of anadromous fish not used for recovery purposes in the Columbia River Basin is limited to approximately 197.4 million (of which 20.2 million are in the Snake River Basin) until the HGMP's are completed and justification can be provided to modify production.

1b. Projected hatchery releases will be used to estimate the percentage of listed salmon and steelhead at selected Columbia and Snake river hydropower projects. This information is necessary for evaluating the potential impacts of proposed research on listed salmon and steelhead. This information is to be provided by the all action agencies to NMFS, Hatchery/Inland Fisheries Branch, 525 NE Oregon Street, Suite 500, Portland Oregon 97232-2737.

2a. The action agencies shall mark a representative sample of hatchery salmon and steelhead released into the Columbia River Basin to allow monitoring and evaluation of hatchery programs to achieve management objectives and minimize negative impacts to listed salmon and steelhead.

2b. USFWS, USACE, and BPA shall mark all steelhead presmolts and smolts, spring/summer chinook salmon presmolts and smolts and a representative sample of fall chinook salmon released into the Snake River Basin from their facilities. This could include fin clips, but shall also include a portion of the release with a mark/tag distinct from other hatcheries.

2c. Protocols shall be developed for fishery augmentation/mitigation programs to return adult hatchery fish to areas where they can be captured and removed to reduce interbreeding and potential genetic introgression with listed salmon and steelhead.

2d. BPA shall wire tag 100% of the fall chinook salmon released into the Umatilla River with at least a representative sample to include coded-wire tags. The remainder of the released fish can be tagged with a blank wire tag. This action is required to allow trapping of stray adults at Snake River dams if the planned augmentation of flow in the Umatilla River is unsuccessful in eliminating straying into the Snake River.

2e. NMFS shall 100% wire tag Klickitat Hatchery fall chinook released into the Klickitat River with at least a representative sample to include coded-wire tags. The remainder of the released fish can be tagged with a blank wire tag. In recent years, approximately, 13% of the fall chinook escapement over Lower Granite Dam is compromised of Klickitat Hatchery strays. This will allow removal at Lower Granite Dam and thus minimize potential genetic introgression of listed Snake River fall chinook.

2f. BPA and NMFS shall continue to trap Umatilla River Hatchery and Klickitat Hatchery fall chinook salmon at Lower Granite Dam to remove these stray hatchery fish. BPA and NMFS shall update information on Umatilla River Hatchery and Klickitat Hatchery fall chinook salmon straying and report to NMFS by March 31 of each year this updated information.

2g. USACE shall continue to mark/tag a representative sample of Bonneville Hatchery upriver bright fall chinook salmon released from Ringold Hatchery. The USACE shall monitor and evaluate adult fall chinook salmon returns for straying into the Snake River from production associated with John Day Dam mitigation.

2h. USFWS shall 100% wire tag yearling fall chinook and a representative sample of subyearling fall chinook salmon released from Lyons Ferry Hatchery. USFWS shall provide a summary of tagged fall chinook salmon including numbers and origin of adults collected for the Lyons Ferry Hatchery program.

3. All action agencies shall provide a separate annual report that summarizes numbers, pounds, dates, tag/mark information, and locations of hatchery releases and adult return information from each hatchery. Adult return information should include the number of hatchery fish on the spawning grounds and number and location of adults that were recovered outside the release areas. Results from monitor and evaluation of ecological interactions should be included in the annual report. This report shall be submitted by January 31, of each year to the Hatchery/Inland Fisheries Branch, NMFS, 525 NE Oregon Street, Suite 500, Portland, Oregon 97232-2737.

4a. The action agencies shall ensure that water intakes into artificial propagation facilities are properly screened using NMFS screening criteria to prevent listed salmon and steelhead from entering. All action agencies shall inspect the water intake screen structures at their hatchery facilities within critical habitat to determine if listed salmon and steelhead are being drawn into the facility. Only facility screens that are not in compliance with NMFS screening criteria need to be included in the annual report called for in 3 above.

4b. All action agencies shall implement Pacific Northwest Fish Health Protection Committee and Integrated Hatchery Operations Team guidelines to ensure that hatchery fish are released in good health, which will minimize impacts to listed from horizontal transmission of pathogens.

4c. The action agencies shall monitor hatchery effluent to ensure compliance with National Pollutant Discharge Elimination System permit limitations. This should ensure that changes in water quality in the receiving streams caused by hatchery effluent are reduced, thus minimizing impacts to listed salmon and steelhead.

4d. USFWS shall remove unmarked adult fall chinook salmon from Dworshak Hatchery trap and release them into the Clearwater River to prevent a lethal take from steelhead trapping operations in the fall.

4e. USFWS shall immediately provide adult steelhead passage above the hatchery barrier dam on Icicle Creek. USFWS shall pass listed adult steelhead trapped in the fish ladder at Leavenworth NFH upstream of the hatchery barrier and upstream of the irrigation diversion (above the natural falls) to begin seeding the Upper Icicle Creek watershed. USFWS shall determine the feasibility of a long-term passage solution for listed steelhead through the old Icicle Creek channel. Adult passage could potentially provide 21 miles of relatively pristine habitat for listed Upper Columbia River summer steelhead.

5a. The action agencies shall discontinue resident trout stocking into primary spawning and nursery areas of listed salmon and steelhead, unless the action agency can demonstrate that stocking resident trout will not jeopardize the survival or recovery of listed salmon or steelhead. As a condition of stocking resident trout, the action agency shall implement a monitoring and evaluation program to evaluate the potential impacts. The results of the monitoring and evaluation program shall be included in the annual report required in 3 above.

5b. IDFG shall discontinue rainbow trout stocking into primary spawning and nursery areas of listed salmon and steelhead in the Lower Clearwater River. The rainbow trout fingerlings are released into critical habitat for listed fall chinook and steelhead, and directly overlap with USFWS/NPT supplementation programs for fall chinook above Lower Granite Dam. The stocks released are either domestic Kamloops or Spokane River rainbows which are piscivorous and are expected to carry over and grow large enough to prey on listed salmon and steelhead in the Lower Clearwater River.

D. Specific Agency Reasonable and Prudent Measures

The following reasonable and prudent measures are provided to minimize and reduce the anticipated level of incidental take associated with specific agencies artificial propagation programs:

1. BIA

<u>Clearwater River Coho Restoration</u>

a. The BIA, NMFS and USFWS shall coordinate the restoration of coho salmon into the Clearwater River Basin with other co-managers and hatchery production programs in the Snake and Clearwater River basins.

b. The BIA shall conduct a comprehensive monitoring and evaluation program for the coho salmon releases that includes potential ecological interactions with listed fall chinook and steelhead.

2. BPA

Nez Perce Tribal Hatchery

a. The BPA shall coordinate the NPTH with other hatchery production programs in the Snake and Clearwater River basins.

b. The BPA shall determine the potential risks and benefits to the listed Snake River fall chinook from the NPTH fall chinook supplementation program.

c. The BPA shall develop a management plan that includes a risk/benefit analysis. This plan must be coordinated with appropriate co-managers prior to submitting a section 10 direct take permit application for listed Snake River fall chinook.

d. The BPA shall fund a comprehensive monitoring and evaluation program for the NPTH that includes adult and juvenile ecological interactions.

e. The BPA shall provide to NMFS a copy of the NPTH final engineering designs.

f. The BPA shall minimize effects to listed fall chinook and steelhead in areas where construction will occur. Most of the construction activities occur away from the river channel, and trees shall only be removed where necessary, re-vegetate the site after construction, and use erosion control measures to reduce the sedimentation and toxins from entering the streams.

Salmon River Steelhead Stream-Side Egg Incubation Boxes

a. The BPA shall conduct the proposed action in such a way as to minimize adverse genetic and demographic effects on naturally-produced listed steelhead.

Select Area Fisheries Evaluation

a. The BPA shall ensure that net-pen operations are conducted in such a way as to minimize adverse effects on water quality and benthic biodiversity resulting from the presence and operation of the net-pens.

b. The BPA shall ensure that appropriate steps are taken to minimize adverse genetic impacts to natural-origin juvenile and adult salmon and steelhead resulting from the proposed action.

c. The BPA shall ensure that appropriate steps are taken to minimize the occurrence and transmission of disease in natural-origin juvenile and adult salmon and steelhead resulting from the proposed action.

d. The BPA shall ensure that the risk of predation on listed salmon and steelhead by SAFE project adults and juveniles is minimized.

3. NMFS

a. The NMFS shall conduct the proposed actions in such a way as to minimize adverse genetic and demographic effects on naturally-produced listed steelhead.

b. The NMFS shall conduct monitoring and evaluation activities for salmon and steelhead releases into the Lower Columbia River that include potential ecological interactions with listed Lower Columbia River steelhead.

4. USFWS

a. The USFWS' hatchery programs shall promote the enhancement of the survival and/or recovery of the listed Snake River Basin steelhead ESU.

b. The LSRCP cooperators shall continue to coordinate fishing regulations with hatchery programs in order to contribute to restoration of listed species.

5. IDFG Non-Federally Funded Programs

a. The IDFG shall conduct proposed artificial propagation actions in such a way as to minimize adverse genetic and ecological effects on listed salmon and steelhead.

b. The IDFG shall conduct monitoring and evaluation activities for hatchery salmon and steelhead releases into the Snake and Salmon rivers that include potential ecological interactions with listed species of salmon and steelhead.

c. The IDFG shall monitor and evaluate the incidental take of listed species at the Hells Canyon Dam and Pahsimeroi Hatchery adult traps.

6. ODFW Non-Federally Funded Programs

a. The ODFW shall conduct the proposed actions in such away as to minimize adverse genetic and demographic effects on listed steelhead.

b. The ODFW shall conduct monitoring and evaluation activities for salmon and steelhead releases into the Sandy and Hood river basins that include potential ecological interactions with listed Lower Columbia River steelhead.

c. The ODFW shall conduct an evaluation of the Marmot Dam fish trap, North Fork fish trap and the Powerdale Dam fish trap to determine incidental take associated with the removal of hatchery adults.

7. WDFW Non-Federally Funded Programs

a. The WDFW shall conduct the proposed actions in such a way as to minimize adverse genetic and demographic effects on naturally-produced listed steelhead.

b. The WDFW shall conduct monitoring and evaluation activities for salmon and steelhead releases into the Cowlitz and Lewis river basins that include potential ecological interactions with listed Lower Columbia River steelhead.

c. The WDFW shall conduct an evaluation of the hatchery fish weirs and traps to determine incidental take associated with the removal of hatchery adults.

E. Specific Agency Terms and Conditions

To carry out these reasonable and prudent measures, the following terms and conditions shall be implemented by action agencies (BIA, BPA, NMFS, USACE, USFWS, IDFG, ODFW, and WDFW) and their contractors:

1. BIA

<u>Clearwater River Coho Restoration</u>

a. The BIA and USFWS shall develop a long term management plan for restoration of coho salmon into the Clearwater River Basin by September 15, 1999. The long term management plan must be developed and coordinated through the *U.S. v Oregon* parties. Hatchery broodstock, natural production and harvest (ceremonial and sport) goals must be identified in the long term management plan. Harvest of adult coho salmon in the Clearwater River Basin must be designed with appropriate co-managers in a way that does not jeopardize listed Snake River steelhead and fall chinook. A completed long term management plan must be submitted and approved by NMFS prior to transfer and/or release of coho salmon into the Clearwater River Basin in 2000.

b1. The BIA shall conduct a monitoring and evaluation program that addresses potential adverse affects from competition, predation and residualism of coho salmon on listed steelhead and fall chinook.

b2. The BIA shall monitor and evaluate juvenile releases and adult returns to the coho facilities and weirs. The BIA shall provide a separate annual report by January 15, of each year that summarizes numbers, pounds, date, tag/mark information and locations of juvenile fish released and adult return information (including stray rates) from the coho salmon program. Monitoring and evaluation activities should be included in the annual report.

b3. The BIA shall coded-wire tag a minimum of 60,000 coho salmon smolts to be released into Clear, Potlatch and Lapwai creeks respectively. A total of 1,500 coho salmon for each release site (parr and smolts at Potlatch River) and approximately 1,500 collected at screw traps must be PIT tagged. These tags are necessary to determine smolt-to-adult return rates and outmigration timing and detection rates at Columbia and Snake River dams.

b4. The BIA shall attempt to determine if the untagged adults returning to creek weirs and other locations within the Snake River Basin are a result of smolt, parr or egg releases by using scale pattern analysis.

b5. The BIA shall monitor and evaluate ecological interactions between listed Snake River steelhead and coho salmon (especially residual coho) in all streams that are stocked with coho salmon. Evaluating the effects of coho salmon releases on listed steelhead is necessary because density dependent effects may occur even when the streams' estimated carrying capacity is not exceeded. If monitoring and evaluation information indicates a significant decline in Snake River steelhead abundance for streams stocked with coho salmon, especially Meadow Creek, then BIA shall re-calculate the carrying capacity estimate and reduce the number of coho salmon to be stocked accordingly. The estimated carrying capacity for each stream that is stocked with coho salmon must not be exceeded.

b6. The BIA shall monitor and evaluate ecological interactions between listed Snake River fall chinook and coho salmon. The possibility exists that coho salmon may move downstream into fall chinook critical habitat and interact, even though coho and fall chinook generally use different habitat. This information should be summarized and submitted to NMFS in the annual January 15 report.

b7. The BIA shall conduct spawning ground carcass surveys to determine the number and location of coho salmon on the spawning grounds. BIA shall summarize the number of carcasses collected by location and submit it to NMFS by January 15 or each year.

b8. The BIA shall provide around the clock on-site monitoring for the juvenile screw trap on Lower Lolo Creek. The trap shall be checked daily on days the trap is operated and all juvenile steelhead collected must be released immediately. During high flow events, the trap shall be checked more frequently to prevent mortality. The incidental take limits specified for Snake River steelhead in Lower Lolo Creek must not be exceeded. BIA shall submit to NMFS one report that summarizes the incidental catch, release and mortality of juvenile steelhead at the Lower Lolo Creek screw trap. The report should be submitted by January 15 of each year for the winter trapping season.

2. BPA

Nez Perce Tribal Hatchery

a. The BPA shall work with NMFS to develop and implement management plans for anadromous hatchery production programs in the Snake and Clearwater River basins.

b. The BPA shall conduct a risk/benefit analysis for the natural fall chinook populations in the Snake and Clearwater rivers from the proposed fall chinook supplementation program prior to releasing any NPTH hatchery fall chinook into the Clearwater River Basin. The NPTH relies on a two-fold increase in smolt-to-adult survival due to mainstem passage improvements and a 15% smolt survival advantage over conventional hatcheries through NATURES rearing methods. The analysis should include a range of survival values, along with the best case scenario. This analysis should provide a better understanding of the potential benefits to listed Snake River fall chinook. The NMFS is available to assist BPA with the analysis, if needed. The analysis and the potential risks and benefits to the population must be submitted to NMFS for review and approval before proceeding with the NPTH proposed fall chinook programs. The NPTH fall chinook programs may be modified to minimize the risks to the natural fall chinook population.

c. The BPA shall submit a section 10 permit application for directed take of listed Snake River fall chinook prior to taking the wild fall chinook into the Phase II broodstock program.

d. The BPA shall fund the monitoring and evaluation program to Level II - Partial Implementation. This level would ensure that all the critical aspects of the NPTH program are being addressed.

e1. The BPA shall monitor and evaluate hatchery operations, juvenile releases and adult returns to the NPTH facilities and weirs. The BPA shall provide a separate annual report by January 15 that summaries numbers, pounds, date, tag/mark information and locations of juvenile fish released and adult return information (including stray rates) from the NPTH. Monitoring and evaluation activities should be included in the annual report.

e2. The BPA shall mark a representative sample of fall chinook and mark all spring chinook released into the Clearwater River Basin with one or more of the following marks/tags: fin clips, coded-wire tags, PIT tags, visual implant tags or other forms of benign biological marks to distinguish hatchery fish from wild fish. The marks/tags must allow visual identification of NPTH from other hatchery fish released into the Clearwater River Basin.

e3. The BPA shall monitor and evaluate ecological interactions between listed Snake River steelhead and hatchery spring chinook in all streams that are stocked with spring chinook. Evaluating the affects of spring chinook releases on listed steelhead is necessary because density dependent effects may occur even when the streams’ estimated carrying capacity is not limited. If monitoring and evaluation information indicates a significant decline in Snake River steelhead abundance for streams stocked with hatchery chinook, then BPA shall re-calculate the carrying capacity estimate and reduce the number of hatchery-produced chinook to be stocked accordingly. The estimated carrying capacity for each stream that is stocked with hatchery spring chinook must not be exceeded.

e4. The BPA shall conduct spawning ground carcass surveys in the lower Clearwater River to determine the composition of wild and hatchery fall chinook on the spawning grounds. Even though the fall chinook supplementation program will use Lyons Ferry Hatchery stock, which is within the ESU, there are still potential genetic impacts to natural fish. One major concern would be the "early run" hatchery-produced fall chinook that may not return to their acclimation and rearing sites in the South Fork Clearwater and Selway rivers. BPA shall submit to NMFS reports in October, November and December summarizing the number of carcasses collected and composition of hatchery and wild fall chinook.

e5. The BPA shall provide seven day a week on-site monitoring of the juvenile screw traps on Meadow, Upper Lolo and Lower Lolo creeks. Traps shall be checked daily and all juvenile steelhead collected must be released immediately. During high flow events, the trap shall be checked more frequently to prevent mortality as seen in 1995 when debris clogged the trap. The incidental take limits specified for Snake River steelhead in Upper Lolo, Lower Lolo and Meadow creeks must not be exceeded. BPA shall submit to NMFS two reports that summarize the incidental catch, release and mortality of juvenile steelhead at the three screw traps. The reports should be submitted within 30 days after completion of both the spring and fall trapping seasons.

f. The BPA shall submit final engineering designs for exact locations of water source and discharge lines, orientation and location of ponds and housing facilities, location of temporary weirs and access road locations to NMFS for review prior to construction.

g. The BPA shall implement erosion control and toxin (fuel) handling measures during construction of the Cherrylane Central Incubation and Rearing Facility and satellite facilities for spring and fall chinook.

<u>Salmon River Steelhead Stream-Side Egg Incubation Boxes</u>

a. The BPA shall conduct the proposed action as a continuation of the "Pilot Studies" as approved in 1995, 1996, 1997, and 1998.

b. The BPA shall monitor the survival of eggs and fry produced by the stream-side incubator "Pilot Studies" as described in the biological assessment.

c. The BPA shall monitor rearing density of steelhead fry and parr in streams stocked through the stream-side incubator project in comparison with unstocked control streams.

d. The BPA shall submit a report of steelhead eggs distributed to the stream-side incubator program, fry production, survival rates, rearing densities and other monitoring results for each year of the “Pilot Studies” to NMFS by April 1, 1999.

e. The BPA and other cooperators in the stream-side incubator “Pilot Studies” shall submit a draft plan describing long term objectives of the project, prior to requests for steelhead eggs in 1999.

f. The BPA in cooperation with NMFS and IDFG shall develop a plan to identify the persistence or absence of indigenous genetic material of native steelhead in the Upper Salmon River and identify appropriate donor stocks for recovery programs.

<u>Select Area Fisheries Evaluation (SAFE)</u>

a. The BPA shall ensure that all releases of SAFE project fish are consistent with the NMFS production cap, or similar NMFS guidelines which may be developed in the future regarding artificial production release affects on ESA-listed fish.

b. The BPA shall continue to evaluate the water quality and benthic biodiversity at net-pen sites, and continue to develop and implement feeding and operation procedures that minimize adverse habitat impacts and keep remaining adverse impacts localized.

c. The BPA shall include all available stream survey data in determining whether SAFE project fish occur in areas outside the project area. This could provide important information on evaluating straying and the efficacy of project actions to reduce straying, as well as risks from genetic and disease effects.

d. The BPA shall continue to evaluate the appropriateness of broodstocks used for SAFE project rearing and release. If a brood source is identified which is more suitable for use, given the conservation needs of listed species, all appropriate steps shall be taken to replace the former brood stock with the one identified.

e. The BPA shall monitor straying of SAFE project adult salmonids, especially Rogue River bright fall chinook to other hatchery or natural spawning locations, and shall identify and implement all steps necessary to maintain a proportion of non-ESU (SAFE project fish and other non-ESU strays) on spawning grounds at less than 5%.

f. The BPA shall annually provide to NMFS a report detailing the observed and estimated impacts to listed species resulting from the proposed action, and the steps taken to mitigate for such impacts. This report shall include information on numbers and scheduling of SAFE project releases, straying of SAFE project fish to other locations (hatcheries and natural spawning areas), and other pertinent information on project effects. It is desirable that harvest impacts on listed fish, and total catch, be included in the report. This report shall be provided to NMFS by June 30 of each following year. This report may be part of other reports compiled on SAFE project operations.

g. The BPA shall require that project biologists determine that chum salmon juveniles have left rearing streams in the Grays Bay area before releasing coho and spring chinook juveniles from the Deep River site net-pens.

3. NMFS Mitchell Act

a1. The NMFS shall release hatchery steelhead smolts in lower river reaches where possible, where few wild fish spawn and to which returning hatchery adults would be expected to home.

a2. The NMFS shall minimize the number of hatchery adults remaining to potentially spawn with wild fish through removal of hatchery fish at sufficiently high harvest and/or trapping rates.

a3. The NMFS shall mark all hatchery steelhead and cutthroat trout populations released into anadromous waters to allow for monitoring of hatchery fish migration, fisheries contribution, and survival, and to allow for ready differentiation between hatchery and wild fish.

a4. The NMFS shall comply with all ODFW and WDFW fish transfer standards to minimize potential negative genetic and fish disease effects on wild fish.

a5. The NMFS and WDFW shall continue the exclusion of hatchery steelhead from upriver wild steelhead production areas through the removal of hatchery fish at Kalama Falls barrier.

a6. The NMFS shall monitor, research and report hatchery smolt migration performance, behavior and intra and interspecific interactions with wild fish to assess, and adjust if necessary, hatchery production, and release strategies to minimize effects on wild fish.

a7. The NMFS shall conduct spawning ground surveys to estimate the number of hatchery steelhead that are spawning naturally in habitat for listed steelhead in the Lower Columbia River.

4. USFWS

a. USFWS shall continue the current release of Imnaha stock steelhead smolts released into Little and Big Sheep creeks for the Imnaha River steelhead program..

5. IDFG Non-Federally Funded Programs

a1. The IDFG shall manage the number of hatchery steelhead adults that escape to spawn naturally within the straying guidelines by maintaining high harvest rates in recreational fisheries or removal at traps.

a2. The IDFG shall mark all hatchery salmon and steelhead to allow for monitoring of hatchery fish migration, contribution to fisheries, survival rates, and to allow for ready differentiation between wild and hatchery fish. Specifically for steelhead, IDFG shall coded-wire tag a representative sample of steelhead released. IDFG shall use an external mark other than an adipose clip to flag or identify coded-wire tagged steelhead to allow identification by other agencies in the Columbia River Basin. Currently, IDFG does not use a unique external mark to identify all coded-wire tagged steelhead, which is used to notify personnel that it has a wire tag. Without this external mark there is no way of knowing, if IDFG steelhead releases from IPC facilities are straying into other areas, like other steelhead releases made in the Snake River Basin.

b1. The IDFG shall monitor and maintain trend data on smolts residualism rates through snorkel surveys, creel census and downstream smolt tracking.

b2. The IDFG shall attempt to monitor the proportion of hatchery fish spawning in the wild by spawning grounds surveys, carcass counts or fishery data.

6. ODFW Non-Federally Funded Programs

a1. The ODFW shall release hatchery steelhead smolts in lower river reaches where few wild fish spawn and to which returning hatchery adults would be expected to home.

a2. The ODFW shall mark all hatchery steelhead populations released into anadromous waters to allow for monitoring of hatchery fish migration, fisheries contribution, and survival, and to allow for ready differentiation between hatchery and wild fish.

a3. The ODFW shall maximize removal of non-endemic summer steelhead adults from the Sandy, Clackamas, and Hood rivers through harvest management and the trapping and recycling of hatchery adults at the Marmot Dam, the North Fork Fish Ladder, and Powerdale Dam fish traps.

b1. The ODFW shall continue to monitor, research and report hatchery smolt migration performance, behavior and intra and interspecific interactions with wild fish to assess, and adjust if necessary, hatchery production, and release strategies to minimize effects on wild fish.

b2. The ODFW shall attempt to conduct spawning ground surveys in the lower mainstem areas below Marmot Dam on the Sandy River, below River Mill on the Clackamas, and below Powerdale Dam on the Hood River to determine if hatchery summer steelhead are spawning in areas used by naturally-produced winter steelhead.

c. The ODFW shall conduct an evaluation of the Marmot Dam fish trap to determine incidental take of listed Lower Columbia River steelhead during the removal of hatchery adults, and take actions to minimize incidental take.

7. WDFW Non-Federally Funded Programs

a1. The WDFW shall acclimate and release hatchery steelhead smolts in lower river reaches where possible, where few wild fish spawn and to which returning hatchery adults would be expected to home and have a tendency to hold prior to migrating upstream for spawning.

a2. The WDFW shall minimize the number of hatchery adults remaining to potentially spawn with wild fish through removal of hatchery fish at sufficiently high harvest and/or trapping rates.

a3. The WDFW shall mark all hatchery steelhead and cutthroat trout populations released into anadromous waters to allow for monitoring of hatchery fish migration, fisheries contribution, and survival, and to allow for ready differentiation between hatchery and wild fish.

a4. The WDFW shall comply with all WDFW fish transfer standards to minimize potential negative genetic and fish disease effects on wild fish.

a5. The WDFW shall continue the exclusion of hatchery steelhead from up-river wild steelhead productions are through removal of hatchery fish at trapping sites on Cedar Creek (tributary to the N.F. Lewis River) and the Green River (at the North Toutle Fish Collection Facility).

a6. The WDFW shall evaluate the use of direct releases of hatchery steelhead from acclimation sites located in small tributaries and from major hatcheries with off-channel fishways to draw returning adults away from natural steelhead production areas in mainstem rivers.

a7. The WDFW shall evaluate the effectiveness of collecting volitionally-migrating steelhead produced at Merwin Hatchery for truck-planting downstream of the city of Woodland, to promote homing of returning hatchery fish to the lower area where fish are not likely to spawn. This strategy also reduces the risk of predation on wild steelhead that generally rear in up-river areas. The results shall be included in the annual report.

b1. The WDFW shall continue to monitor, research and report hatchery smolt migration performance, behavior and intra and interspecific interactions with wild fish to assess, and adjust if necessary, hatchery production, and release strategies to minimize effects on wild fish.

b2. The WDFW shall attempt to conduct spawning ground surveys to estimate the number of hatchery steelhead that are spawning naturally in habitat of listed Lower Columbia River steelhead.

XI. REINITIATION OF CONSULTATION

This concludes formal consultation on the artificial propagation associated with Federal and non-Federal hatchery programs in the Columbia River basin. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, the action agencies must immediately request reinitiation of section 7 consultation.

We would consider the proposed action to be modified in a manner that causes an effect to listed species not considered in this biological opinion if the total annual releases of unlisted fish in the Columbia River Basin are projected to exceed 197.4 million or if annual production in the Snake River Basin is projected to exceed 20.2 million. If the annual reviews of NMFS' and BPA' programs at the Klickitat Hatchery fall chinook and Umatilla Hatchery fall chinook programs indicates that straying into the Snake River above Lower Granite Dam will exceed the straying standard in place for that year (currently set at 5% of the population above Lower Granite Dam), we would consider this new information that reveals effects of the proposed action that may affect listed species in a manner or to an extent not considered in this biological opinion. Finally, we would consider the 1999 renegotiations of the Columbia River Fish Management Plan as significant new information that would warrant reinitiation of section 7 consultation.

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