Appendix E
Wenatchee Subbasin Plan

Hatchery Information for Subbasin Planning

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Wenatchee Subbasin

I. Introduction

Various processes are underway within the Columbia Basin that direct hatchery program implementation. The listing of certain populations of fish under the ESA has also dictated hatchery program modifications and reform.

Some of the principal processes are:

Federal:

Hatchery and Genetic Management Plans:
The Hatchery and Genetic Management Plan (HGMP) process was initiated to identify offsite mitigation opportunities associated with operation of the Federal Columbia River Power System. The HGMP process is designed to describe existing propagation programs, identify necessary or recommended modifications of those programs, and help achieve consistency of those programs with the Endangered Species Act. The HGMP process only addresses anadromous salmon and steelhead programs.

Hatchery and Genetic Management Plans are described in the final salmon and steelhead 4(d) rule (July 10, 2000; 65 FR 42422) as a mechanism for addressing the take of certain listed species that may occur as a result of artificial propagation activities. NOAA Fisheries will use the information provided by HGMPs in evaluating impacts on anadromous salmon and steelhead listed under the ESA. In certain situations, the HGMPs will apply to the evaluation and issuance of section 10 take permits. Completed HGMPs may also be used for regional fish production and management planning by federal, state, and tribal resource managers.

The primary goal of the HGMP process is to devise biologically-based artificial propagation management strategies that ensure the conservation and recovery of listed Evolutionarily Significant Units (ESUs). The HGMP process also seeks to document and implement hatchery reform in the Columbia Basin. Much of the initial work on the HGMP process was coordinated and combined with efforts to complete the Artificial Production Review and Evaluation (APRE – see below)) analysis, which looked at the same sorts of information.

Artificial Production Review and Evaluation (APRE)
The APRE process seeks to document progress toward hatchery reform in the Columbia Basin. The NPCC used consultants and representatives of the Columbia Basin fishery managers to analyze existing programs and recommend reforms; a draft report that will go to the Council and the region has been prepared. The APRE process includes both anadromous and non-anadromous fish in its analysis.

Pacific Coastal Salmon Recovery Fund
The Pacific Coastal Salmon Recovery Fund (PCSRF) was established in FY2000 to provide grants to the states and tribes to assist state, tribal and local salmon conservation and recovery efforts. The PCSRF was requested by the governors of the states of Washington, Oregon, California and Alaska in response to Endangered Species Act (ESA) listings of West Coast

salmon and steelhead populations. The PCSRF supplements existing state, tribal and federal programs to foster development of federal-state-tribal-local partnerships in salmon recovery and conservation; promotes efficiencies and effectiveness in recovery efforts through enhanced sharing and pooling of capabilities, expertise and information. The goal of the Pacific Coastal Salmon Recovery Fund is to make significant contributions to the conservation, restoration, and sustainability of Pacific salmon and their habitat.

The PCSRF's enhancement objective is*: To conduct activities that enhance depressed stocks of wild anadromous salmonids through hatchery supplementation, reduction in fishing effort on depressed wild stocks, or enhancement of Pacific salmon fisheries on healthy stocks in Alaska. This includes supplementation and salmon fishery enhancements.*

US v. OR

United States v Oregon, originally a combination of two cases, Sohappy v. Smith and U.S. v. Oregon, legally upheld the Columbia River treaty tribes reserved fishing rights. Specifically the decision acknowledged the treaty tribes reserved rights to fish at "all usual and accustomed" places whether on or off the reservation, and were furthermore entitled to a "fair and equitable share" of the resource. Although the Sohappy case was closed in 1978, U.S. v. Oregon remains under the federal court's continuing jurisdiction serving to protect the tribes treaty reserved fishing rights. This case is tied closely to U.S. v. Washington, which among other things defined "fair and equitable share" as 50 percent of all the harvestable fish destined for the tribes' traditional fishing places, and established the tribes as co-managers of the resource.

In 1988, under the authority of U.S. v. Oregon, the states of Washington, Oregon and Idaho, federal fishery agencies, and the treaty tribes agreed to the Columbia River Fish Management Plan (CRFMP), which was a detailed harvest and fish production process. There are no financial encumbrances tied to the process. Rather, the fish production section reflects current production levels for harvest management and recovery purposes, since up to 90% of the Columbia River harvest occurs on artificially produced fish. This Plan expired in 1998, and has had subsequent annual rollover of portions in which agreement has been reached. However, a newly negotiated CRFMP is forthcoming.

Hatchery production programs in the upper Columbia sub-basins are included in the management plans created by the fishery co-managers identified in the treaty fishing rights case *United States v Oregon*. The parties to *U.S. v Oregon* include the four Columbia River Treaty Tribes – Yakama Nation, Warm Springs, Umatilla, and Nez Perce tribes, NOAA-Fisheries, U.S. Fish and Wildlife Service, and the states of Oregon, Washington, and Idaho. The Shoshone-Bannock Tribe is admitted as a party for purposes of production and harvest in the upper Snake River only. These parties jointly develop harvest sharing and hatchery management plans that are entered as orders of the court that are binding on the parties. The "relevant co-managers" described in the *U.S. v Orego*n management plans are, for the mid-Columbia sub-basins, the federal parties, Yakama Nation, and Washington Department of Fish and Wildlife.

Hatchery programs are viewed by the Yakama Nation as partial compensation for voluntary restrictions to treaty fisheries imposed by the tribe to assist in rebuilding upriver populations of naturally-spawning salmonids. Because treaty and non-treaty fisheries are restricted on the basis of natural stock abundance, the tribal priority is to use hatcheries in a manner that supplements natural spawning and increases average population productivity. Perspectives on the appropriate

use of hatchery-origin fish for supplementation vary between federal, state, and tribal fish co-managers. Federal and, to a lesser degree, state co-managers place a higher priority on managing the genetic risks of hatchery supplementation of natural populations, while the tribe sees the demographic threats of habitat loss and degradation as the greater risk to natural populations. In general, however, all parties agree that hatcheries can and should be operated as integral components of natural populations where the survival benefits of the hatchery can result in a significant increase in net population productivity.

Federal ESA

Current ESA Section 10 Permits for listed summer steelhead (Permit #1395); listed spring chinook (Permit #1196) and non-listed anadromous fish (Permit # 1347) also direct artificial production activities associated with the habitat conservation plans. Douglas PUD, Chelan PUD and WDFW are co-permittees, therefore provisions within the permits and associated Biological Opinions are incorporated into the hatchery programs undertaken in the HCP's.

State:
The state, along with the federal government has various forums in which they are active. All have some role in determining or balancing artificial production programs, as well as the ones that follow under "other". Essentially no specific action would occur until the action is determined to be warranted in the already established processes.

Other:

FERC processes:
Under current settlement agreements and stipulations, the three mid-Columbia PUDs pay for the operation of hatchery programs within the Columbia Cascade Province. These programs determine the levels of hatchery production needed to mitigate for the construction and continued operation of the PUD dams.

Habitat Conservation Plans:
In 2002, habitat conservation plans (HCPs) were signed by Douglas and Chelan PUDs, WDFW, USFWS, NOAA Fisheries, and the Colville Confederated Tribes. The overriding goal of the HCPs are to achieve no-net impact[1] on anadromous salmonids as they pass Wells (Douglas PUD), Rocky Reach, and Rock Island (Chelan PUD) dams. One of the main objectives of the hatchery component of NNI is to provide species specific hatchery programs that may include contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest.

Biological Assessment and Management Plan:

[1] NNI refers to achieving a virtual 100% survival of anadromous salmonids as they pass the mainstem projects. This is achieved through 91% survival of adults and juveniles (or 93% for juveniles) passing the projects, and 7% compensation through hatchery programs and 2% contribution through a tributary fund, which will fund projects to improve salmonid habitat in the tributaries.

The biological assessment and management plan (BAMP) was developed by parties negotiating the HCPs in the late 1990s. The BAMP was developed to document guidelines and recommendations on methods to determine hatchery production levels and evaluation programs. It is used within the HCP as a guiding document for the hatchery programs.

All of these processes affect the hatchery programs within the Upper Columbia Basin in one way or another.

Historic and current programs and facilities

Historic programs

The first hatchery that released salmonids in the Wenatchee Basin began operation in 1899 on the Wenatchee River (Chiwaukum Creek). This hatchery was built to replenish the salmon (primarily Chinook, and coho) runs, which had virtually been eliminated by the 1890s (Gilbert and Evermann 1895; WDFG 1898). The Wenatchee facility was closed from 1904 to 1913 because of severe weather, logistics of the location, but primarily because it lacked adequate brood stock.

The biggest problems encountered in the early years of the hatcheries were lack of fish for broodstock, and because of irrigation diversions that entrained large numbers of juveniles (both naturally- and artificially produced).

Most of the fish planted from the Wenatchee facility in the first few years of production were probably coho (WDFG 1904-1920; Craig and Suomela 1941). For the first few years, species were not differentiated, with almost 8 million fry planted per year from the Wenatchee facility. Beginning in 1904, when species were differentiated, by far the majority of fish released were coho. After the Wenatchee hatchery was moved downstream near the town of Leavenworth in 1914, Chinook production began again, with supplementation of eggs from other hatcheries as far away as the Willamette and McKenzie rivers of Oregon (WDFG 1914; Craig and Suomela 1941).

Success of the releases of fish from these hatcheries is unknown, but not thought to have been large.

Current programs

Current program overview:

Artificial production of anadromous fish in the Wenatchee Subbasin includes spring Chinook, summer Chinook, summer steelhead, sockeye, and reintroduction of coho salmon (Table 1). Spring Chinook and summer steelhead are currently ESA-listed as endangered through the Endangered Species Act of 1973. Summer Chinook are considered a depressed population. Once extirpated from the Wenatchee Subbasin, small numbers of coho salmon have been reintroduced, and plans are currently in the feasibility stage for larger scale reintroduction. Hatchery intervention in the Wenatchee Subbasin is guided by a two-pronged approach that encourages

local adaptation, preservation and enhancement of specific populations while simultaneously spreading the risk through selection of several artificial production alternatives.

Table 1. Artificial anadromous fish production in the Wenatchee Subbasin

Fish Species	Facility	Funding Source	Production level goals
Spring Chinook	Eastbank Fish Hatchery Complex (Chiwawa acclimation pond) (Operated by WDFW)	Chelan County PUD	672,000
	Leavenworth National Fish Hatchery (Operated by USFWS)	Bureau of Reclamation	1,625,000
Steelhead	Eastbank Fish Hatchery Complex (Operated by WDFW)	Chelan County PUD	400,000
Summer Chinook	Eastbank Fish Hatchery Complex (Dryden acclimation pond) (Operated by WDFW)	Chelan County PUD	864,000
Sockeye	Eastbank Hatchery (Operated by WDFW)	Chelan County PUD	200,000
Coho	Leavenworth NFH, Enitat NFH, Peshastin Incubation Facility (Operated by USFWS and YN) Cascade Fish Hatchery (Operated by ODFW) Willard NFH (Operated by USFWS)	BPA (Fish & Wildlife Program)	> 500,000
	Acclimation sites at Nason Creek, Beaver Creek and Icicle Creek (YN)	BPA (Fish & Wildlife Program)	> 500,000

Federal programs

Grand Coulee Fish Maintenance Project (GCFMP)

The USFWS operates the Leavenworth NFH Complex in the CCP region constructed by the U.S. Bureau of Reclamation (BOR) to replace fish losses that resulted from construction of Grand Coulee Dam. These programs were authorized as part of the Grand Coulee Fish Maintenance Project (GCFMP) on April 3, 1937, and re-authorized by the Mitchell Act (52 Stat. 345) on May 11, 1938. The complex consists of three hatchery facilities, Leavenworth, Entiat, and Winthrop NFHs.

Leavenworth NFH

Leavenworth National Fish Hatchery (NFH) was originally authorized by the Grand Coulee Fish Maintenance Project (GCFMP) on April 3, 1937, and reauthorized by the Mitchell Act (52 Stat. 345) on May 11, 1938. It began operations in 1942. Leavenworth NFH is one of three mid-Columbia hatcheries constructed by the Bureau of Reclamation (BOR) as mitigation for the Grand Coulee Dam-Columbia Basin Project. It is currently used for adult collection, egg incubation and rearing of spring Chinook salmon. It also provides juveniles and/or adults for re-establishing spring Chinook runs in other Columbia River tributaries, as needed (e.g., Peshastin Creek adult out-plants). The hatchery complex (Complex) consists of Leavenworth, Entiat, and Winthrop NFH's.

Facility description: Leavenworth NFH is situated on Icicle Creek, 2.8 miles from its confluence with the Wenatchee River. Fish returning to LNFH must travel about 497 miles to and from the ocean, and must pass seven Columbia River hydroelectric dams on their migrations.

Rearing facilities include two – 15 x 150 foot adult holding ponds, 45 – 8 x 80 raceways, 14 – 10 x 100 covered raceways, 72 troughs, 108 starter tanks, plus 40 small and 22 large Foster-Lucas ponds (not used for hatchery production).

The primary water source for the hatchery is Icicle Creek. The water right allows for the diversion of up to 42 cubic feet per second (cfs) for production. During low flows in the summer, the hatchery water supply (Icicle Creek) is supplemented with water from Snow and Nada lakes (up to 16,000 acre feet; these lakes are located in the upper Icicle Creek watershed). The hatchery also has seven wells, with a total water right of 6,700 gallons per minute. The well water is mainly used for egg incubation and early rearing.

State programs

Rock Island Fish Hatchery Complex

The Rock Island Fish Hatchery Complex (RIFHC) began operation in 1989 as mitigation for salmonids lost as a result of operation of Rock Island Dam. The facility was constructed by, and operates under funding from, Chelan PUD originally through the Rock Island Settlement Agreement. Currently, Chelan PUD and fisheries agencies and the Colville Confederated Tribes have signed a habitat conservation plan (HCP). When the HCP is incorporated into Chelan PUD's FERC license, it will supersede the Settlement Agreement. Production levels and evaluation programs are outlined within the HCP (Table 1)**.**

Facility description: The RIFHC has one main incubation and rearing hatchery (Eastbank) and five satellite rearing/acclimation facilities, and four broodstock trapping sites. The main hatchery, Eastbank, has two adult holding ponds, 70 half-stacks of vertical incubators equipped with a chilled water supply (4.5 gpm per half-stack), eight 3,750 cu. ft. raceways and five 22,200 cu. ft. raceways. Eastbank has four wells that supply 53 cfs. This water varies in temperature from a low of 46° F in May to a high of 57° F in December. Rearing space at Eastbank was designed to maintain maximum loading densities below the criteria of Piper et al. (1982), as modified by Wood (Chelan PUD and CH2MHILL 1988).

Three satellite facilities of the RIFHC are found within the Wenatchee River Basin; Lake Wenatchee net pens (sockeye), Chiwawa rearing ponds (spring Chinook), and the Dryden pond acclimation site (summer/fall Chinook). Steelhead are currently scatter planted in Nason Creek, and the Wenatchee and Chiwawa rivers.

At Lake Wenatchee, there are six floating net pens for juvenile rearing (about 20 x 20 x 20 ft) and two adult holding pens (about 16 x 16 x 20). The Chiwawa facility has two 50 x 150 x 5 ft ponds (water source from the Chiwawa and Wenatchee rivers), and the Dryden facility has one 864,000 ft^3 pond (water source from the Wenatchee River).

II. Program Goals and Objectives

Federal programs

Leavenworth National Fish Hatchery (NFH)**:**
Specific fishery objectives which were originally established for Leavenworth NFH were (from Calkins et al. 1939):

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 with the natural food supply in the streams."*

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."*

Shelldrake (1993) updated the objectives of the mid-Columbia NFHs:

- *Hatchery production* [specific to each facility].
- *Minimize interaction with other fish populations through proper rearing and release strategies.*
- *Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.*
- *Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.*
- *Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.*
- *Communicate effectively with other salmon producers and managers in the Columbia River Basin.*

The USFWS's current mission for the Leavenworth complex is (USFWS 2002a):

> *"To produce high quality spring Chinook salmon and summer steelhead smolts commensurate with the production goals established by the Columbia River Fisheries Management Pla*n"

Original production consisted of Chinook salmon trapped at Rock Island Dam (1940 – 43), but since then has included several resident and anadromous salmonid species, including spring, summer, and fall Chinook, coho, sockeye, summer steelhead, rainbow trout, and kokanee.

Early spring Chinook salmon stocks used for the program came from several lower Columbia River locations. These include McKenzie River, OR (1941); Willamette River, OR (1965); Eagle Creek NFH (1966); Cowlitz River (1974, 76); Little White Salmon NFH (1974, 77-79), and the

current stock originated from Carson NFH (1970-73, 75-81, 85). The Carson stock developed from adults, trapped at large, from Bonneville Dam in the 1950's. No eggs or fry have been imported into LNFH for almost 20 years.

State programs

Rock Island Fish Hatchery Complex

The goal of the RIFHC is to use artificial production to replace adult production lost due to smolt mortality at mainstem hydroelectric projects, while not reducing the natural production or long-term fitness of salmonid stocks in the area (WDF 1993). Specific goals of the WDFW hatcheries (WDF 1993) are:

- *Hatchery production* [in terms of number of fish released from each site],
- *minimize interactions with other fish populations through rearing and release strategies, maintain stock integrity and genetic diversity of each population or unique stock through proper management of genetic resources.*
- *maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens,*
- *conduct environmental monitoring to ensure that the hatchery operations comply with water quality standards and to assist in managing fish health,*
- *communicate effectively with other salmon producers and managers in the Columbia River basin, and with implementers of local and regional flow and spill programs, and*
- *develop a Conservation Plan and conduct a comprehensive monitoring/evaluation program to determine that the program meets mitigation obligations, estimate survival to adult, evaluate effects of the program on local naturally producing populations, and evaluate downstream migration rates in regards to size and timing of fish released.*

Yakama Nation Program

The long-term goal of the YN/BPA Mid-Columbia Coho Reintroduction Feasibility Project is to reestablish naturally reproduction coho salmon populations in mid-Columbia river basins (Wenatchee, Entiat, and Methow), with numbers at or near carrying capacity that provide opportunities for harvest (YN et.al. 2002). The long-term goal is closely tied to the vision of reintroduction of coho in the Yakima basin and other areas from which the species has been eliminated. Mid-Columbia coho reintroduction is identified as a priority in the *Wy-Kan-Ush-Mi-Wa-Kish-Wit* document (Tribal Restoration Plan) and by the four Columbia River Treaty Tribes and has been affirmed as a priority by the Northwest Power Planning Council.

The short term goals of the feasibility phase, expected to last through 2004, is to determine whether a broodstock can be developed from Lower Columbia River coho stocks, whose progeny can survive in increasing numbers to return as adults to the mid-Columbia region, and to initiate natural reproduction in areas of low risk to sensitive species and in other select areas to study the risks and interactions with sensitive species (YN et al. 2002). Studies completed

during the feasibility phase will inform future decisions about whether the long-term vision can be achieved.

III. Program Operations

Federal

Leavenworth National Fish Hatchery

Brood stock collection and spawning:
Adult spring Chinook salmon return to the hatchery beginning in late April – early May. The adult escapement goal for the hatchery (number of adults needed to meet the production goal) is 1,000. Beginning in 2001, an additional 350 adults have been collected for transfer and release into Peshastin Creek for natural spawning.

All brood stock used for production are volunteers to the facility. Adults swim up the collection ladder and into one of two holding ponds. The holding ponds measure 15 x 150 feet, and are joined in the middle by an adjustable slide-gate. The gate is opened and adults are allowed to enter the second pond during sorting, counting, etc. The holding ponds supply attraction water for the ladder. Adults are secured from throughout the run spectrum, which results in excess brood. Excess fish are periodically donated to various tribes and a local non-profit group (TU).

The ladder typically operates from May into July. Because of limited space in the holding ponds, coupled with the desire to keep surplus adults in the river for harvest, the ladder in some years is "pulsed" (opened a few days per week).

The adult pre-spawning survival goal is 98%, and for years 1993 to 2002, averaged just over 95% (87-97%; D. Davies, pers. comm.).

Spawning usually begins in mid-August, and can continue into early-September. Approximately two weeks prior to initial spawning, all adult females are injected with an antibiotic (erythromycin), to help combat the vertical transmission of Bacterial Kidney Disease (BKD) from the mother to the eggs.

Pathogen and disease monitoring start with adult testing of captured populations for all reportable aquatic viruses and bacteria at the minimum assumed pathogen prevalence level of 5% (i.e. 50 individuals). Since approximately 1994, the actual sampling has been a minimum of 210 adults (60 males and 150 females) for these pathogens. In addition, all females spawned are specifically and individually tested for *Renibacterium salmoninarum*, the causative agent of BKD. This is essential to determine the pathogen levels and eliminate or segregate the resulting eggs from different risk levels. This process greatly reduces the likelihood of transmitting the disease from infected females to progeny. All eggs and accompanying containers are disinfected with iodine solution during the water hardening process following fertilization.

Juvenile releases: Juveniles are released annually as yearlings in mid-April. The yearlings are forced from the ponds, directly into Icicle Creek, when the majority is in a smolt or pre-smolt

stage. Timing of release is coordinated with Columbia mainstem project operations to help maximize downstream migration survival. All juveniles released from LNFH are adipose fin-clipped. With 100% marked juveniles, subsequent adult harvest can be maximized while also strengthening the ability to evaluate ecological effects. The current release goal is 1,625,000 smolts annually. From 1971 to 2001, annual releases of spring Chinook from LNFH have averaged 1,649,074 fish.

Hatchery Barrier: Built in 1938 – 1940, the barrier was designed to exclude ascending adults from areas upstream of the hatchery and to help insure sufficient adults for brood. In recent years, the USFWS, along with other entities, have investigated the potential of providing passage for certain fish species to areas above the barrier. The effects of, and potential solutions to the barrier issue are currently being addressed in a Final Environmental Impact Statement (FEIS) that has been drafted and issued. Current plans are to provide passage in the next few years (2005 or 2006).

Hatchery water intake system: The hatchery's water delivery system consists of three major components and conveyance systems: 1) the gravity intake on Icicle Creek, 2) the Snow Lake Supplementation Water Supply Project and, 3) the well system on hatchery property.

The intake is located at RM 4.5, approximately 1.5 miles upstream of the hatchery. Water is conveyed to the hatchery through a buried 31-inch pipe system. This water enters a sand-settling basin and on through two screen chambers prior to its arrival at the hatchery. The water intake structure consists of a diversion dam, fish ladder, wide bar trash rack (6 inch spacing) and another narrower bar trash rack (1 1/2 inch spacing) located in a building. This structure is currently not properly screened, but plans are underway to bring it into compliance.

Entrained fish in the system can return to the river several ways: 1) the Cascade irrigation diversion, which branches off the system below the intake, has a drum screen to divert fish into a sluiceway back to the river, 2) the overflow area at the sand-settling basin can pass fish back to the river via effluent and, 3) the two screen chambers. One is within a building and is equipped with 1/8 inch x 1/8 inch plastic coated screens which divert fish into a bypass pipe to the river. The other screen chamber is covered and is equipped with 3/32-inch round-holed screens, which divert fish into an overflow channel leading back to the river. From both screen chambers, water is delivered to the rearing ponds and back to the river. Both screen chambers meet the standards for screening criteria described in the *1994 Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* developed by NMFS.

During construction of the hatchery, it was recognized that surface flow in Icicle Creek might at times be insufficient to meet production demands. A supplementary water supply project in Snow and Nada Lakes was therefore developed and a water right to 16,000 acre feet of Snow Lake was obtained. These lakes are located approximately 7 miles from the hatchery and about one-mile above it in elevation. A _ mile tunnel was drilled and blasted through granite to the bottom of Snow Lake and a control valve was installed at the outlet of the tunnel. Operation of the control valve is determined by Icicle Creek flow and water temperature. The control valve is typically opened mid-July or as soon as the creek water consistently reaches 58°F (D. Davies, USFWS, pers. comm.). Water drained from Snow Lake enters Nada Lake, which drains into

Snow Creek, a tributary to Icicle Creek that enters at RM 5.5. Thus, supplemental flows, ranging from 45 to 60 cfs from Snow Creek, enter Icicle Creek one-mile above LNFH's intake system.

During critical periods of the rearing cycle, well water is used to cool/warm stream water, and stream water to temper well water. The intake and water delivery systems are currently being addressed under a separate Biological Assessment and consultation process.

Evaluation: The Mid-Columbia River Fishery Resource Office (MCRFRO) provides monitoring, evaluation, and coordination services concerning Leavenworth NFH production. MCRFRO staff monitors hatchery returns, biological characteristics of the hatchery stock, fish marking, tag recovery, and other aspects of the hatchery program, and they maintain the database that stores this information. MCRFRO also cooperates with the hatchery, fish health and technology centers, and co-managers to evaluate fish culture practices, assess impacts to native species, and coordinate hatchery programs both locally and regionally.

The Leavenworth NFH Complex has a team comprised of staff from the hatcheries, Fish Health, and the MCRFRO (Hatchery Evaluation Team). Current evaluation practices/studies include: bio-sampling of returning adults, 100% external marking of released juveniles, application of PIT tags, assessment of stray rates, travel-time of released juveniles through the Columbia River corridor, assessment of potential of hatchery fish to transfer diseases to wild stocks, success/failure of hatchery produced adults to reproduce naturally, use of NATURE's type rearing[2], raceway density studies, genetic comparisons of hatchery and wild stocks, and feed (fish food) evaluations, among others. The sport harvest in Icicle Creek is also closely monitored to measure potential impacts to the listed stocks.

State program

Program operations for the various species raised under the RIFHC are as follows:

Sockeye
Broodstock is captured at Tumwater Dam on the Wenatchee River. Adults are hauled to Lake Wenatchee, where they are held and spawned. Eggs are then incubated and early reared at Eastbank Hatchery. The hatchery production level is currently 200,000 subyearlings, reared in net pens in Lake Wenatchee from July through November. Sockeye are released at two different times (August and November) in an effort to reduce post-release mortality.

Under the Chelan PUD's HCP, compensation for sockeye for the Wenatchee independent population could be increased, but not until 2013.

Spring Chinook
Returning spring Chinook adults are collected at a weir on the Chiwawa River and a ladder trap at Tumwater Dam. Fish are then hauled to Eastbank Hatchery, where they are spawned, incubated and reared until the following October.

[2] NATURE's rearing is a "hands off" approach where artificial substrate and woody debris is added to the raceways. Automatic feeders are also utilized, negating the need to "hand feed".

Production at Eastbank Fish Hatchery has varied considerably since the program began with brood year 1989. The variability in production is a function of poor adult returns, inefficient traps, and different broodstock collection strategies stemming from adaptive management strategies for this population. Smolt production from the Eastbank Fish Hatchery has averaged 116,012 smolts annually, representing 17.3% of the interim production level (672,000) identified in the BAMP (1998). Under the Chelan PUD's HCP, compensation for spring Chinook for the Wenatchee independent population could be decreased, possibly prior to 2013.

Summer Chinook

Artificial production of summer Chinook for the Wenatchee Subbasin is run under the RIFHC. Summer Chinook production at Eastbank Hatchery is intended to mitigate for summer Chinook losses at Rock Island Dam. The production level for the Wenatchee River is a total of 864,000 yearling summer Chinook at 10 fish/lb (BAMP 1998).

Broodstock (492 adults) are collected at the left and right bank Dryden traps and Tumwater Dam trapping facility and transported to the Eastbank Hatchery. Incubation, spawning, and initial rearing of Wenatchee summer Chinook take place at the Eastbank facility. The fish are then transferred to the Dryden Acclimation Pond towards the end of their second winter, where they are volitionally released at smolt size (10fish/lb.) into the Wenatchee River in April-May.

Summer Steelhead

Adult Wenatchee River summer steelhead are collected for broodstock from the run-at-large at the right and left bank Dryden Dam traps and Tumwater Dam. The program goal is to collect a minimum of 50% natural origin adults and to exclude progeny of HxH matings in the hatchery component. Due to adult steelhead holding temperatures at Eastbank FH, steelhead are transferred to, held, and spawned at Wells FH. Incubation and final rearing occurs at Eastbank FH facilities.

The annual release goal For Eastbank FH is 400,000 smolts into the Wenatchee River, Nason Creek, and Chiwawa River basins however, smolt production from the Eastbank Fish Hatchery has averaged 266,632 smolts annually, representing 66.7% of the interim production level identified in the BAMP (1998).

Non-anadromous fish releases

Non anadromous fish have been planted within the Wenatchee Basin since the early 1900s. Rainbow trout, cutthroat trout, brook trout, and a few brown trout have all been planted at various times through multiple hatchery programs.

Following micro-habitat work in the 1980s that showed negative effects on pre-smolt steelhead from "catchable" releases of rainbow trout, all releases of rainbow were shifted from streams to various lakes within the basin which did not have connectivity to anadromous areas.

Yakama Nation Program

Coho

Adult coho salmon are collected by the Tribe from the run-at-large primarily from the right and left bank Dryden Dam traps. In years when insufficient numbers of coho are taken at Dryden Dam, supplemental broodstock may be collected at Tumwater Dam, Dam 5 on Icicle Creek, and/or the LNFH fishway. Currently the program collects naturally produced coho in the proportion in which they occur within the run. Adult coho are transferred to Entiat National Fish Hatchery where they are held and spawned by the YN and USFWS. Coho eggs are incubated at Entiat National Fish Hatchery, YN's Peshastin Incubation Facility, and in some years, Leavenworth NFH. Upon reaching between 500 and 600 temperature units, the coho eggs are transferred to Willard National Fish Hatchery and Cascade FH for rearing. Eagle Creek National Fish Hatchery was a rearing facility for coho released in mid-Columbia tributaries brood years 1998 and 2000. Eagle Creek National Fish Hatchery may be used as a rearing facility again in the future. Coho smolts produced from adult returns to the Methow River have been released in the Wenatchee Basin. Currently in the feasibility phase, changes in rearing, incubation, and acclimation facilities may continue to occur. Details on mating protocols, rearing and acclimation strategies, size at release and monitoring and evaluation can be found in the Yakama Nation's Mid-Columbia Coho HGMP (YN et al.2002).

Under the feasibility study, the Wenatchee River coho release goal is 1,000,000 smolts. Over one-half of smolts are currently released into Icicle Creek from Dam 5 and/or LNFH small Foster Lucas Ponds, for the purpose of broodstock development. The remainder of the coho smolts are acclimated and released from small natural ponds near suitable coho spawning and rearing habitat in Nason Creek, Beaver Creek, and the Little Wenatchee River. The actual numbers locations of coho release are re-evaluated annually.

Conservation of the Species: The capture of endangered UCR spring Chinook salmon and summer steelhead by WDFW for artificial propagation efforts are designed to benefit the species. The primary objectives of these efforts are to preserve extant spring Chinook and steelhead populations in the region, and to boost the abundance of remaining stocks. There are risks of ecological and genetic impacts to the ESA-listed juvenile and adult spring Chinook salmon and steelhead resulting from the proposed programs. However, the risk of extinction to natural populations is high enough that aggressive intervention is required.

Genetic and Ecological Effects on Natural Populations: The genetic risks to naturally produced populations from artificial propagation include reduction in the genetic variability (diversity) among and within populations, genetic drift, selection, and domestication which can contribute to a loss of fitness for the natural populations (Hard *et al.*1992; Cuenco *et al.* 1993; NRC 1996; and Waples 1996).

Disease interactions between hatchery fish and listed fish in the natural environment may be a source of pathogen transmission. Because 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; Håstein and Lindstad 1991).

To address concerns of potential disease transmission from hatchery to natural 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.

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 for space and cover in the Wenatchee River probably occurs between hatchery and natural fish shortly after release and during downstream migration, but based on the smolt travel times the duration of interaction is minimal in the river (WDFW 1998a). Rearing and release strategies at all WDFW salmon and steelhead hatcheries are designed to limit adverse ecological interactions through minimizing the duration of interaction between newly liberated hatchery salmon and steelhead and naturally produced fish.

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).

Hatchery salmonids that do not emigrate after release are said to have residualized. These fish that residualize can adversely affect naturally produced fish through competition and predation. Chinook salmon do not tend to residualize (Groot and Margolis 1991), thus no effects are expected on natural UCR spring Chinook salmon or steelhead in the Wenatchee River.

Harvest Management: Fish harvest in the Columbia River basin affects the listed species by incidentally taking them in fisheries that target non-listed species. The largest potential impacts on UCR spring Chinook and steelhead come from treaty Indian and non-tribal fisheries in the Columbia River mainstem and potentially tributaries (Icicle Creek) (Myers *et al.* 1998).

A sport fishery for steelhead in the UCR has been authorized under Section 10 Permit 1395. In years when the escapement of hatchery origin steelhead is greater than expected (i.e., over-escapement) the fishery was specifically designed to remove excess hatchery fish from the spawning grounds with minimal impacts to the natural origin steelhead.

Domestication of Hatchery Fish: Another concern of the artificial propagation of salmon is domestication, which is the change in quantity, variety, and combination of alleles within a captive population or between a captive population and its source population in the wild that are

the result of selection in an artificial environment (Busack and Currens 1995). Domestication occurs because putting fish into an artificial environment for all or part of their lives imposes different selection pressures on them than does the natural environment. The concern is that domestication effects will decrease the performance of hatchery fish and their descendants in the wild. The concern is that hatchery fish selected to perform well in a hatchery environment tend to not perform well when released into the wild due to the difference between the hatchery and the wild environments. Potential impacts to the natural population occur when the hatchery fish spawns in the wild and the resulting performance of the natural population is reduced due to outbreeding depression (Busack and Currens 1995). The selection of broodstock is a common source of biased sampling. In general, broodstock selection should be random but bias occurs when selection is based on particular traits. Genetic changes due to unintentional selection can be caused by the hatchery environment, which allows more fish to survive compared to the natural environment. The elimination of all risks due to genetic diversity loss and domestication is not possible, but NOAA Fisheries believes that these risks can be minimized through the following measures proposed for the adult supplementation program:

- Address genetic concerns regarding selectivity, the collection of adult broodstock at traps for the supplementation program shall be representative of the run-at-large with respect to natural and hatchery parentage, migration timing, age class, morphology, and sex ratio;
- Provide that a proportion of each population that will not be subjected to artificial propagation and the associated potential risk of negative genetic effects, upstream escapement goal of approximately 80 adults per population will be maintained as a minimum level for natural spawning when escapement to Wells Dam is greater than 668 adults;
- An effective population size (N_e) of 500 fish per population per generation should be the *long-term* program production objective to maintain an adequate genetic base, even thought an N_e of at least 50 adults per generation is required to reduce the risk of inbreeding depression and genetic drift in the short term (fewer than 5 salmon generations) (BAMP 1998). If fewer adults are available, production can be scaled to ensure that hatchery-origin progeny do not overwhelm the population as a whole;
- Rear fish at minimum pond loading densities to reduce the risk of domestication effects and;
- Eliminate of Carson-stock spring Chinook (a highly domesticated stock) that will further reduce potential genetic effects.

Monitoring and Evaluation*:* The evaluation plan includes genetic monitoring of the hatchery and naturally produced fish, migration timing and survival of the hatchery releases, and studies to evaluate interaction between hatchery and naturally produced fish. Monitoring and evaluation of the hatchery programs in the Methow River is on-going. The plan for the adult-based supplementation program addresses three critical uncertainties associated with the program:

- whether the hatchery facilities can safely meet their production objectives;
- the effect of the programs on the long-term reproductive success of the population in the natural environment;
- the identification of ways to operate the facilities to reduce the short-term ecological impacts to the naturally produced fish (WDFW 1998a).

Adaptive Management
The monitoring and evaluation program will also provide data that can be used to change the program if the results suggest doing so. The monitoring and evaluation programs will also provide invaluable data on the use of supplementation to conserve and recover ESA-listed salmon species.

Tribal Harvest Allocations
All hatchery programs in the Methow Basin are currently included in the Columbia River Fish Management Plan (i.e., US *v.* Oregon).

IV. Program Success

Federal program

Adult returns: Chapman et al. (1995) compared the number of smolts[3] released to the number of adults returning to the Wenatchee, Entiat, and Methow rivers. For fish returning to the Wenatchee River, the smolt-to-adult survival averaged 0.45% (range: 0.14 - 0.99%, corrected for inter-dam loss, and incidental in-river and ocean harvest) between release year 1978 and 1990. Shelldrake (1993) lists the smolt-to-adult survival goal as 0.5%, which he shows as the five year average (range 0.12-0.92%). Mullan et al. (1992) report the mean smolt-to-adult survival of fish from Leavenworth NFH from 1976 - 1988 as 0.55% (range: 0.21-0.70%). They conclude,

> *The universal presence of bacterial kidney disease (BKD) in hatchery stocks is a prime suspect for the poor returns of Chinook salmon. Equally obvious is that the behavior of Chinook salmon in hatcheries is conditioned differently from that of wild fish. Large age-0 and yearling Chinook salmon smolts released to Icicle Creek were not cover-oriented, remained at the water surface and drifted downstream in the thalweg regardless of season or time of day, and had no apparent social structure, and were hyperactive . . . Recently hatched fry released to Icicle Creek, by contrast quickly removed themselves from the strong currents and mimicked the behavior of naturally produced Chinook . . . Behavior and BKD in hatchery Chinook is related . . .*

While the return per release of adult Chinook may be low, hatchery fish have still made up the majority of returning fish to the Wenatchee River in most years since the 1960s. Hatchery fish have made up greater than 50% of the run in practically every year since 1980. The percentage of hatchery fish in the spring Chinook run in the Wenatchee River appears to be increasing in recent years, probably as a result of increased smolt-to-adult survival in the early 1990s.

[3] They did not account for fry or parr releases in our estimates, or fish released in the fall or winter. While it is probable that these fish have made some contribution to the returning adults, they were unsure how to represent post release mortality (i.e., how many of the fish actually migrated downstream). Considering this, the estimates of smolt-to-adult survival that they derived should be considered biased upward.

The sport and tribal harvest in Icicle Creek, which is entirely attributed to LNFH, is the only fishery on spring Chinook in the upper-Columbia Region. For years 1984 to 2001, an average of 6,005 adults (range= 484 to 15,082) of LNFH origin have returned to the Wenatchee River Basin.

State program

Viable Populations:

Spring Chinook
Based on parr production, supplementation appears to be improving the Chiwawa spring Chinook population to some degree (Hillman and Miller 2002). However, it is difficult to quantify because the potential trends observed by Hillman and Miller need to be combined with population estimates and survival rates from reference areas before the total "picture" is known.

Summer Chinook
High escapements of summer Chinook in the Wenatchee Basin in recent years have been positively influenced in part by the hatchery program at Dryden Pond. A goal of a supplementation program is to increase the number of spawners by allowing hatchery fish to spawn naturally. Subsequent increases in the number of naturally produced fish on the spawning grounds would support the hypothesis that hatchery fish contributed to future adult returns.

Steelhead
An increase in the number of wild fish incorporated into the broodstock would reduce any potential genetic impacts to the wild fish. In the Wenatchee Basin, near equal proportions of hatchery and naturally produced adults allows for a broodstock composition that minimizes potential genetic impacts.

Sockeye
Poor post release survival (i.e., predation) likely reduced the survival rates of the Wenatchee sockeye program. Recent changes to the size and time of release have significantly increased the post release survival of the hatchery fish. Subsequent adult returns are not complete, but are expected to be much greater than previously reported.

Contribution of adults to recovery or harvest:
Returning adults from these programs are intended to increase to naturally spawning populations. The hatchery programs have successfully contributed adults to the naturally spawning populations. However, harvest does occur in years of high abundance on summer chinook and sockeye.

Smolt to adult return rates for Chiwawa spring chinook averaged 0.33 for brood years 1989 through 1997 (range: 0.04-0.96). For Wenatchee steelhead, smolt to adult returns averaged 0.47 for brood years 1996 through 2000 (range: 0.12-1.24). Wenatchee sockeye averaged 0.6 for

brood years 1989 through 1997, ranging from 0.0-2.14. Wenatchee summer chinook have averaged 0.29 for brood years 1989 through 1997, ranging from 0.03-0.98.

Effects on Wild and Native Populations and Environment: Effects on the wild populations (target and non-target) will be assessed at the juvenile stage using smolt traps and when fish return as adults. The relative productivity of the spawning population will be monitored over time using smolt traps located within the Basin. Relationships between smolt production and spawner abundance (% hatchery fish on the spawning grounds) will provide information related to reproductive potential of the stocks and habitat. Relationships in productivity between stocks would also provide some information regarding competition in the freshwater environment. Smolt traps also provide information regarding trends in other species not directly associated with hatchery programs (i.e., non-target taxa of concern).

Spawning ground surveys will not only be used to develop smolt-to-adult return rates (SARs) for hatchery and wild fish, but provide information on spawn timing and distribution. Biological data collected from carcasses will also provide data concerning age and size at maturity.

Comparisons of any these parameters (juvenile or adult) between hatchery and wild fish would provide insight on the effects hatchery fish may have on wild populations. Any effects that are detected (greater than acceptable levels) would be addressed in subsequent changes in the respective hatchery program.

Yakama Nation

Coho Salmon

The first releases of coho salmon into the Wenatchee River under the YN's coho reintroduction project began in 1999. Smolt-to-Adult survival rates have ranged from 0.03% to 0.51%. The first significant adult returns of first generation mid-Columbia brood coho occurred in 2003 with the highest observed SAR (0.51%) since the projects inception.

Spawning ground surveys have been used to record naturally spawning coho in the Wenatchee Basin. As a direct result of the reintroduction effort, naturally spawning coho have been found in Nason Creek, Beaver Creek, Wenatchee River, Icicle Creek, Peshastin Creek, and Mission Creek. The population of naturally produced coho smolts emigrating from the Wenatchee River was estimated to be approximatelty17,054 in 2002 (BY 2000) and 36,678 in 2003 (BY 2001) (T. Miller WDFW, unpublished data).

Results of species interaction work have been equally promising. The YN has observed extremely low levels of predation by hatchery coho smolts on spring chinook fry as demonstrated through several predation evaluations in the Wenatchee and Yakima Rivers. Studies to evaluate predation by naturally produced coho on spring chinook fry are in the early stages. Two years of microhabitat and competition evaluations indicated that naturally reared coho parr selected different habitats than spring chinook parr or steelhead.

Entiat Subbasin

I. Introduction

Various processes are underway within the Columbia Basin that direct hatchery program implementation. The listing of certain populations of fish under the ESA has also dictated hatchery program modifications and reform.

Some of the principal processes are:

Federal:

Hatchery and Genetic Management Plans:
The Hatchery and Genetic Management Plan (HGMP) process was initiated to identify offsite mitigation opportunities associated with operation of the Federal Columbia River Power System. The HGMP process is designed to describe existing propagation programs, identify necessary or recommended modifications of those programs, and help achieve consistency of those programs with the Endangered Species Act. The HGMP process only addresses anadromous salmon and steelhead programs.

Hatchery and Genetic Management Plans are described in the final salmon and steelhead 4(d) rule (July 10, 2000; 65 FR 42422) as a mechanism for addressing the take of certain listed species that may occur as a result of artificial propagation activities. NOAA Fisheries will use the information provided by HGMPs in evaluating impacts on anadromous salmon and steelhead listed under the ESA. In certain situations, the HGMPs will apply to the evaluation and issuance of section 10 take permits. Completed HGMPs may also be used for regional fish production and management planning by federal, state, and tribal resource managers.

The primary goal of the HGMP process is to devise biologically-based artificial propagation management strategies that ensure the conservation and recovery of listed Evolutionarily Significant Units (ESUs). The HGMP process also seeks to document and implement hatchery reform in the Columbia Basin. Much of the initial work on the HGMP process was coordinated and combined with efforts to complete the Artificial Production Review and Evaluation (APRE – see below)) analysis, which looked at the same sorts of information.

Artificial Production Review and Evaluation (APRE):

The APRE process seeks to document progress toward hatchery reform in the Columbia Basin. The NPCC used consultants and representatives of the Columbia Basin fishery managers to analyze existing programs and recommend reforms; a draft report that will go to the Council and the region has been prepared. The APRE process includes both anadromous and non-anadromous fish in its analysis.

Pacific Coastal Salmon Recovery Fund

The Pacific Coastal Salmon Recovery Fund (PCSRF) was established in FY2000 to provide grants to the states and tribes to assist state, tribal and local salmon conservation and recovery efforts. The PCSRF was requested by the governors of the states of Washington, Oregon, California and Alaska in response to Endangered Species Act (ESA) listings of West Coast salmon and steelhead populations. The PCSRF supplements existing state, tribal and federal programs to foster development of federal-state-tribal-local partnerships in salmon recovery and conservation; promotes efficiencies and effectiveness in recovery efforts through enhanced sharing and pooling of capabilities, expertise and information. The goal of the Pacific Coastal Salmon Recovery Fund is to make significant contributions to the conservation, restoration, and sustainability of Pacific salmon and their habitat.

The PCSRF's enhancement objective is*: To conduct activities that enhance depressed stocks of wild anadromous salmonids through hatchery supplementation, reduction in fishing effort on depressed wild stocks, or enhancement of Pacific salmon fisheries on healthy stocks in Alaska. This includes supplementation and salmon fishery enhancements*.

US v. OR

United States v Oregon, originally a combination of two cases, Sohappy v. Smith and U.S. v. Oregon, legally upheld the Columbia River treaty tribes reserved fishing rights. Specifically the decision acknowledged the treaty tribes reserved rights to fish at "all usual and accustomed" places whether on or off the reservation, and were furthermore entitled to a "fair and equitable share" of the resource. Although the Sohappy case was closed in 1978, U.S. v. Oregon remains under the federal court's continuing jurisdiction serving to protect the tribes treaty reserved fishing rights. This case is tied closely to U.S. v. Washington, which among other things defined "fair and equitable share" as 50 percent of all the harvestable fish destined for the tribes' traditional fishing places, and established the tribes as co-managers of the resource.

In 1988, under the authority of U.S. v. Oregon, the states of Washington, Oregon and Idaho, federal fishery agencies, and the treaty tribes agreed to the Columbia River Fish Management Plan (CRFMP), which was a detailed harvest and fish production process. There are no financial encumbrances tied to the process. Rather, the fish production section reflects current production levels for harvest management and recovery purposes, since up to 90% of the Columbia River harvest occurs on artificially produced fish. This Plan expired in 1998, and has had subsequent annual rollover of portions in which agreement has been reached. However, a newly negotiated CRFMP is forthcoming.

Hatchery production programs in the upper Columbia sub-basins are included in the management plans created by the fishery co-managers identified in the treaty fishing rights case *United States v Oregon*. The parties to *U.S. v Oregon* include the four Columbia River Treaty Tribes – Yakama Nation, Warm Springs, Umatilla, and Nez Perce tribes, NOAA-Fisheries, U.S. Fish and Wildlife Service, and the states of Oregon, Washington, and Idaho. The Shoshone-Bannock Tribe is admitted as a party for purposes of production and harvest in the upper Snake River only. These parties jointly develop harvest sharing and hatchery management plans that are entered as orders of the court that are binding on the parties. The "relevant co-managers" described in the *U.S. v Orego*n management plans are, for the mid-Columbia sub-basins, the federal parties, Yakama Nation, and Washington Department of Fish and Wildlife.

Hatchery programs are viewed by the Yakama Nation as partial compensation for voluntary restrictions to treaty fisheries imposed by the tribe to assist in rebuilding upriver populations of naturally-spawning salmonids. Because treaty and non-treaty fisheries are restricted on the basis of natural stock abundance, the tribal priority is to use hatcheries in a manner that supplements natural spawning and increases average population productivity. Perspectives on the appropriate use of hatchery-origin fish for supplementation vary between federal, state, and tribal fish co-managers. Federal and, to a lesser degree, state co-managers place a higher priority on managing the genetic risks of hatchery supplementation of natural populations, while the tribe sees the demographic threats of habitat loss and degradation as the greater risk to natural populations. In general, however, all parties agree that hatcheries can and should be operated as integral components of natural populations where the survival benefits of the hatchery can result in a significant increase in net population productivity.

ESA

Current ESA Section 10 Permits for listed summer steelhead (Permit #1395); listed spring chinook (Permit #1196) and non-listed anadromous fish (Permit # 1347) also direct artificial production activities associated with the habitat conservation plans. Douglas PUD, Chelan PUD and WDFW are co-permittees, therefore provisions within the permits and associated Biological Opinions are incorporated into the hatchery programs undertaken in the HCP's.

State:

The state, along with the federal government have various forums in which they are active. All have some role in determining or balancing artificial production programs, as well as the ones that follow under "other". Essentially no specific action would occur until the action is determined to be warranted in the already established processes.

Other:

<u>FERC processes:</u>

Under current settlement agreements and stipulations, the three mid-Columbia PUDs pay for the operation of hatchery programs within the Columbia Cascade Province. These programs determine the levels of hatchery production needed to mitigate for the construction and continued operation of the PUD dams.

<u>Habitat Conservation Plans:</u>

In 2002, habitat conservation plans (HCPs) were signed by Douglas and Chelan PUDs, WDFW, USFWS, NOAA Fisheries, and the Colville Confederated Tribes. The overriding goal of the HCPs are to achieve no-net impact[4] on anadromous salmonids as they pass Wells (Douglas PUD), Rocky Reach, and Rock Island (Chelan PUD) dams. One of the main objectives of the

[4] NNI refers to achieving a virtual 100% survival of anadromous salmonids as they pass the mainstem projects. This is achieved through 91% survival of adults and juveniles (or 93% for juveniles) passing the projects, and 7% compensation through hatchery programs and 2% contribution through a tributary fund, which will fund projects to improve salmonid habitat in the tributaries.

hatchery component of NNI is to provide species specific hatchery programs that may include contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest.

Biological Assessment and Management Plan:
The biological assessment and management plan (BAMP) was developed by parties negotiating the HCPs in the late 1990s. The BAMP was developed to document guidelines and recommendations on methods to determine hatchery production levels and evaluation programs. It is used within the HCP as a guiding document for the hatchery programs.

All of these processes affect the hatchery programs within the Entiat River Basin in one way or another.

Historic programs
Historically, fish have been released as part of the GCFMP beginning in the 1940s. Chinook, sockeye, steelhead and some coho were released as part of that program. Until about 8 years ago, steelhead were also released as part of a state program that was funded by Chelan PUD for mitigation for the operation of Rocky Reach and Rock Island dams.

Current programs
Current program overview: Currently, the Entiat NFH is the only hatchery program within the Entiat Basin. The BAMP identifies the Entiat as a potential reference stream, where no hatcheries would be directly influencing the population dynamics.

Facility description: The hatchery, 6.7 miles upstream from the confluence with the Columbia River, has 2 – 16 x 120 foot adult holding ponds, 30 – 8 x 80 raceways, and 32 starter tanks. Fish returning to Entiat NFH must travel about 491 river miles and negotiate passage through eight Columbia River hydroelectric dams.

In the past, the primary water source for the hatchery was the Entiat River. The current program utilizes ground water as the primary source. In 1996, the water rights for the river source (surface) and wells (ground) were combined for a total allotment of 22.5 cfs. The water right for Limekiln Spring is 7 cfs or 3,142 gpm. The hatchery water intake is located at river mile 7.2, approximately 1/3 mile upstream of the hatchery. The intake structure consists of a diversion dam, intake well, and bar trash-racks. Screening for the system is in compliance with current standards.

Surface water is used on a limited basis. It has been determined that Entiat River water contains high organic loads and detrimental parasites *(Myxobolus sp.)* which have been shown to have a negative impact on hatchery fish production. Since 1990, hatchery production has relied primarily on ground and spring water for fish production. The availability of said ground water determines fish production numbers at ENFH.

While there have been no coho releases to date in the Entiat River basin, the Yakama Nation's coho reintroduction project includes future plans to reintroduce coho salmon to the Entiat River (Yakama Nation et al. 2002), and is identified as a priority in the *Wy-Kan-Ush-Mi-Wa-Kish-Wit* document (Tribal Restoration Plan). Reintroduction methods would likely be similar to efforts in the Wenatchee and Methow sub-basins (Yakama Nation et. al. 2002***),*** As a direct result of the current coho reintroduction efforts in the Wenatchee and Methow Rivers, some natural coho production has been documented in the Entiat River.

II. Program Goals and Objectives

Federal program

Grand Coulee Fish Maintenance Project (GCFMP)

The USFWS operates the Leavenworth NFH Complex in the CCP region constructed by the U.S. Bureau of Reclamation (BOR) to replace fish losses that resulted from construction of Grand Coulee Dam. These programs were authorized as part of the Grand Coulee Fish Maintenance Project (GCFMP) on April 3, 1937, and re-authorized by the Mitchell Act (52 Stat. 345) on May 11, 1938. The complex consists of three hatchery facilities, Leavenworth, Entiat, and Winthrop NFHs, with the following mission:

*"To produce high quality spring Chinook salmon and summer steelhead smolts commensurate with the production goals established by the Columbia River Fisheries Management Pla*n" (USFWS 2002a)

Objectives originally established for the Leavenworth Hatchery Complex, as part of the GCFMP were (from Calkins et al. 1939):

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 the earlier undisturbed conditions and with the natural food supply in the streams.*

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.*

Current objectives of the USFWS hatcheries are outlined in USFWS (1986a, b). In the USFWS Statement of Roles and Responsibilities, the broad roles of the hatcheries are,

. . . to seek and provide for mitigation of fishery resource impairment due to Federal water-related developments . . . the Fishery Resource Program goal, in fulfilling its mitigative responsibilities, is to ensure that established and future fishery resource mitigation requirements are fully and effectively discharged. Implicit in this goal is the replacement of fishery resource losses caused by specific Federal projects . . . and another responsibility of the Leavenworth Hatchery . . . is to restore depleted Pacific salmon and steelhead stocks of national significance in accord with statutory mandates such as the Pacific Northwest Electric Power Planning and

Conservation Act, Mitchell Act, Salmon and Steelhead Conservation Act, Pacific Salmon Treaty Act of 1985 and Indian Treaties and related Court decisions.

Shelldrake (1993) updated the objectives of the mid-Columbia NFHs:

- *Hatchery production* [specific to each facility].
- *Minimize interaction with other fish populations through proper rearing and release strategies.*
- *Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.*
- *Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.*
- *Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.*
- *Communicate effectively with other salmon producers and managers in the Columbia River Basin.*

The initial plan for the operation of the Leavenworth Hatchery Complex (Leavenworth, Entiat and Winthrop NFHs) called for the collection of adult salmon and steelhead at Rock Island Dam and transport to the hatchery for holding and spawning. Eggs and juveniles would subsequently be shipped to the satellite facilities. Sockeye (*O. nerka*), Chinook, and steelhead were the species of emphasis, and later coho were added. Sockeye production ended in the 1960s because of low survival, and disease problems (USFWS 1986a). Coho production also ended in the 1960s

The hatcheries built as part of the GCFMP began operation in the early 1940s at Leavenworth (Icicle Creek, a tributary of the Wenatchee River), Entiat, and Winthrop (Methow River). The Leavenworth facility was built as the main hatchery site, and the Entiat and Winthrop hatcheries as substations. These hatcheries were built as part of the program to relocate populations of salmon and steelhead that formerly ascended the Columbia River upstream from the Grand Coulee Dam site.

Yakama Nation Program

The long-term goal of the YN/BPA Mid-Columbia Coho Reintroduction Feasibility Project is to reestablish naturally reproduction coho salmon populations in mid-Columbia river basins (Wenatchee, Entiat, and Methow), with numbers at or near carrying capacity that provide opportunities for harvest (YN et.al. 2002). This long-term goal is closely tied to the vision of reintroduction of coho to the Yakima basin and to other areas from which the species has been eliminated. Mid-Columbia coho reintroduction is identified as a priority in the *Wy-Kan-Ush-Mi-Wa-Kish-Wit* document (Tribal Restoration Plan) and by the four Columbia River Treaty Tribes and has been affirmed as a priority by the Northwest Power Planning Council.

The short term goals of the feasibility phase, expected to last through 2004, is to determine whether a broodstock can be developed from Lower Columbia River coho stocks, whose progeny can survive in increasing numbers to return as adults to the mid-Columbia Region, and

to initiate natural reproduction in areas of low risk to sensitive species and in other select areas to study the risks and interactions with sensitive species (YN et al. 2002). Studies done in this phase will inform future decisions about whether the long-term vision can be achieved. Reintroduction of coho into the Entiat sub-basin may occur after 2004 as the YN is preparing a proposal which involves an initial release of up to 200,000 smolts in 2005 from yet-to-be-determined acclimation sites in the basin. Many of the studies regarding coho residualism, survival, species interactions, competition, and predation, which have been conducted in the Yakima, Wenatchee and Methow rivers are transferable and will be used to implement a long term program in the Entiat sub-basin.

III. Program Operations

Entiat NFH released Spring Chinook that originated from commingled upriver stocks intercepted at Rock Island Dam in 1942 and 1944. Annual reports dating from 1945-1974, indicate that the facility produced summer Chinook, spring Chinook, sockeye, coho, rainbow and steelhead trout either as smolts, fry releases, catchables, and/or eyed egg transfers. Racks were installed across the river as a barrier to deflect returning adult salmonids into the facility. This practice of blocking the river began when water flows permitted work to be done in the river, typically late May early June. Racks were removed usually in November before ice became a problem.

On March 15th, 1951, Entiat NFH was transferred to the Branch of Fishery Biology to serve as a salmon cultural laboratory headed by Roger E. Burrows. Both experimental and production operations were performed. Studies included feeding trials, pituitary, hydraulic, development, and incubation experiments.

In 1953 an electric weir was installed on an experimental basis across the Entiat River to block upstream migration and to ensure adult brood stock collection. The weir was designed similar to electric weirs used in the Great Lakes to control sea lampreys. It consisted of 50, 1.5" pipe electrodes, suspended vertically at 3 foot intervals at an angle across the river. A 1.5"pipe ground line was also installed 15 feet below the electrodes following the contour of the river and parallel to the electrode line. The weir was charged by 110 volt, 60 cycle alternating current. Steelhead, Dolly Varden and other trout were passed above the weir when captured in the holding pond. In 1954, due to the effectiveness of the electric weir at higher water flows some spring Chinook were capture and spawned in August. Of the 903,410 Chinook eggs taken in 1954, 35% were derived from spring Chinook. Sockeye eggs were also taken that year and subsequently shipped to Leavenworth NFH for further rearing. In 1954, the state of Washington negotiated an escapement of 50% for Chinook returning to the Entiat. In 1955, an estimated 200 adults reached spawning grounds above the facility. In 1956, escapement was believed to be over 1000 spring and summer Chinook. The goal at that time was to allow all returning spring Chinook to pass while retaining the summer run for artificial propagation.

On March 1st, 1961 the Entiat NFH was no longer a "Salmon Cultural Laboratory" and was returned to a production facility. The hatchery began to rear rainbow trout as well as Chinook salmon. Rainbow trout were distributed to areas on the Yakama Indian Reservation, Nason and Icicle Creeks, juvenile ponds in Cashmere, WA and the Entiat River. Planting areas expanded in 1963 to include areas on the Warm Springs Reservation, Peshastin and Douglas creeks, and Lilly

and Clear Lakes. Distributions of Cutthroat trout were also made. Annual reports do not specify whether or not the electric weir was in operation. Reports do state that the State of Washington was trapping Chinook at Rocky Reach Dam for the Chinook program at Turtle Rock. Releases of coho salmon smolts began in 1965 and continued until 1970. It appears from the records that the eggs for the Coho program were shipped from Little White Salmon NFH. Records do not indicate why programs started and/or stopped. There were comments about significant trapping taking place at the newly constructed Rocky Reach Dam in the 60's.

In 1974, Spring Chinook salmon smolt production resumed with eggs from several locations; Cowlitz River (1974), Carson NFH (1975-1982), Little White Salmon NFH (1976, 1978, 1979, 1981), Leavenworth NFH (1979-1981, 1994) and Winthrop NFH (1988). Returning adults have voluntarily entered the fish trap at the facility and have been the primary brood stock for the station in 1980, and from 1982 to 2002 (Cooper et. al. 2002).

Adult spring Chinook salmon return to the hatchery beginning in early to mid-May. The escapement goal for the hatchery is 350 adults for a subsequent release of 400,000 smolts. Extra adults are spawned because of an aggressive program to cull diseased eggs. Bacterial Kidney Disease (BKD) is prevalent at this facility, and highly infected eggs are taken out of production. Spawning begins in mid-August and can continue into mid-September. The ENFH stock of spring Chinook salmon is not listed under the Endangered Species Act (ESA).

All brood stock used for production are volunteers to the facility. Adults swim up the collection ladder and into one of two holding ponds. The holding ponds measure 16 x 120 feet and are supplied with a mixture of surface and ground water for attraction and operation of the ladder.

The ladder operates throughout the entire run spectrum. The goal is to collect all returning hatchery adults so they don't mix and spawn with the listed natural stock found in upriver areas. Excess adults are periodically donated to various tribes for subsistence and ceremonial purposes.

All adult crosses (matings) are randomly made, no selection occurs. Spawning occurs once per week and all females that are ripe on that day are spawned.

Juveniles are released as yearlings annually, in early to mid-April. The yearlings are "force" released directly into the Entiat River when the majority is in a smolt or pre-smolt stage. All juveniles released from ENFH are adipose fin-clipped. With 100% marking of released juveniles, the potential for harvest increases while also strengthening our ability to evaluate ecological affects.

Throughout the years, the spring Chinook release goal at ENFH has varied considerably. The current goal is 400,000 smolts annually. For years 1976 to 2001, the average yearling release was 576,660 fish.

As previously mentioned, the stock of spring Chinook propagated at ENFH is not listed under the ESA. All other stocks found in the Entiat River Basin are listed as "endangered". Therefore, the potential is greater that the program may have a negative influence on the listed stocks present. Potential genetic and ecological affects to the natural population includes; predation,

competition, residualism, genetic introgression to natural stocks, and transmission of diseases or parasites. For a description of these effects, please refer to the Hatchery and Genetic Management Plan (HGMP) for this hatchery.

Current evaluation practices include: bio-sampling of returning adults, 100% external marking of all juveniles released, application of PIT tags, assessment of stray rates, travel-time of released juveniles through the Columbia corridor, assessment of potential for hatchery fish to transfer diseases to wild fish, success/failure of hatchery adults spawning naturally, use of NATURE's type rearing,[5] raceway density studies, genetic comparison of hatchery and wild stocks, and feed (fish food) evaluations, among others.

The Leavenworth NFH Complex (Leavenworth, Entiat, and Winthrop NFH's) has a team comprised of staff from the hatcheries, Fish Health, and Mid-Columbia River Fishery Resource Office. This team (Hatchery Evaluation Team) meets twice annually and part of its charge is to evaluate data obtained from on- and off-station studies. If the team decides that the data warrants a change, their request is elevated to supervisors for review or is simply implemented.

IV. Program Success

Entiat NFH was constructed to mitigate for lost habitat due to the construction of Grand Coulee Dam. The primary objective of this facility is to provide fish for harvest. The hatchery stock, although not ESA listed, is a healthy and viable population. Although in some years excess adults were available for harvest, the spring Chinook fishery in the Entiat River has been closed since the mid-1980's. Although few in numbers, some ENFH adults are captured in the lower Columbia River fishery.

Average escapement for years 1980 to 2001 is 677 adults (range = 80 to 2,666). Although no harvest has been allowed in many years, several tribes periodically receive excess adults for subsistence and ceremonial purposes. With 100% marking of released juveniles, the potential for a fishery may increase.

Due to the ESA listing of three species of salmonids in the upper-Columbia region, the USFWS was required to complete a HGMP and numerous Biological Assessments (BA's) describing potential hatchery affects on these populations. The resulting Biological Opinion's (BiOp) are an analysis of the BA's, in which Conservation Recommendations, contained within, direct the USFWS to conduct various assessments. Some of these assessments were mentioned previously in the Monitoring and Evaluation section.

[5] NATURE's rearing is a "hands off" approach where artificial substrate and woody debris is added to the raceways. Automatic feeders are utilized, negating the need to "hand feed".

Methow Subbasin

I. Introduction

Various processes are underway within the Columbia Basin that direct hatchery program implementation. The listing of certain populations of fish under the ESA has also dictated hatchery program modifications and reform.

Some of the principal processes are:

Federal:

Hatchery and Genetic Management Plans:

The Hatchery and Genetic Management Plan (HGMP) process was initiated to identify offsite mitigation opportunities associated with operation of the Federal Columbia River Power System. The HGMP process is designed to describe existing propagation programs, identify necessary or recommended modifications of those programs, and help achieve consistency of those programs with the Endangered Species Act. The HGMP process only addresses anadromous salmon and steelhead programs.

Hatchery and Genetic Management Plans are described in the final salmon and steelhead 4(d) rule (July 10, 2000; 65 FR 42422) as a mechanism for addressing the take of certain listed species that may occur as a result of artificial propagation activities. NOAA Fisheries will use the information provided by HGMPs in evaluating impacts on anadromous salmon and steelhead listed under the ESA. In certain situations, the HGMPs will apply to the evaluation and issuance of section 10 take permits. Completed HGMPs may also be used for regional fish production and management planning by federal, state, and tribal resource managers.

The primary goal of the HGMP process is to devise biologically-based artificial propagation management strategies that ensure the conservation and recovery of listed Evolutionarily Significant Units (ESUs). The HGMP process also seeks to document and implement hatchery reform in the Columbia Basin. Much of the initial work on the HGMP process was coordinated and combined with efforts to complete the Artificial Production Review and Evaluation (APRE – see below)) analysis, which looked at the same sorts of information.

Artificial Production Review and Evaluation (APRE)
The APRE process seeks to document progress toward hatchery reform in the Columbia Basin. The NPCC used consultants and representatives of the Columbia Basin fishery managers to analyze existing programs and recommend reforms; a draft report that will go to the Council and the region has been prepared. The APRE process includes both anadromous and non-anadromous fish in its analysis.

Pacific Coastal Salmon Recovery Fund

The Pacific Coastal Salmon Recovery Fund (PCSRF) was established in FY2000 to provide grants to the states and tribes to assist state, tribal and local salmon conservation and recovery efforts. The PCSRF was requested by the governors of the states of Washington, Oregon, California and Alaska in response to Endangered Species Act (ESA) listings of West Coast salmon and steelhead populations. The PCSRF supplements existing state, tribal and federal programs to foster development of federal-state-tribal-local partnerships in salmon recovery and conservation; promotes efficiencies and effectiveness in recovery efforts through enhanced sharing and pooling of capabilities, expertise and information. The goal of the Pacific Coastal Salmon Recovery Fund is to make significant contributions to the conservation, restoration, and sustainability of Pacific salmon and their habitat.

The PCSRF's enhancement objective is*: To conduct activities that enhance depressed stocks of wild anadromous salmonids through hatchery supplementation, reduction in fishing effort on depressed wild stocks, or enhancement of Pacific salmon fisheries on healthy stocks in Alaska. This includes supplementation and salmon fishery enhancements*.

US v. OR

United States v Oregon, originally a combination of two cases, Sohappy v. Smith and U.S. v. Oregon, legally upheld the Columbia River treaty tribes reserved fishing rights. Specifically the decision acknowledged the treaty tribes reserved rights to fish at "all usual and accustomed" places whether on or off the reservation, and were furthermore entitled to a "fair and equitable share" of the resource. Although the Sohappy case was closed in 1978, U.S. v. Oregon remains under the federal court's continuing jurisdiction serving to protect the tribes treaty reserved fishing rights. This case is tied closely to U.S. v. Washington, which among other things defined "fair and equitable share" as 50 percent of all the harvestable fish destined for the tribes' traditional fishing places, and established the tribes as co-managers of the resource.

In 1988, under the authority of U.S. v. Oregon, the states of Washington, Oregon and Idaho, federal fishery agencies, and the treaty tribes agreed to the Columbia River Fish Management Plan (CRFMP), which was a detailed harvest and fish production process. There are no financial encumbrances tied to the process. Rather, the fish production section reflects current production levels for harvest management and recovery purposes, since up to 90% of the Columbia River harvest occurs on artificially produced fish. This Plan expired in 1998, and has had subsequent annual rollover of portions in which agreement has been reached. However, a newly negotiated CRFMP is forthcoming.

Hatchery production programs in the upper Columbia sub-basins are included in the management plans created by the fishery co-managers identified in the treaty fishing rights case *United States v Oregon*. The parties to *U.S. v Oregon* include the four Columbia River Treaty Tribes – Yakama Nation, Warm Springs, Umatilla, and Nez Perce tribes, NOAA-Fisheries, U.S. Fish and Wildlife Service, and the states of Oregon, Washington, and Idaho. The Shoshone-Bannock Tribe is admitted as a party for purposes of production and harvest in the upper Snake River only. These parties jointly develop harvest sharing and hatchery management plans that are entered as orders of the court that are binding on the parties. The "relevant co-managers" described in the *U.S. v Orego*n management plans are, for the mid-Columbia sub-basins, the federal parties, Yakama Nation, and Washington Department of Fish and Wildlife.

Hatchery programs are viewed by the Yakama Nation as partial compensation for voluntary restrictions to treaty fisheries imposed by the tribe to assist in rebuilding upriver populations of naturally-spawning salmonids. Because treaty and non-treaty fisheries are restricted on the basis of natural stock abundance, the tribal priority is to use hatcheries in a manner that supplements natural spawning and increases average population productivity. Perspectives on the appropriate use of hatchery-origin fish for supplementation vary between federal, state, and tribal fish co-managers. Federal and, to a lesser degree, state co-managers place a higher priority on managing the genetic risks of hatchery supplementation of natural populations, while the tribe sees the demographic threats of habitat loss and degradation as the greater risk to natural populations. In general, however, all parties agree that hatcheries can and should be operated as integral components of natural populations where the survival benefits of the hatchery can result in a significant increase in net population productivity.

ESA

Current ESA Section 10 Permits for listed summer steelhead (Permit #1395); listed spring chinook (Permit #1196) and non-listed anadromous fish (Permit # 1347) also direct artificial production activities associated with the habitat conservation plans. Douglas PUD, Chelan PUD and WDFW are co-permittees, therefore provisions within the permits and associated Biological Opinions are incorporated into the hatchery programs undertaken in the HCP's.

State:

The state, along with the federal government have various forums in which they are active. All have some role in determining or balancing artificial production programs, as well as the ones that follow under "other". Essentially no specific action would occur until the action is determined to be warranted in the already established processes.

Other:

FERC processes:

Under current settlement agreements and stipulations, the three mid-Columbia PUDs pay for the operation of hatchery programs within the Columbia Cascade Province. These programs determine the levels of hatchery production needed to mitigate for the construction and continued operation of the PUD dams.

Habitat Conservation Plans:

In 2002, habitat conservation plans (HCPs) were signed by Douglas and Chelan PUDs, WDFW, USFWS, NOAA Fisheries, and the Colville Confederated Tribes. The overriding goal of the HCPs are to achieve no-net impact[6] on anadromous salmonids as they pass Wells (Douglas PUD), Rocky Reach, and Rock Island (Chelan PUD) dams. One of the main objectives of the

[6] NNI refers to achieving a virtual 100% survival of anadromous salmonids as they pass the mainstem projects. This is achieved through 91% survival of adults and juveniles (or 93% for juveniles) passing the projects, and 7% compensation through hatchery programs and 2% contribution through a tributary fund, which will fund projects to improve salmonid habitat in the tributaries.

hatchery component of NNI is to provide species specific hatchery programs that may include contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest.

Biological Assessment and Management Plan:
The biological assessment and management plan (BAMP) was developed by parties negotiating the HCPs in the late 1990s. The BAMP was developed to document guidelines and recommendations on methods to determine hatchery production levels and evaluation programs. It is used within the HCP as a guiding document for the hatchery programs.

All of these processes affect the hatchery programs within the Methow River Basin in one way or another.

Historic and current programs and facilities

Historic programs

The first hatcheries that released salmonids in the mid-Columbia Basin began operation in 1899 near the confluence of the Twisp River on the Methow River (WDFG 1899). This hatchery was built to replenish the salmon (primarily chinook, and coho) runs, which had virtually been eliminated by the 1890s (Gilbert and Evermann 1895; WDFG 1898).

The biggest problems encountered in the early years of the hatcheries were lack of fish for broodstock, and because of irrigation diversions that entrained large numbers of juveniles (both naturally- and artificially produced; WDFG 1904):

Most of the fish planted from the Methow facility in the first few years of production were probably coho (WDFG 1904-1920; Craig and Suomela 1941). For the first few years, species were not differentiated, with up to 3 million eggs per year collected from the Methow.

Very few chinook were released from the first Methow River hatchery (Craig and Suomela 1941). Egg take between the years 1908 - 1912 ranged from 5,000 - 68,000 (average 24,100). In 1915, the hatchery was moved downstream near the mouth of the river at Pateros. The hatchery was moved for two main reasons: it lacked brood stocks other than coho, and the new location lay downstream from the irrigation intakes (WDFG 1917). From WDFG (1917),

> *Two years of operation of the new hatchery have demonstrated the wisdom of the change. Not only are we now securing more silverside salmon spawn at the new location than we did at the old, but our new location has developed to be the best hatchery in the state for the taking of Steelhead salmon eggs. Also, we have been able here to secure Spring Chinook salmon eggs . . .,*

and from Craig and Suomela,

. . . however, chinooks were never obtained in any quantity. . . some eggs were transferred to Methow from other locations. Even chum salmon eggs were shipped there in 1916 and 1917. . . In many cases there is no indication as to where the transferred chinook eggs were taken, but some were obtained from the U. S. Bureau of Fisheries hatcheries on the lower Columbia and probably some of the Washington hatcheries from that section also contributed late run stock to the Methow River. It is very questionable whether any of these fish were able to return to the Methow River, since the distance they would have to migrate is much greater than that to which the original stock was accustomed. However, these records indicate that the Washington State Fisheries authorities made attempts to introduce strange runs of salmon to the Methow as well as to the Wenatchee.

In 1917, 1.5 million eggs were received at the Methow Hatchery from unknown origin. In the late 1920s, eggs were received from exotic hatcheries, but appear to be mostly late-run chinook (Craig and Suomela 1941).

The release of fry from the early hatcheries on the Wenatchee and Methow rivers probably contributed little to adult returns.

Current program overview:

Current programs

Artificial production of anadromous fish in the Methow Subbasin includes spring Chinook, summer Chinook, summer steelhead and reintroduction of coho salmon (Table 1). Spring Chinook and summer steelhead are currently ESA-listed as endangered through the Endangered Species Act of 1973. Summer Chinook are considered a depressed population. Once extirpated from the Methow Subbasin, small numbers of coho salmon have been reintroduced, and plans are currently in the feasibility stage for larger scale reintroduction. Hatchery intervention in the Methow Subbasin is guided by a two-pronged approach that encourages local adaptation, preservation and enhancement of specific populations while simultaneously spreading the risk through selection of several artificial production alternatives.

Considerable controversy regarding the effects of the GCFMP, non-indigenous introductions, recent fishery management actions (variable broodstock collection and hatchery mating) on population structure, and regarding interpretation of available genetic data has prompted variable interpretations of spring Chinook population structuring in the Methow Basin. In response to uncertainty about population structure, poor adult returns, and a desire to spread the risk of hatchery intervention strategies, a conceptual approach was developed during the creation of the Biological Assessment and Management Plan (BAMP) for mid-Columbia River Hatchery Programs. The approach consisted of enlarging the effective hatchery supplementation spawning population of Methow River and the Chewuch River populations during periods of low adult returns, by managing them as a single gene pool. During years of sufficient adult returns, tributary trapping locations would be utilized to obtain the broodstock components of each

tributary population and within population mating would be a priority in an attempt to preserve and enhance discrete population attributes that exist in the Methow Basin.

Management decisions regarding the Twisp River population varied from those developed for the Methow and Chewuch populations. The Twisp River population was deemed the most divergent of the indigenous populations in the Subbasin and the least tolerant of genetic introgression (Wells Project Coordinating Committee 1995). The Twisp River population is managed more as a distinct population, using adult supplementation and captive broodstock programs. The Joint Fisheries Party (JFP, composed of federal and state agencies and tribes) opted to phase out the Twisp Captive brood program beginning in 2000, leaving 1999 as the last brood year remaining in the program.

Table 1. Artificial anadromous fish production in the Methow Subbasin

Fish Species	Facility	Funding Source	Production level goals
Spring Chinook	Methow Fish Hatchery Acclimation sites at the Methow, Biddle, Twisp and Chewuch Acclimation ponds (Operated by WDFW)	Douglas County PUD	(349,000)[7]
	Winthrop NFH (Operated by USFWS)	Bureau of Reclamation	600,000
Steelhead	Wells Dam Hatchery Complex (Operated by WDFW)	Douglas County PUD	349,000 (post HCP)
	Winthrop NFH (Operated by USFWS)	Bureau of Reclamation	100,000
Summer Chinook	Wells Dam Hatchery Complex (Carlton acclimation pond) (Operated by WDFW)	Chelan County PUD	400,0008
Coho	Winthrop NFH (Operated by USFWS)	BPA (Fish & Wildlife Program)	250,000
Coho	Acclimation sites at Eight Mile Creek and Biddle Pond on Wolf Creek (Operated	BPA (Fish & Wildlife Program)	

[7] Under the Wells Settlement Agreement, Douglas PUD is required to raise 225,000 spring chinook for Wells mitigation. Once the HCP is approved, Douglas PUD only needs to raise 61,000 fish to meet its NNI obligation for spring chinook. However, under a separate agreement, Douglas will raise an additional 288,000 (which will be reduced to 90,000 after 2013) spring chinook for Chelan PUD for mitigation under the HCP, bringing the total to 349,000 fish

[8] Under a "species trade agreement" between Chelan and Douglas PUDs, all 400,000 of these fish are currently for Douglas PUD mitigation. Once the HCP is approved then 200,000 of these fish are raised for Douglas PUD mitigation in exchange for fish at the MFH and the remaining 200,000 fish are for the Chelan PUD mitigation.

by YN)

Federal programs

Grand Coulee Fish Maintenance Project (GCFMP)
The USFWS operates the Leavenworth NFH Complex in the UCR region constructed by the U.S. Bureau of Reclamation (BOR) to replace fish losses that resulted from construction of Grand Coulee Dam. These programs were authorized as part of the Grand Coulee Fish Maintenance Project (GCFMP) on April 3, 1937, and re-authorized by the Mitchell Act (52 Stat. 345) on May 11, 1938. The complex consists of three hatchery facilities, Leavenworth, Entiat, and Winthrop NFHs, with the following mission:

"To produce high quality spring Chinook salmon and summer steelhead smolts commensurate with the production goals established by the Columbia River Fisheries Management Plan" (USFWS 2002a)

Historically, these facilities have reared and released spring Chinook salmon eggs transferred from the Carson NFH on the lower Columbia River. Carson-stock spring Chinook salmon are not included in the ESA-listed UCR spring Chinook salmon ESU. The USFWS has discontinued transferring eggs from Carson NFH in favor of utilizing hatchery-origin adult spring Chinook salmon returning to each facility as the primary egg source.

The hatcheries built as part of the GCFMP began operation in the early 1940s at Leavenworth (Icicle Creek, a tributary of the Wenatchee River), Entiat, and Winthrop (Methow River). The Leavenworth facility was built as the main hatchery site, and the Entiat and Winthrop hatcheries as substations. These hatcheries were built as part of the program to relocate populations of salmon and steelhead that formerly ascended the Columbia River upstream from the Grand Coulee Dam site.

Winthrop National Fish Hatchery (NFH)
Located on the Methow River, this substation of the Leavenworth NFH complex began operation in 1941. The Winthrop Hatchery released stream-type Chinook every year from 1941 through 1962. Releases of spring Chinook ceased until 1976, when the current program began, and have since been ongoing. Releases of sockeye have taken place at Winthrop from 1943 to 1957. Spring chinook, steelhead and coho are all currently cultured at the facility.

Broodstock origin for fish released from Winthrop NFH has varied over the years. The first four years of releases were from broodstock collected at Rock Island Dam as part of the GCFMP (see above). Eggs from the Cowlitz, Little White, Carson, Klickitat, and Leavenworth (all Carson stock) hatcheries have been raised and released from Winthrop since the current program began in 1976, although since 1992, all brood used for the program has come from adults returning to the Methow River.

Since brood year 1999, which is the same year spring Chinook were listed under the ESA, no releases of the "pure" unlisted Carson stock has occurred. The listed Methow Composite stock has been utilized in an effort to aid in the recovery of that population.

Facility description: Located on the Methow River, at river mile 50.4, this facility has two 40 by 80 ft adult holding ponds (construction was never completed), sixteen 17 x 76 ft. Foster-Lucas ponds, sixteen 12 x 102 ft, and 30 8 x 80 ft raceways. Inside the hatchery building there are 42 (8 tray) incubators, thirty-five 3 x 16 ft fiberglass tanks, and four 16.5 x 16 concrete starting troughs (USFWS 1986c).

The primary water source for the hatchery is the Methow River. The water right allows for withdrawals up to 50 cfs. Spring Branch Springs provides up to 10 cfs, and two groundwater infiltration galleries and wells provide 1,500 gpm each, with a maximum of 2,400 ac. ft. per year each. The springs and infiltration galleries provide warmer water during the winter months. A third infiltration gallery, capable of pumping 4,500 gpm, is currently under construction.

Evaluation: The Mid-Columbia River Fishery Resource Office (MCRFRO) provides monitoring, evaluation, and coordination services concerning Winthrop NFH production. MCRFRO staff monitors hatchery returns, biological characteristics of the hatchery stock, fish marking, tag recovery, and other aspects of the hatchery program, and they maintain the database that stores this information. MCRFRO also cooperates with the hatchery, fish health and technology centers, and co-managers to evaluate fish culture practices, assess impacts to native species, and coordinate hatchery programs both locally and regionally.

The Leavenworth NFH Complex (which includes Winthrop NFH) has a team comprised of staff from the hatcheries, Fish Health, and the MCRFRO (Hatchery Evaluation Team). Current evaluation practices/studies include: bio-sampling of returning adults, 100% marking of released juveniles, application of PIT tags, assessment of stray rates, travel-time of released juveniles through the Columbia River corridor, assessment of potential of hatchery fish to transfer diseases to wild stocks, success/failure of hatchery produced adults to reproduce naturally, use of NATURE's type rearing[9], raceway density studies, genetic comparisons of hatchery and wild stocks, and feed (fish food) evaluations, among others.

State programs

Methow Fish Hatchery Complex

The Methow Fish Hatchery Complex (MFHC) was built to compensate for losses of smolts caused by the operation of Wells Dam (Erho and Bugert 1995). The facility was constructed by, and operates, under funding from Douglas PUD. Eggs are collected at weirs on the Methow, Twisp, and Chewuch rivers and incubated discretely at the central facility near the town of Winthrop. Smolts (246,000 for each facility) are released from acclimation ponds on the Twisp, Chewuch, and Methow (central facility) rivers (Peck 1993; Bartlett and Bugert 1994).

[9] NATURE's rearing is a "hands off" approach where artificial substrate and woody debris is added to the raceways. Automatic feeders are also utilized, negating the need to "hand feed".

One of the guiding principles of the Methow Basin Spring Chinook Salmon Supplementation Plan (MBSCSP) is to increase natural production of the three principal stocks from the main stem Methow, Chewuch, and Twisp rivers. With the supplementation concept in mind, the general supplementation plan has established separate strategies for two of the three streams with the fish managers agreeing to maintain one composite brood stock for the Methow and Chewuch rivers and a separate brood stock for the Twisp River. Each stock will have specific escapement goals, designed to provide a basis for evaluating the progress of achieving the original intent of the program.

Facility description: The MFHC consists of a central facility on the Methow River, near the town of Winthrop, and two satellite facilities on the Chewuch and Twisp rivers. The main facility is located on the Methow River, approximately 45 miles upstream of the confluence with the Columbia River. This facility has three canopy-covered 8 x 78 x 4 ft adult holding ponds, 12 canopy-covered juvenile raceways of the same dimensions as the adult ponds, and 24 indoor 3 x 59 x 4.5 ft start tanks. In addition, there are three separate incubation rooms with 15 single stack (eight trays per stack) vertical incubators and one 107 x 59 x 4.5 ft acclimation pond, which releases into the mainstem Methow River (Bartlett and Bugert 1994).

The main water source for the Methow facility is from four wells that provide almost 10 cfs. An additional water right of 18 cfs of Methow River water is provided, with 11 cfs guaranteed (the additional 7 cfs is shared with Winthrop NFH in the spring; Bartlett and Bugert 1994).

Almost eight miles upstream of the confluence of the Methow River is the Chewuch River acclimation site. The site has one large acclimation pond, which measures 107 x 70 x 4.5 ft. The water source of the acclimation pond is the Chewuch River, which is supplied by gravity feed from the Chewuch Canal Company's irrigation ditch. The maximum flow to the pond is 6 cfs (Bartlett and Bugert 1994). Adult trapping for the Chewuch fish occurs at Fulton Dam, approximately 4.5 miles downstream of the acclimation pond (1.5 miles upstream of the confluence with the Methow River).

The Twisp River acclimation site is approximately 5 miles upstream of the confluence with the Methow River. The facility has one acclimation pond which measures 107 x 59 x 4.5 ft. The water source of the pond is the Twisp River from the Valley Power irrigation canal, with a maximum flow of 6 cfs. The adult collection weir and trap is located adjacent to the acclimation pond (Bartlett and Bugert 1994).

II. Program Goals and Objectives

Federal programs

Grand Coulee Fish Maintenance Project (GCFMP)

The USFWS's mission for the Leavenworth complex is:

"To produce high quality spring Chinook salmon and summer steelhead smolts commensurate with the production goals established by the Columbia River

*Fisheries Management Pla*n" (USFWS 2002a)

Winthrop National Fish Hatchery (NFH)**:**
Objectives originally established for the Leavenworth Hatchery Complex, as part of the GCFMP were (from Calkins et al. 1939):

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 the earlier undisturbed conditions and with the natural food supply in the streams.*

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.*

Current objectives of the USFWS hatcheries are outlined in USFWS (1986a, b). In the USFWS Statement of Roles and Responsibilities, the broad role of the hatcheries are,

. . . to seek and provide for mitigation of fishery resource impairment due to Federal water-related developments . . . the Fishery Resource Program goal, in fulfilling its mitigative responsibilities, is to ensure that established and future fishery resource mitigation requirements are fully and effectively discharged. Implicit in this goal is the replacement of fishery resource losses caused by specific Federal projects . . . and another responsibility of the Leavenworth Hatchery . . . is to restore depleted Pacific salmon and steelhead stocks of national significance in accord with statutory mandates such as the Pacific Northwest Electric Power Planning and Conservation Act, Mitchell Act, Salmon and Steelhead Conservation Act, Pacific Salmon Treaty Act of 1985 and Indian Treaties and related Court decisions.

Shelldrake (1993) updated the objectives of the mid-Columbia NFHs:

- *Hatchery production* [specific to each facility].
- *Minimize interaction with other fish populations through proper rearing and release strategies.*
- *Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.*
- *Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.*
- *Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.*
- *Communicate effectively with other salmon producers and managers in the Columbia River Basin.*

State programs

Methow Fish Hatchery Complex

One of the guiding principles of the Methow Basin Spring Chinook Salmon Supplementation Plan (MBSCSP) is to increase natural production of the three principal stocks from the main stem Methow, Chewuch, and Twisp Rivers. With this in mind, the general supplementation plan has established separate strategies for each of the three streams. Each stock will have specific escapement goals, designed to provide a basis for evaluating the progress of achieving the original intent of the program. From Erho and Bugert (1995),

> ***Methow River****: Collaboration between Winthrop FH and Methow FH is of paramount importance for the MBSCSP. Gene flow between the two hatcheries will inevitably occur. To be consistent with this situation, all spring chinook salmon that spawn in the mainstem Methow River upstream of the Chewuch River confluence will be managed as one genome. To be successful, this management strategy requires three conditions: 1) no spring chinook salmon from outside this reach will be imported to either hatchery for propagation and released into the Methow River (exogenous salmon may be reared at the hatcheries if they are acclimated and released into their natal stream), 2) all salmon released from either hatchery into the Methow Basin will be externally marked, and 3) salmon that spawn in the Lost River will be included in this population.*
>
> ***Chewuch River****: The Fishery Parties recognize the opportunity to implement innovative fish cultural practices at Methow FH, yet also are acutely aware of the need to ensure high survival of the supplemented populations. The Chewuch River population will therefore be the designated stock used for innovative hatchery management. In general terms, the Chewuch stock may be considered an experimental "treatment" stream, compared to the Twisp River population, which will serve as the "reference". Alternative fish culture may include such practices as life skills training (Olla and Davis 1989, Suboski and Templeton 1989), side channel rearing (Budhabhatti and Maughan 1994), and autumn pre-smolt releases (Bjornn 1978, Bilby and Bisson 1987), or other prototypical hatchery strategies.*
>
> ***Twisp River****: The Twisp River stock will be managed in a manner that ensures the highest survival of both natural and hatchery salmon in that river. Low risk production strategies will be implemented in all stages of the program. The Evaluation Plan will place an emphasis on long-term genetic and demographic monitoring of the Twisp population, to evaluate the stability of a small semelparous population. An estimate of minimum viable population (MVP; Shaffer 1981, 1990, Lacava and Hughes 1984) size will be derived, either through empirical or heuristic analysis (Kapuscinski and Lannan 1986). The escapement goal for the Twisp River will then be based upon the estimated MVP.*

The overall goal of the state hatcheries is to use artificial production to replace adult production lost due to smolt mortality at mainstem hydroelectric projects, while not reducing the natural production or long-term fitness of salmonid stocks in the area (WDF 1993). Specific goals of the WDFW hatcheries (WDF 1993) are:

- *Hatchery production* [in terms of number of fish released from each site],

- *minimize interactions with other fish populations through rearing and release strategies, maintain stock integrity and genetic diversity of each population or unique stock through proper management of genetic resources.*
- *maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens,*
- *conduct environmental monitoring to ensure that the hatchery operations comply with water quality standards and to assist in managing fish health,*
- *communicate effectively with other salmon producers and managers in the Columbia River basin, and with implementers of local and regional flow and spill programs, and*
- *develop a Conservation Plan and conduct a comprehensive monitoring/evaluation program to determine that the program meets mitigation obligations, estimate survival to adult, evaluate effects of the program on local naturally producing populations, and evaluate downstream migration rates in regards to size and timing of fish released.*

Yakama Nation Program

The long-term goal of the YN/BPA Mid-Columbia Coho Reintroduction Feasibility Project is to reestablish naturally reproduction coho salmon populations in mid-Columbia river basins (Wenatchee, Entiat, and Methow), with numbers at or near carrying capacity that provide opportunities for harvest (YN et.al. 2002). This long-term goal is closely tied to the vision of reintroduction of coho to the Yakima basin and to other areas from which the species has been eliminated. Mid-Columbia coho reintroduction is identified as a priority in the *Wy-Kan-Ush-Mi-Wa-Kish-Wit* document (Tribal Restoration Plan) and by the four Columbia River Treaty Tribes and has been affirmed as a priority by the Northwest Power Planning Council.

The short term goals of the feasibility phase, expected to last through 2004, is to determine whether a broodstock can be developed from Lower Columbia River coho stocks, whose progeny can survive in increasing numbers to return as adults to the mid-Columbia Region, and to initiate natural reproduction in areas of low risk to sensitive species and in other select areas to study the risks and interactions with sensitive species (YN et al. 2002). Studies done in this phase will inform future decisions about whether the long-term vision can be achieved. Many of the studies regarding species interactions, competition, and predation, which have been conducted in the Yakima, Wenatchee and Methow rivers are transferable and will be used to implement a long term program in the Methow sub-basin. Currently, coho smolt releases are only from the federal hatchery with the sole purpose of broodstock development and to collect initial survival data. The YN is proposing to expand the program to releases in the natural production areas of the basin to allow implementation of the tribal goal of natural reproduction. Releases to date have indicated that some returning adults have sought out small tributaries in the basin for successful spawning.

III. Program Operations

Federal program

Winthrop NFH

USFWS operates the Winthrop National Fish Hatchery (WNFH) located only a few miles downstream from the Methow FH. Broodstock are typically collected from the volunteer trap located in the hatchery outfall. Approximately 600,000 smolts are released annually directly into the Methow River from the WNFH.

Adult spring Chinook salmon return to the hatchery beginning in early to mid-May. The escapement goal for this hatchery is 350 adults for a subsequent release of 600,000 smolts annually. Spawning begins in mid-August and can continue to mid-September. The stock of spring Chinook propagated at WNFH is listed as "endangered" under the Endangered Species Act (ESA). Brood year 1999 was the first year propagating this stock. Prior to the switch in stocks, a Carson NFH (lower Columbia River) stock was utilized (not ESA listed).

In most years, all brood stock used for production are volunteers to the hatchery. Adults swim up the collection ladder and into a holding area. The capacity of this pond can only support about 400 adults. The current program calls for adults in excess of brood needs to spawn naturally. Therefore, hatchery staff must limit the number of adults entering the ladder. A weir is placed in the channel leading to the ladder and is selectively opened and closed.

During years of extremely low adult returns, as in 1996 and 98, all spring Chinook ascending Wells Dam are captured and transferred to WNFH and the Methow Fish Hatchery. Adult brood for the Winthrop program has, in some years, been captured at the MFH and transferred to WNFH.

For years 1984 to 2001, an average of 685 adults of WNFH origin have returned to the Methow River Basin. Although the original objective of this mitigation program was to provide fish for harvest, it is also trying to aid in the recovery of ESA listed populations.

All juveniles released from WNFH have a coded-wire tag (CWT) inserted in their snout. During the spawning of adults, CWT's from all adults are removed and de-coded prior to the mixing of gametes. This way FWS has the ability to manage particular crosses (matings), as some are more desirable than others.

Juveniles are released as yearlings annually, in mid-April. The smolts are forced from the raceways into the _ mile long spring fed channel (where the ladder is located), which flows to the Methow River. Currently, all juveniles carry a CWT and a portion may also have an adipose-fin clip (depending on lineage).

Throughout the years, the spring Chinook release goal at WNFH has varied. The current goal is 600,000 smolts at 15 to18 fish/pound. For years 1980 to 2001, an average of 642,682 have been released annually.

Winthrop NFH also has a small summer steelhead program. This stock is listed as "endangered" under the ESA. The annual release goal is currently 100,000 smolts. Brood for this program is secured at Wells Dam by WDFW; none of the steelhead are collected as volunteers to WNFH.

Eyed eggs are transferred to WNFH from Wells Hatchery in January or February each year. Approximately 14 months later, the smolts are volitionally released over a 2 – 4 week period starting in early April. Juveniles are 100% fin-clipped and returning adults may be harvested in the sport fishery above Rocky Reach Dam.

State program

Spring Chinook

The Methow Fish Hatchery operates as an adult-based supplementation program using multiple adult broodstock collection locations including the Chewuch, Twisp, and upper Methow rivers. Additional supplementation includes volunteer returns to Methow Fish Hatchery and Winthrop NFH. The long-term production objective for the Methow Fish Hatchery was set at 738,000 yearling spring Chinook smolts in the Wells Dam Settlement Agreement (1990). However, the maximum capacity of the facility was modified during the development of the Mid-Columbia Habitat Conservation Plan (MCHCP) to 550,000 yearlings at 15 fish/lb. (BAMP 1998).

Poor returns of wild fish and limited broodstock collection capabilities coupled with historically poor spring Chinook replacement rates of 0.7 recruits per spawner (1985-1990; L. LaVoy, WDFW, unpublished data) prompted the development of a 3-tiered broodstock collection protocol for the spring Chinook supplementation program in the Methow Subbasin. Under a revised approach adopted in 1996, the location and extent of broodstock collections is based on projected escapement at Wells Dam (Table 2). Broodstock collection protocols are now developed annually and are determined by adult escapement above Wells Dam, expected escapement to tributary and hatchery locations, estimated wild/hatchery proportion, and production objectives and stock origin (endemic/non-endemic).

Table 2. Broodstock collection guidelines of the Methow Basin spring Chinook supplementation plan (ESA Section 7 Draft Biological Opinion, Section 10 Permit 1196)

Wells Escapement Projection	Broodstock Collection Objective
< 668	100% collection of Wells Dam escapement; place all fish into the adult-based supplementation program.
>668 <964	Pass a minimum of 296 adults upstream of Wells Dam for natural spawning.
> 964	Collection at levels to meet interim production level of 550,000 and 600,000 smolts at Methow Fish Hatchery and Winthrop NFH, respectively.

The hatchery and acclimation ponds are operated in a manner that is consistent with accepted aquaculture standards and those identified in the Wells Dam Settlement Agreement. Broodstock handling, spawning, fertilization, incubation, rearing, fish transport, and release activities are

detailed in annual summary reports of specific brood years for the Methow Basin Spring Chinook Salmon Hatchery Program (Bartlett et al. 1994; Bartlett 1996; Bartlett 1997; Bartlett 1998; Bartlett 1999; and Jateff 2001).

Production at the Methow Fish Hatchery has varied considerably since the program began with brood year 1992. The variability in production is entirely a function of poor adult returns and different broodstock collection strategies stemming from adaptive management strategies for this population. Smolt production from the Methow Fish Hatchery has averaged 388,471 smolts over the past five years, representing 71% of the interim production level of 550,000 fish identified in the BAMP (1998).

Since adult returns were so low in the beginning years of the program, WDFW used some Carson stock fish in their program. WDFW is now actively avoiding fish of Carson ancestry in their broodstock, and the WNFH is also moving away from using these fish too.

WDFW spawns both listed hatchery x natural and natural x natural crosses to the extent possible and evaluate the success of the two types of crosses. When possible, naturally produced fish retained for broodstock shall represent the natural-origin population in terms of age composition, sex ratio, and run timing. To the greatest extent possible, WDFW shall maintain known Twisp River spring Chinook salmon as a separate broodstock within the hatchery. The progeny of known Twisp River spring Chinook salmon shall be distinctly marked for identification purposes.

To reduce and control fish disease incidences, WDFW will use the disease control procedures identified in the operations plans and adhere to the Washington Co-Manager, Pacific Northwest Fish Health Protection Committee and IHOT [Integrated Hatcheries Operation Team] fish disease control policies.

Summer Chinook

Artificial production of summer Chinook for the Methow Subbasin is provided through the Rock Island Project Settlement Agreement (and will be superseded by the HCP), via the Eastbank Hatchery. The hatchery was constructed in 1989 and is located adjacent to Rocky Reach Dam on the Columbia River. The program is funded by Chelan County PUD and operated by WDFW. Summer Chinook production at Eastbank Hatchery is intended to mitigate for summer Chinook losses at Rock Island Dam. The production objective for the Methow River is a total of 400,000 yearling summer Chinook at 10 fish/lb (BAMP 1998).

Broodstock (556 adults) are collected at the Wells Dam east ladder trapping facility and transported to the Eastbank Hatchery. These fish originate from Okanogan/Methow (Wells Dam traps) summer Chinook populations of natural or hatchery-origin, and are indigenous to the Methow/Okanogan system. Returning salmon from the Carlton (Methow River) program also volunteer into Wells Fish Hatchery, yet they are identified by Code Wire Tags (CWT) and can be placed into their program of origin if desired (Eltrich et al. 1995; BAMP 1998). Incubation,

spawning, and initial rearing of Methow summer Chinook take place at the Eastbank facility. The fish are then transferred to the Carlton Acclimation Pond towards the end of their second winter, where they are volitionally released at smolt size (10fish/lb.) into the Methow River in April-May (these fish are currently raised for Wells mitigation under a "species trade" between Chelan and Douglas PUD. Once the HCPs are finalized, the 400,000 fish will be spilt 50:50 between the two PUDs (until 2013, when Chelan's obligation may go down)).

Broodstock collection protocols are developed annually and determined by annual escapement at Rocky Reach Dam, subject to in-season adjustments. Specific broodstock collection criteria are listed below (adapted from Petersen et al. 1999b and BAMP 1998). Facility operation description, biological attributes and aquaculture practices and standards are detailed in the HGMP for summer Chinook as developed for the Section 7 Draft Biological Opinion for ESA-section 10 Permit #901/902 (Incidental Take of Listed Salmon and Steelhead from Federal and Non-federal Hatchery Programs that Collect, Rear and Release Unlisted Fish Species; WDFW 2000) and as developed for the Rocky Reach and Rock Island Anadromous Fish Agreement and Habitat Conservation Plan.

- Trap no more than 20% of the adult run, based on counts at Rocky Reach Dam;
- If cumulative adult counts at Rocky Reach Dam are less than 40% of the ten-year average, cease trapping until the 40% escapement level has been reached;
- Begin trapping after June 28 and end trapping on or before August 28;
- Conduct trapping on no more than 3 days per week for a maximum of 16-hours per day;
- Do not use the west ladder on Wells Dam for broodstock collections unless difficulties are encountered with broodstock collections in the east ladder;
- Mark all summer Chinook trapped in the Wells Dam ladders to differentiate them from fish volunteering to the Wells Hatchery trap; and
- Collect the run-at-large including the age-3 component.

<u>Summer Steelhead</u>

Steelhead are collected from the run-at-large at the west ladder trap at Wells Dam. Beginning in 2003, wild origin fish were also collected from the east ladder trap to incorporate a greater number of wild fish into the broodstock (33%). Adult steelhead are spawned and reared at Wells FH.

Approximately 125,000 eyed-eggs are shipped to Winthrop National Fish Hatchery to support a 100,000 smolt program that are released directly from the hatchery into the Methow River. Wells FH annually transports and releases an additional 350,000 smolts into the Twisp, Chewuch, and Methow Rivers and an additional 130,000 steelhead smolts for release into the Okanogan and Similkameen rivers.

Non-anadromous fish releases

Non anadromous fish have been planted within the Methow Basin since the early 1900s. Rainbow trout, cutthroat trout, brook trout, and a few brown trout have all been planted at various times through multiple hatchery programs.

Following micro-habitat work in the 1980s that showed negative effects on pre-smolt steelhead from "catchable" releases of rainbow trout, all releases of rainbow were shifted from streams to various lakes within the basin which did not have connectivity to anadromous areas.

Yakama Nation Program

Coho

Coho salmon are collected as volunteers into the Winthrop National Fish hatchery and from the run-at-large at Wells Dam west bank and/or east bank fish traps to support a 250,000 smolt program (YN et al. 2002) . Methow basin coho broodstock may be supplement with eyed-eggs transferred from Wenatchee Basin incubation facilities or from hatcheries on the lower Columbia River (Cascade FH, Eagle Creek NFH, or Willard NFH) in years where broodstock collection falls short of production goals. Coho reared at Winthrop NFH are volitionally released into the Methow River or transferred to the Wenatchee River for acclimation and release. Under the current feasibility program, coho releases from the Winthrop National Fish Hatchery are design to contribute to the broodstock development process. Details on mating protocols, rearing and acclimation strategies, size at release and monitoring and evaluation can be found in the Yakama Nation's Mid-Columbia Coho HGMP (YN et al.2002).

Conservation of the Species: The capture of endangered UCR spring Chinook salmon and summer steelhead by WDFW for artificial propagation efforts are designed to benefit the species. The primary objectives of these efforts are to preserve extant spring Chinook and steelhead populations in the region, and to boost the abundance of remaining stocks. There are risks of ecological and genetic impacts to the ESA-listed juvenile and adult spring Chinook salmon and steelhead resulting from the proposed programs. However, the risk of extinction to natural populations is high enough that aggressive intervention is required.

Genetic and Ecological Effects on Natural Populations: The genetic risks to naturally produced populations from artificial propagation include reduction in the genetic variability (diversity) among and within populations, genetic drift, selection, and domestication which can contribute to a loss of fitness for the natural populations (Hard *et al.*1992; Cuenco *et al.* 1993; NRC 1996; and Waples 1996).

Disease interactions between hatchery fish and listed fish in the natural environment may be a source of pathogen transmission. Because 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; Håstein and Lindstad 1991).

It is acknowledged that among-population diversity for a portion of the ESU (Methow River Basin populations) may be negatively affected by the WDFW and USFWS programs if

escapements remain low. Specifically, this effect may result from the consolidation of Methow Basin populations into a single Methow population through collection and mating of upriver-origin spawners arriving at Wells Dam. However, this strategy will provide unique information on how best to increase the abundance of fish, and the populations' recovery.

USFWS and the fisheries co-managers have implemented the phasing out of the non-endemic Carson-stock spring Chinook hatchery program to address the potential for genetic introgression and out-breeding depression. Efforts are being made to minimize the effects of these fish on the natural spawning population. By phasing out the Carson-stock spring Chinook and changing to Methow Composite stock, the potential adverse genetic effects from natural spawning hatchery fish will be greatly reduced.

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 for space and cover in the Methow River probably occurs between hatchery and natural fish shortly after release and during downstream migration, but based on the smolt travel times the duration of interaction is minimal in the river (WDFW 1998a). Rearing and release strategies at all WDFW salmon and steelhead hatcheries are designed to limit adverse ecological interactions through minimizing the duration of interaction between newly liberated hatchery salmon and steelhead and naturally produced fish.

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).

Hatchery salmonids that do not emigrate after release are said to have residualized. These fish that residualize can adversely affect naturally produced fish through competition and predation. Chinook salmon do not tend to residualize (Groot and Margolis 1991), thus no effects are expected on natural UCR spring Chinook salmon or steelhead in the Wenatchee River.

Harvest Management: Fish harvest in the Columbia River basin affects the listed species by incidentally taking them in fisheries that target non-listed species. The largest potential impacts on UCR spring Chinook and steelhead come from treaty Indian and non-tribal fisheries in the Columbia River mainstem and potentially tributaries (Myers *et al.* 1998).

A sport fishery for steelhead in the UCR has been authorized under Section 10 Permit 1395. In years when the escapement of hatchery origin steelhead is greater than expected (i.e., over-escapement) the fishery was specifically designed to remove excess hatchery fish from the spawning grounds with minimal impacts to the natural origin steelhead.

Domestication of Hatchery Fish: Another concern of the artificial propagation of salmon is domestication, which is the change in quantity, variety, and combination of alleles within a captive population or between a captive population and its source population in the wild that are the result of selection in an artificial environment (Busack and Currens 1995). Domestication occurs because putting fish into an artificial environment for all or part of their lives imposes different selection pressures on them than does the natural environment. The concern is that domestication effects will decrease the performance of hatchery fish and their descendants in the wild. The concern is that hatchery fish selected to perform well in a hatchery environment tend to not perform well when released into the wild due to the difference between the hatchery and the wild environments. Potential impacts to the natural population occur when the hatchery fish spawns in the wild and the resulting performance of the natural population is reduced due to outbreeding depression (Busack and Currens 1995). The selection of broodstock is a common source of biased sampling. In general, broodstock selection should be random but bias occurs when selection is based on particular traits. Genetic changes due to unintentional selection can be caused by the hatchery environment, which allows more fish to survive compared to the natural environment. The elimination of all risks due to genetic diversity loss and domestication is not possible, but NOAA Fisheries believes that these risks can be minimized through the following measures proposed for the adult supplementation program:

- Address genetic concerns regarding selectivity, the collection of adult broodstock at traps for the supplementation program shall be representative of the run-at-large with respect to natural and hatchery parentage, migration timing, age class, morphology, and sex ratio;
- Provide that a proportion of each population that will not be subjected to artificial propagation and the associated potential risk of negative genetic effects, upstream escapement goal of approximately 80 adults per population will be maintained as a minimum level for natural spawning when escapement to Wells Dam is greater than 668 adults;
- An effective population size (N_e) of 500 fish per population per generation should be the *long-term* program production objective to maintain an adequate genetic base, even thought an N_e of at least 50 adults per generation is required to reduce the risk of inbreeding depression and genetic drift in the short term (fewer than 5 salmon generations) (BAMP 1998). If fewer adults are available, production can be scaled to ensure that hatchery-origin progeny do not overwhelm the population as a whole;
- Rear fish at minimum pond loading densities to reduce the risk of domestication effects and;
- Eliminate of Carson-stock spring Chinook (a highly domesticated stock) that will further reduce potential genetic effects.

Monitoring and Evaluation*:* The Wells Settlement Agreement (by which MFHC was authorized, and which will be superseded by the HCP) includes provision for evaluation of the MFHC, both in terms of meeting its production requirements under Phase I of the HCP, and its effects on natural production. This evaluation plan includes genetic monitoring of hatchery and naturally produced fish, migration timing and survival studies of hatchery releases, and studies to evaluate interaction between hatchery- and naturally produced fish. Monitoring and evaluation of the hatchery programs in the Methow River is on-going. The plan for the adult-based supplementation program addresses three critical uncertainties associated with the program:

- whether the hatchery facilities can safely meet their production objectives;
- the effect of the programs on the long-term reproductive success of the population in the natural environment;
- the identification of ways to operate the facilities to reduce the short-term ecological impacts to the naturally produced fish (WDFW 1998a).

Adaptive Management

The monitoring and evaluation program will also provide data that can be used to change the program if the results suggest doing so. The monitoring and evaluation programs will also provide invaluable data on the use of supplementation to conserve and recover ESA-listed salmon species.

Tribal Harvest Allocations

All hatchery programs in the Methow Basin are currently included in the Columbia River Fish Management Plan (i.e., US *v.* Oregon).

IV. Program Success

Federal program

Winthrop NFH was constructed to mitigate for lost habitat due to the construction of Grand Coulee Dam. The original objective of this facility was to provide adults for harvest. This role has changed in recent years. While in some years a sport fishery is open for adult steelhead returning to WNFH, it is desired that adult spring Chinook salmon (in excess of brood needs) are allowed to spawn naturally in the Methow River. This program change was driven by the ESA, and now focuses primarily on recovery.

State program

Viable Populations:

Spring Chinook

In recent years the number of hatchery fish on the spawning grounds have greatly exceeded the number of wild fish (>90%). The number of spring chinook (hatchery and wild) returning to the Methow Basin has also greatly exceeded escapement levels. While an increase in wild fish abundance has been observed, future adult returns should provide more information to the efficacy of the hatchery program in increasing the abundance of naturally produced populations.

Summer Chinook

Record escapements of summer Chinook in the Methow Basin in recent years have been positively influenced in part by the hatchery program at Carlton Pond. A goal of a supplementation program is to increase the number of spawners by allowing hatchery fish to

spawn naturally. Subsequent increases in the number of naturally produced fish on the spawning grounds would support the hypothesis that hatchery fish contributed to future adult returns.

Steelhead
An increase in the number of wild fish incorporated into the broodstock would reduce any potential genetic impacts to the wild fish. In the Methow Basin, a high abundance of hatchery fish due to above average SAR's has lead to escapement levels far above the carrying capacity of the basin. In response, the WDFW developed a methodology using a sport fishery to reduce the number of hatchery fish on the spawning grounds, reducing not only density dependent effects but also genetic impacts.

Hatchery fish have been a dominant part of the spawning population for many years. However, the objective of the hatchery program has only recently changed to a recovery role versus a harvest augmentation role. Wild or naturally produced fish comprise approximately 10% of the run over Wells Dam. If the hatchery program is successful the proportion of wild fish should increase in subsequent years.

Contribution of adults to recovery or harvest:
Returning adults from these programs are intended to increase to naturally spawning populations. The hatchery programs have successfully contributed adults to the naturally spawning populations. However, harvest does occur in years of high abundance on summer chinook. Harvest of steelhead has recently been authorized under Section 10 Permit 1395 as a method to reduce hatchery fish on the spawning grounds.

Summer/fall Chinook smolts released from the Carlton acclimation pond have averaged 0.19 return rate to adults, ranging from 0.02 to 0.81 for brood years 1989 through 1997.

Effects on Wild and Native Populations and Environment: Effects on the wild populations (target and non-target) will be assessed at the juvenile stage using smolt traps and when fish return as adults. The relative productivity of the spawning population will be monitored over time using smolt traps located within the Basin. Relationships between smolt production and spawner abundance (% hatchery fish on the spawning grounds) will provide information related to reproductive potential of the stocks and habitat. Relationships in productivity between stocks would also provide some information regarding competition in the freshwater environment. Smolt traps also provide information regarding trends in other species not directly associated with hatchery programs (i.e., non-target taxa of concern).

Spawning ground surveys will not only be used to develop smolt-to-adult return rates (SARs) for hatchery and wild fish, but provide information on spawn timing and distribution. Biological data collected from carcasses will also provide data concerning age and size at maturity.

Comparisons of any these parameters (juvenile or adult) between hatchery and wild fish would provide insight on the effects hatchery fish may have on wild populations. Any effects that are detected (greater than acceptable levels) would be addressed in subsequent changes in the respective hatchery program.

Yakama Nation

Coho Salmon

Adult coho returns to Winthrop NFH in 1999 marked the first generation of the developing mid-Columbia coho broodstock. This first generation of mid-Columbia brood coho was spawned and reared at Winthrop NFH and acclimated and released in the Wenatchee Basin. Since then releases in the Methow River have continued to focus on the broodstock development process. Smolt-to-Adult rates for coho returning to the Methow River have ranged between 0.02% and 0.27%. Natural coho spawning has been document in the mainstem Methow River, Beaver Creek, Gold Creek, and Spring Creek.

Studies to evaluate species interactions have primarily been conducted in the Yakima and Wenatchee sub-basins, however many of the results may be transferable to coho reintroduction efforts in the Methow sub-basin. The YN has observed only low levels of predation by hatchery coho smolts on spring chinook fry as demonstrated through several predation evaluations in the Wenatchee and Yakima Rivers. Studies to evaluate predation by naturally produced coho on spring chinook fry are in the early stages, while two microhabitat and competition evaluations indicated that naturally reared coho parr selected different habitats than spring chinook parr or steelhead.

Okanogan Subbasin

I. Introduction

Various processes are underway within the Columbia Basin that direct hatchery program implementation. The listing of certain populations of fish under the ESA has also dictated hatchery program modifications and reform.

Some of the principal processes are:

Federal:

Hatchery and Genetic Management Plans:

The Hatchery and Genetic Management Plan (HGMP) process was initiated to identify offsite mitigation opportunities associated with operation of the Federal Columbia River Power System. The HGMP process is designed to describe existing propagation programs, identify necessary or recommended modifications of those programs, and help achieve consistency of those programs with the Endangered Species Act. The HGMP process only addresses anadromous salmon and steelhead programs.

Hatchery and Genetic Management Plans are described in the final salmon and steelhead 4(d) rule (July 10, 2000; 65 FR 42422) as a mechanism for addressing the take of certain listed species that may occur as a result of artificial propagation activities. NOAA Fisheries will use the information provided by HGMPs in evaluating impacts on anadromous salmon and steelhead listed under the ESA. In certain situations, the HGMPs will apply to the evaluation and issuance of section 10 take permits. Completed HGMPs may also be used for regional fish production and management planning by federal, state, and tribal resource managers.

The primary goal of the HGMP process is to devise biologically-based artificial propagation management strategies that ensure the conservation and recovery of listed Evolutionarily Significant Units (ESUs). The HGMP process also seeks to document and implement hatchery reform in the Columbia Basin. Much of the initial work on the HGMP process was coordinated and combined with efforts to complete the Artificial Production Review and Evaluation (APRE – see below)) analysis, which looked at the same sorts of information.

Artificial Production Review and Evaluation (APRE)
The APRE process seeks to document progress toward hatchery reform in the Columbia Basin. The NPCC used consultants and representatives of the Columbia Basin fishery managers to analyze existing programs and recommend reforms; a draft report that will go to the Council and the region has been prepared. The APRE process includes both anadromous and non-anadromous fish in its analysis.

Pacific Coastal Salmon Recovery Fund

The Pacific Coastal Salmon Recovery Fund (PCSRF) was established in FY2000 to provide grants to the states and tribes to assist state, tribal and local salmon conservation and recovery efforts. The PCSRF was requested by the governors of the states of Washington, Oregon, California and Alaska in response to Endangered Species Act (ESA) listings of West Coast salmon and steelhead populations. The PCSRF supplements existing state, tribal and federal programs to foster development of federal-state-tribal-local partnerships in salmon recovery and conservation; promotes efficiencies and effectiveness in recovery efforts through enhanced sharing and pooling of capabilities, expertise and information. The goal of the Pacific Coastal Salmon Recovery Fund is to make significant contributions to the conservation, restoration, and sustainability of Pacific salmon and their habitat.

The PCSRF's enhancement objective is*: To conduct activities that enhance depressed stocks of wild anadromous salmonids through hatchery supplementation, reduction in fishing effort on depressed wild stocks, or enhancement of Pacific salmon fisheries on healthy stocks in Alaska. This includes supplementation and salmon fishery enhancements*.

US v. OR

United States v Oregon, originally a combination of two cases, Sohappy v. Smith and U.S. v. Oregon, legally upheld the Columbia River treaty tribes reserved fishing rights. Specifically the decision acknowledged the treaty tribes reserved rights to fish at "all usual and accustomed" places whether on or off the reservation, and were furthermore entitled to a "fair and equitable share" of the resource. Although the Sohappy case was closed in 1978, U.S. v. Oregon remains under the federal court's continuing jurisdiction serving to protect the tribes treaty reserved fishing rights. This case is tied closely to U.S. v. Washington, which among other things defined "fair and equitable share" as 50 percent of all the harvestable fish destined for the tribes' traditional fishing places, and established the tribes as co-managers of the resource.

In 1988, under the authority of U.S. v. Oregon, the states of Washington, Oregon and Idaho, federal fishery agencies, and the treaty tribes agreed to the Columbia River Fish Management Plan (CRFMP), which was a detailed harvest and fish production process. There are no financial encumbrances tied to the process. Rather, the fish production section reflects current production levels for harvest management and recovery purposes, since up to 90% of the Columbia River harvest occurs on artificially produced fish. This Plan expired in 1998, and has had subsequent annual rollover of portions in which agreement has been reached. However, a newly negotiated CRFMP is forthcoming.

Hatchery production programs in the upper Columbia sub-basins are included in the management plans created by the fishery co-managers identified in the treaty fishing rights case *United States v Oregon*. The parties to *U.S. v Oregon* include the four Columbia River Treaty Tribes – Yakama Nation, Warm Springs, Umatilla, and Nez Perce tribes, NOAA-Fisheries, U.S. Fish and Wildlife Service, and the states of Oregon, Washington, and Idaho. The Shoshone-Bannock Tribe is admitted as a party for purposes of production and harvest in the upper Snake River only. These parties jointly develop harvest sharing and hatchery management plans that are entered as orders of the court that are binding on the parties. The "relevant co-managers" described in the *U.S. v Orego*n management plans are, for the mid-Columbia sub-basins, the federal parties, Yakama Nation, and Washington Department of Fish and Wildlife.

Hatchery programs are viewed by the Yakama Nation as partial compensation for voluntary restrictions to treaty fisheries imposed by the tribe to assist in rebuilding upriver populations of naturally-spawning salmonids. Because treaty and non-treaty fisheries are restricted on the basis of natural stock abundance, the tribal priority is to use hatcheries in a manner that supplements natural spawning and increases average population productivity. Perspectives on the appropriate use of hatchery-origin fish for supplementation vary between federal, state, and tribal fish co-managers. Federal and, to a lesser degree, state co-managers place a higher priority on managing the genetic risks of hatchery supplementation of natural populations, while the tribe sees the demographic threats of habitat loss and degradation as the greater risk to natural populations. In general, however, all parties agree that hatcheries can and should be operated as integral components of natural populations where the survival benefits of the hatchery can result in a significant increase in net population productivity.

ESA

Current ESA Section 10 Permits for listed summer steelhead (Permit #1395); listed spring chinook (Permit #1196) and non-listed anadromous fish (Permit # 1347) also direct artificial production activities associated with the habitat conservation plans. Douglas PUD, Chelan PUD and WDFW are co-permittees, therefore provisions within the permits and associated Biological Opinions are incorporated into the hatchery programs undertaken in the HCP's.

State:

The state, along with the federal government have various forums in which they are active. All have some role in determining or balancing artificial production programs, as well as the ones that follow under "other". Essentially no specific action would occur until the action is determined to be warranted in the already established processes.

Other:

<u>FERC processes:</u>
Under current settlement agreements and stipulations, the three mid-Columbia PUDs pay for the operation of hatchery programs within the Columbia Cascade Province. These programs determine the levels of hatchery production needed to mitigate for the construction and continued operation of the PUD dams.

<u>Habitat Conservation Plans:</u>
In 2002, habitat conservation plans (HCPs) were signed by Douglas and Chelan PUDs, WDFW, USFWS, NOAA Fisheries, and the Colville Confederated Tribes. The overriding goal of the HCPs are to achieve no-net impact[10] on anadromous salmonids as they pass Wells (Douglas

[10] NNI refers to achieving a virtual 100% survival of anadromous salmonids as they pass the mainstem projects. This is achieved through 91% survival of adults and juveniles (or 93% for juveniles) passing the projects, and 7% compensation through hatchery programs and 2% contribution through a tributary fund, which will fund projects to improve salmonid habitat in the tributaries.

PUD), Rocky Reach, and Rock Island (Chelan PUD) dams. One of the main objectives of the hatchery component of NNI is to provide species specific hatchery programs that may include contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest.

Biological Assessment and Management Plan:
The biological assessment and management plan (BAMP) was developed by parties negotiating the HCPs in the late 1990s. The BAMP was developed to document guidelines and recommendations on methods to determine hatchery production levels and evaluation programs. It is used within the HCP as a guiding document for the hatchery programs.

All of these processes affect the hatchery programs within the Upper Columbia Basin in one way or another.

Historic and current programs and facilities

Historic programs

Other than two releases of sockeye as part of the Grand Coulee Fish Maintenance Project, anadromous fish releases began in the Okanogan Basin in the early 1960s, when steelhead were released into the Similkameen River as part of a state program (Chapman et al. 1994). Periodic releases of steelhead have been made since the 1960s (and regularly since the early 1990s) into Omak Creek, and regularly since 1966 into the mainstem Okanogan River as mitigation for the operation of Wells Dam, which is funded by Douglas PUD. A small number of "catchable" trout were also released into the Okanogan; once in the 1940s, and then three more times in the 1970s. Since the early 1990s, summer/fall Chinook have been released in the Similkameen River.

Current program overview:

Currently, there are releases of summer/fall Chinook, steelhead, and experimental programs for spring Chinook and sockeye (in Canada).

Table 1. Current artificial anadromous fish production in the Okanogan Subbasin.

Fish Species	Facility	Funding Source	Production level goals
Spring Chinook	Omak Creek, Ellisford Pond	BPA, CCT	30,000-150,000 (current production is dependent on availability of Carson-stock eggs)
Steelhead	Wells hatchery, Omak Cr.	DPUD	100,000
Summer Chinook	CPUD	Similkameen rearing pond	576,000
Sockeye	none	Douglas PUD	To compensate for __ smolts, DPUD has funded a cooperative water flow effort in the Okanogan River upstream from Lake Osoyoos, which has increased survival of incubating sockeye.

Coho	n/a	n/a	n/a

State and other programs

Summer/Fall Chinook: Artificial propagation of summer Chinook was initiated in 1989 through a mitigation agreement with Chelan and Douglas PUDs. The program is intended to mitigate for the loss of summer Chinook from the operations of Wells, Rocky Reach, and Rock Island dams (WDFW 1999). This program also provides surplus fish for recreational and tribal ceremonial and subsistence fisheries.

Spring Chinook: Spring Chinook were extirpated from the Okanogan River before the 1930s due to excessive harvest in the lower Columbia River, and habitat destruction in Canadian waters and tributaries of the Okanogan River in the U.S. (Craig and Suomela 1931; Fish and Hanavan 1948). There has never been a formal mitigation program for spring Chinook in the Okanogan River.

Currently, spring Chinook are artificially propagated and released in the Okanogan subbasin through a cooperative agreement between NOAA Fisheries, USFWS, CCT, and WDFW, as an interim, segregated harvest program to support tribal ceremonial and subsistence fishing and provide information for a proposed, long-term integrated recovery program.

Steelhead: Wells Hatchery is funded by Douglas PUD and operated by WDFW as mitigation for passage mortalities at Wells Dam. Steelhead are artificially propagated and released in the Okanogan subbasin as an integrated harvest program. The Colville Tribes have also initiated a local broodstock program and will be starting a kelt reconditioning program to create a comprehensive integrated recovery program through funding by BPA.

Release numbers and locations of Wells Hatchery stock steelhead have varied considerably over the past 12 years. In the lower Similkameen River, releases have varied from 37,500 to 82,415 since 1992 (APRE 2003b). Releases elsewhere in the Okanogan subbasin, primarily Omak and Salmon Creeks, has varied from 30,000 to 160,756 since 1992 (APRE 2003a). Current releases of Wells Hatchery stock steelhead are planned at 50,000 into the lower Similkameen River and 50,000 at other locations in the Okanogan subbasin.

Coho: There never has been an artificial propagation program for coho salmon in the Okanogan subbasin, and none are proposed at this time, but may be in the future.

Sockeye: Sockeye salmon were to be propagated in the subbasin as part of the authorized mitigation program for Grand Coulee Dam. However, while there were two releases of sockeye into Lake Osoyoos during the GCFMP, the sockeye hatchery was not constructed. A short-term sockeye propagation program was initiated in the 1990s at Cassimer Bar Hatchery, but suspended after only a few years as success was questionable and the direction of mitigation was shifted to habitat improvement in Canadian waters.

Currently, a program funded by Douglas PUD for compensation of sockeye passage losses at Wells Dam, coordinates water releases in the upper Okanogan River, which has increased egg and fry survival of sockeye.

Facilities Description:

Summer/fall Chinook
This propagation program is operated as an integrated harvest program to mitigate for the effects of the three PUD dams. Adult summer Chinook are collected at the Wells Dam trap, held at Eastbank Hatchery located on the Columbia River at Rocky Reach Dam, north of Wenatchee. All spawning, incubation and early rearing occur at Eastbank Hatchery. In October, the fingerling Chinook are transported to Similkameen Pond, located at river mile 3.1 on the Similkameen River. Here the fish are acclimated through the winter until their release in April of the following year. In 2004, 100,000 of the program's 576,000 smolt release were reared at the Bonaparte Pond, located at river mile 56 on the Okanogan River, with the intent of dispersing subsequent spawning of returning adults in historical habitats. This program may continue in the future if facility modifications are made to reduce over-winter mortality.

Spring Chinook
Two spring Chinook programs have been initiated in the Okanogan subbasin on an interim, informal basis. In Omak Creek, an integrated recovery program is underway to reintroduce spring Chinook in this historical habitat. The program was initiated in 2001 with scatter planting of 40,000 yearling spring Chinook in Omak Creek, below Mission Falls. These fish were of Carson stock origin reared at Winthrop NFH. These releases continued in 2002 with a scatter planting of 48,000 Carson stock Chinook from Leavenworth NFH. In 2003, 35,000 spring Chinook from Leavenworth NFH were again released in Omak Creek, but were first acclimated at the newly constructed St. Mary's Mission Acclimation Pond. All 45,000 Chinook scheduled for release in 2004 were lost when the new acclimation pond's pump failed. These releases are intended to test the capability of Omak Creek and the Okanogan River to again support spring Chinook.

In the Okanogan River, a segregated harvest program was initiated in 2001 with the acclimation of 254,000 Carson stock spring Chinook in Ellisforde Pond for release in April 2002. These fish were from Winthrop NFH and were surplus to management needs in the Methow subbasin. Releases of 100,000 spring Chinook from Leavenworth NFH were made in 2003 (from Bonaparte Pond) and 2004 (again from Ellisforde Pond). The first returns from these fish are expected in 2005 as four-year-olds. The objective of these fish is to test the capability of the Okanogan River to support spring Chinook migration and to provide a tribal ceremonial and subsistence fishery. No spawning of these fish in the Okanogan River is desired.

Steelhead
Wells Hatchery is located adjacent to Wells Dam at river mile 535 of the Columbia River. The hatchery production destined for the Okanogan is currently operated as an integrated recovery program, contributing to the conservation of the population, but also providing some harvest opportunity. Broodstock is collected from the west bank fish ladder at Wells Dam and from

volunteer returns to the Hatchery, held to maturity and spawned at the Hatchery. Two mating categories are used, wild x hatchery crosses and hatchery x hatchery crosses (APRE 2003a). The latter crosses have been released in the Okanogan subbasin, however, plans are now to release H x W crosses in the Okanogan whenever possible. Juvenile steelhead are reared to yearlings, then transported to the Okanogan subbasin where they are scatter planted in the Similkameen River (50,000), Omak Creek, Salmon Creek, and the Okanogan River (50,000) in late April to mid May.

In 2003, the Colville Tribes initiated a local broodstock program, collecting steelhead returning to Omak Creek. Eggs are incubated and subsequent fingerlings and pre-smolts reared at Colville Trout Hatchery, river mile 542 of the Columbia River. The integrated recovery program is planned to release 20,000 smolts in April or May of each year (NMFS 2003).

Genetic Integrity of Populations

Summer/fall Chinook
The Okanogan subbasin population of summer/fall Chinook is a fully integrated between the natural and hatchery origin fish. "There are no known genotypic, phenotypic, or behavior differences between the hatchery stocks and natural stocks in the target area" (WDFW 1999). The Okanogan and Methow populations have been managed as a single entity with a common hatchery broodstock.

The later-arriving component of the Okanogan summer/fall Chinook population has been severely depressed due to mortalities imposed by passage through nine mainstem dams, higher harvest rates on these fish in lower river fall Chinook fisheries, and the lack of artificial propagation. This component of the run is proposed by intensive propagation to restore its abundance (CCT 2004a).

Spring Chinook
There currently is no natural spring Chinook population in the Okanogan subbasin.

Steelhead
Current steelhead populations originated from a mix of indigenous upper Columbia Basin stocks intercepted during the GCFMP of the 1930s and 1940s, and potential resident fish. The Wells Hatchery stock was initiated in the 1960s from naturally spawning populations migrating past Priest Rapids Dam. The genetic background of the stock is therefore from a mix of populations. The stock is considered highly domesticated from years of broodstock collection at the hatchery and the low level of natural-origin fish available for inclusion in the broodstock. With about 81% of the natural spawning escapement consisting of hatchery-origin fish and the Okanogan subbasin receiving progeny of H x H crosses, the natural populations have been substantially affected by the Wells Hatchery program.

The new conservation programs initiated by the Colville Tribes and further efforts of WDFW at the hatchery to incorporate different matings (HxW, etc.) are intended to improve the viability and adaptability of steelhead in the Okanogan (and other) subbasin.

II. Program Goals and Objectives

Summer/fall Chinook
The goal of the Similkameen Pond program is "…to mitigate for the loss of summer Chinook salmon adults that would have been produced in the region in the absence of Wells, Rocky Reach, and Rock Island hydroelectric projects" (WDFW 1999). To this end, the mitigation agreement requires the production and release of 576,000 yearling summer Chinook in the Okanogan subbasin. Performance objectives and performance indicators have been established for the program (WDFW 1999) that addresses program benefits and risks.

Spring Chinook
The goal of the integrated recovery program in Omak Creek is to restore a natural spawning population of spring Chinook in historical habitats that contributed to the fisheries of the Confederated Tribes of the Colville Reservation. This program would also assist, longer-term in the recovery of endangered Upper Columbia River Spring Chinook when Carson stock is replaced with Methow Composite stock. Phase I of this program is intended to return 200- 700 adults to the subbasin to allow assessment of survival parameters and suitability of habitat.

The goal of the segregated harvest program is to mitigate for the loss of spring Chinook due to the construction of Grand Coulee, Chief Joseph, Wells, Rocky Reach, Rock Island, Wanapum, Priest Rapids, McNary, John Day, The Dalles, and Bonneville Dams. The fish will be managed for tribal ceremonial and subsistence fisheries and recreational angling. The Phase I of this program is intended to return 400 – 1,400 adults to the Okanogan River for tribal and recreational harvest. These fish will also be used to test the feasibility of live-capture, selective fishing gears the Colville Tribes intend to deploy for subsistence fishing.

Steelhead
The goal of the Wells Hatchery program in the Okanogan subbasin is to contribute to the conservation and recovery of steelhead while providing for recreational and tribal harvest when compatible with recovery.

From brood year 1981 through brood year 1996, smolt-to-adult survival for Wells Hatchery stock has ranged from 0.29% to 7.54 %, with a median survival of 0.92% and a mean survival of 1.63 % (WDFW 2002).

<u>Proposed programs</u>

Summer/fall Chinook
The Colville Tribes are proposing the construction of Chief Joseph Dam Hatchery and the use of 2 new acclimation ponds on the Okanogan River to increase the abundance, distribution and diversity of the propagation program for summer/fall Chinook in the Okanogan subbasin.
The Colville Tribes (CCT 2004a) have proposed to increase production levels of summer/fall Chinook to increase the abundance, diversity, and distribution of the naturally spawning

population and provide a more stable base for tribal ceremonial and subsistence fishing and recreational angling. The proposed program would initially release an additional 400,000 yearling summer/fall Chinook from a new acclimation site proposed near river mile 49, and 700,000 yearling and sub-yearling Chinook from a new acclimation pond at the mouth of Omak Creek (river mile 32). The broodstock for these releases would constitute the later-arriving Chinook that are not included in the current propagation program.

The current escapement goal for summer/fall Chinook in the Okanogan and Methow rivers is 3,500 fish past Wells Dam. The Colville Tribes have proposed to expand this escapement initially by 1,200 later-arriving summer/fall Chinook in the Okanogan subbasin. The Colville Tribes, in their draft Okanogan River Summer/Fall Chinook HGMP, are proposing an expanded management program to increase the escapement of summer/fall Chinook throughout their historical range in the Okanogan River by employing habitat enhancement and an expanded and diversified propagation program. The ultimate management goal will need to be derived from monitoring and evaluating the significant new program. The goal will need to include both increased escapement and stable harvestable surpluses for tribal and recreational fisheries.

Spring Chinook
The Colville Tribes are seeking an extension of the interim programs described above until a larger and more formal program can be initiated. The Colville Tribes are seeking a program that would initially release 200,000 Carson stock spring Chinook from Ellisforde Pond and 50,000 from St. Mary's Mission Pond. Eggs for this program would be collected at Leavenworth NFH then incubated and reared at Willard NFH prior to transfer to the two acclimation ponds in October (CCT, 2004b).

The Colville Tribes have proposed in their Okanogan River Spring Chinook HGMP to initiate a significant reintroduction effort. This would begin using Carson stock in an integrated recovery program followed by a transition to endangered Upper Columbia River Spring Chinook from the Methow subbasin upon its availability. The Colville Tribes are also proposing an initial isolated harvest program using Carson stock Chinook to be converted later to an integrated harvest program upon the availability of Methow subbasin fish. The HGMP's recovery goal is to restore spring Chinook in their historical tributary habitats, including eventually in Canadian waters. Enumerating a recovery goal at this time is premature until the Colville proposals are approved.

Steelhead
The Colville Tribes have initiated preparation of an Okanogan River Steelhead HGMP. The goal of the program will be to restore endangered steelhead in their historical habitats and create harvestable surpluses for tribal ceremonial and subsistence fisheries and for recreational harvest. Recovery of steelhead will require a mix of habitat restoration actions in tributary streams and artificial propagation. The later will include initiating a local Okanogan River broodstock to replace the homogenized, domesticated stock at Wells Hatchery and a kelt reconditioning program. Enumerating a recovery goal at this time is premature until the Colville Tribes' HGMP has been completed and implementation approved.

The objective of the new local broodstock project is to release 20,000 yearlings in Omak Creek starting in 2004. At that time, Wells Hatchery steelhead will no longer be released in Omak Creek.

The Colville Tribes will also soon be initiating a kelt recondition project in Omak Creek as part of a research experiment to compare the relative reproductive success of natural-origin, hatchery-origin, and reconditioned kelts in producing offspring.

The Colville Tribes are initiating development of a comprehensive HGMP for future management of steelhead in the Okanogan subbasin, working directly with WDFW and other fishery co-managers. Objectives for future management will include recovery of the population and provisions for tribal ceremonial and subsistence harvest and recreational angling that is consistent with recovery

Sockeye & Coho
There have never been or are no longer artificial propagation programs for sockeye or coho salmon in the Okanogan subbasin. Rehabilitation of the sockeye population in the Okanogan subbasin is currently being pursued through habitat rehabilitation efforts largely in Canada. First Nations in Canada have also initiated an artificial propagation program to increase fry production in lake waters. The Colville Tribes may soon propose a coho salmon reintroduction program for the Okanogan River. At that time, an HGMP will be prepared.

Relationship Between Artificial and Natural Populations

Summer/fall Chinook
The current propagation program uses broodstock collected at Wells Dam from mid July through August 28th, a combination of Chinook destined for the Okanogan and Methow rivers (and perhaps Columbia River). The Similkameen Pond program has successfully increased the abundance of the naturally spawning Chinook as evidenced by the high proportion of hatchery fish in the spawning population. The resulting population of hatchery-origin and natural-origin fish is fully integrated.

It appears that the Similkameen program has been essential in maintaining at least the short-term health of the summer/fall Chinook population in the Okanogan subbasin. [note – this is speculative, and if it is just dam based – then why has the Wenatchee late-run population been increasing over the last 40 years?] As with almost all supplemented populations of salmon, however, what is not known is the relative reproductive success of these hatchery-origin fish compared to the natural-origin Chinook in producing offspring.

Historically, natural Okanogan summer/fall Chinook have displayed a dominate sub-yearling or ocean-type life history strategy with juvenile fish entering the ocean in their first year. More recently, biologists have been documenting that many natural-origin adults are the result of a yearling or reservoir reared life history, apparently over-wintering in the Columbia River reservoirs prior to entering the ocean (J. Sneva, WDFW, pers. Comm.). However, the presence of the reservoir reared pattern became apparent well before demographic changes could have

taken place through the summer Chinook supplementation yearling programs. And in fact, the reservoir rearing could be an environmental adaptation for summer Chinook in the impounded Columbia River system. The Similkameen Pond propagation program releases yearling smolts that have been shown in other summer/fall Chinook programs to survive at much higher rates than sub-yearling releases. The effect of yearling releases on the long-term health of the population is not known.

A second variation of the artificial propagation program relative to the natural population is the timing of broodstock collection. All broodstock collected for the hatchery program is done from mid-July through August 28th, although summer/fall Chinook continue to migrate past Wells Dam into November. This truncated collection period was initiated to avoid including stray fall Chinook from lower river programs in the broodstock. This straying problem has since been eliminated, because Turtle Rock no longer uses Priest Rapids Hatchery fall Chinook, but rather uses summer Chinook collected at Wells Hatchery.

The expanded propagation program proposed by the Colville Tribes (CCT 2004) has been designed to enhance the qualities of the current Similkameen Pond program. Adult Chinook would be collected in or near the Okanogan River to create a fully localized broodstock of fish adapted to the Okanogan River. Broodstock would include the later-arriving population component (September to early November) that are believed to spawn in the lower river reaches, later in the fall. The added numbers of juvenile fish would be acclimated at two new sites in the mid and lower Okanogan River (Riverside and Omak) to seed these underutilized, historical habitats. And also, about 40% of the juvenile releases at Omak would be sub-yearling fish, the natural life history, to monitor their success relative to the yearling hatchery releases and the natural-origin migrants.

Spring Chinook

Spring Chinook salmon were extirpated from the Okanogan subbasin so there is no natural population. Carson stock spring Chinook have been used as eggs and are readily available from the Wenatchee subbasin and the stock has performed relatively successfully in the Columbia Cascade Province when artificially propagated. The Colville Tribes have proposed to use Carson stock until a surplus of ESA-listed Methow Composite stock is available from Winthrop NFH and Methow State Hatchery that can be introduced into the Okanogan subbasin as an experimental population under the terms of the ESA (CCT 2004b).

Steelhead

Steelhead populations are currently listed as endangered in the Columbia Cascade Province with natural cohort replacement rates prior to 1995 thought to be 0.3 or less for the various populations. The Okanogan subbasin has been a low priority for steelhead recovery efforts. At one time, NOAA Fisheries concluded that, "Current habitat conditions are not conducive to steelhead in the Okanogan River subbasin." Further, the Wells Hatchery releases destined for the Okanogan subbasin are from hatchery x hatchery crosses which would be expected to have the least success in natural reproduction. WDFW's spawning ground objective for the listed ESU has been 6,000. However, the Okanogan subbasin was not included in this objective.

With recent habitat improvements in Omak and Salmon creeks, natural reproduction of steelhead in the Okanogan subbasin has been increasing. In 2002, 39 steelhead redds were observed in two miles of reference reaches and natural-origin steelhead fry were abundant (Fisher 2003a). In 2003, 21 steelhead redds were observed in the same reaches. Fry were again abundant in some reaches, but not others due to a kill resulting from an accidental dumping of fire retardant (Fisher 2003b). Also in 2003, six steelhead redds were observed in Salmon Creek following an experimental release of water by the Okanogan Irrigation District. Subsequently, fry production was observed (Fisher 2003c). Further demonstrating the improved status of natural-origin steelhead in the Okanogan subbasin, with issuance of Section 10 (a)(1)(A) Permit 1395 to WDFW in October of 2003, NOAA Fisheries designated mortality limitations to natural-origin steelhead in the Okanogan River with runs up to 600 natural-origin fish.

Internal and External Consistency of Program to Purpose

Summer/fall Chinook

The Similkameen Pond program has been operated consistently with the planned objective of managing the Okanogan and Methow summer/fall Chinook as a single population. Actions that need to be undertaken in the Okanogan subbasin to improve the consistency of the existing program include:

1. Develop a local Okanogan broodstock, separate from the Methow population.
2. Propagate the entire summer/fall Chinook run, including fish arriving in September, October, and November.
3. Propagate and evaluate the benefits and costs of releasing the natural sub-yearling type juvenile in addition to the yearling smolts.
4. Continue to disperse acclimated hatchery releases throughout the full range of historical habitat.
5. Develop harvest strategies that manage for the proportion of hatchery-origin fish in the spawning population to optimize the population's viability.

Spring Chinook

The programs are too new to evaluate internal or external consistency. A key external risk that must be evaluated is the extent, if any, to which the Carson-stock spring Chinook stray to the Methow subbasin and spawn with ESA-listed Chinook of the Upper Columbia River Spring Chinook ESU or survive through the summer in the Okanogan River and spawn with summer/fall Chinook. Management actions will be taken to minimize these risks.

Steelhead

The current steelhead program in the Okanogan subbasin is going through a substantial change. Additional planning and execution via a new HGMP will be required to direct a holistic and consistent program. Actions that need to be undertaken in the Okanogan subbasin to improve the consistency of the existing program include:

1. Implement new acclimation sites for Wells Hatchery stock steelhead in the Okanogan subbasin that will provide ongoing conservation and fishery benefits, but not conflict with the new local broodstock and kelt reconditioning programs being developed in Omak Creek.

2. Transition from the aggregate, domesticated Wells Hatchery stock to an entire Okanogan subbasin program supported by local broodstock.
3. Implement a steelhead marking program that will support, yet differentiate the Wells Hatchery stock and Omak Creek programs.
4. Expand the local broodstock and kelt reconditioning programs from a base of Omak Creek to programs appropriate for the entire Okanogan subbasin.
5. Adjust proposed programs based on results of planned research in Omak Creek to evaluate the relative reproductive success of hatchery-origin, natural-origin, and reconditioned kelt steelhead.

III. Program Operations

Summer/fall Chinook

To implement the current Similkameen Pond program, broodstock are collected at the Wells Dam east ladder trap from mid-July through August 28th then immediately transported to Eastbank Hatchery for holding and maturing. For both the Okanogan and Methow programs, 556 Chinook are taken with equal numbers of males and females. In taking broodstock, there in no protocol for selecting for or against any particular trait. The program has specific protocols that ensure broodstock collection does not adversely affect natural spawning goals (WDFW 1999).

Adults are primarily spawned from late September through late October. A 1:1 mating scheme is employed. Eggs are placed in Heath stack incubators. Ponding of swim-up fry occurs after accumulation of about 1,700 temperature units from early May through June. About 85% of fertilized eggs survive to fry ponding. Rearing of juveniles is performed in raceways following loading densities of 6 lbs./gpm and 0.75 lbs./cu. ft. (WDFW 1999).

Fish health and disease are continuously monitored (10-15 times) by professionals in compliance with standard fish health policy standards. BKD is the primary disease of concern.

In October, fingerlings are transferred from Eastbank Hatchery to Similkameen Pond where they are reared for 6 months through the winter until release in early April. The objective for smolts is 576,000 at 10 fpp. All smolts are adipose fin clipped and coded wire tagged for identification.

Okanogan summer/fall Chinook contribute in various amounts to fisheries along the West Coast from S.E. Alaska to the Columbia River. Prior to recent harvest restrictions implemented due to widespread listings of salmon species pursuant to the Endangered Species Act, summer Chinook were harvested at high rates in ocean fisheries of Alaska and British Columbia. With the increased runs of the past three years, recreational fishing and tribal treaty fisheries in the Columbia River have enjoyed increased harvests. In the past two years, recreational fishing in the Okanogan River has resumed. The Okanogan summer/fall Chinook provide the Colville Tribes' with their last remaining ceremonial and subsistence fishery of any magnitude. Average Tribal harvests have been consistently below 1,000 fish until the past few years when harvest has exceeded 3,000 Chinook.

Spring Chinook
Broodstock collection, mating, egg incubation, and early rearing of the spring Chinook released in the Okanogan subbasin is performed at Leavenworth NFH, the operations of which can be viewed in the appended Okanogan River Spring Chinook HGMP (CCT 2004b) or sought in that facility's HGMP or the Wenatchee Subbasin Plan.

In October of each year the fingerling spring Chinook are transported to St. Mary's Mission Pond on Omak Creek and Ellisforde Pond on the Okanogan River. Ellisforde Pond is an open-air pond, is 225' x 90' x 6' deep, and has 121,500 cubic feet of useable rearing volume. The Pond's water is supplied by six pumps, each delivering 5 cfs from the Okanogan River. The pond is located on the left bank of the Okanogan River at river mile 62, near the community of Ellisforde. St Mary's Mission Pond is 72' x 12'x 4' and served with gravity flow from Omak Creek and from a well. Either water source can provide the necessary 550 gpm water supply. The Chinook are fed a restricted diet through the winter months followed by increased feeding and accelerated growth prior to their April release. The size objective for these Chinook is 15 fpp.

Steelhead
Steelhead broodstock for the Wells Hatchery stock program are collected in the west ladder of Wells Dam and from volunteer returns to the Hatchery. Fish are collected from throughout the run starting in August and into the following spring. To supply sufficient steelhead for all subbasins in the upper Columbia, 420 steelhead are collected for broodstock. Wild-origin fish have made up 5-12% of the broodstock. Fish are spawned in the spring as they ripen. Steelhead matings for the program are W x W, H x W, and H x H, with the latter destined for the Okanogan subbasin.

For the new local broodstock program, the 10 - 16 adult fish required for broodstock are collected at a weir and trap located at approximately river mile 0.5 in Omak Creek near its confluence with the Okanogan River. The trap is operated from March until early May. Collected steelhead are transported to Cassimer Bar Hatchery for holding. Hatchery-origin broodstock may be returned to Omak Creek if natural-origin steelhead are later trapped in order to meet broodstock protocols. Broodstock are examined weekly for ripeness and accordingly spawned. The mating preference is W x W crosses and secondarily H x W crosses.

At Cassimer Bar Hatchery, eggs are incubated in vertical Heath trays. Green egg to eyed egg survival is expected to be about 80%. Upon hatching and button-up, fry are transferred to modified Capillano troughs (63 cu. ft). Steelhead are reared in the troughs until July or when they reach 400/lb, when they are transferred to outside raceways (Golder 2002). Fingerlings are marked using elastomer-type tags. Due to water and space limitations at Cassimer Bar Hatchery, final rearing of the steelhead occurs at Colville Trout Hatchery.

Steelhead are reared to a size of 10 to 15 fish per pound and then scatter-planted in Omak Creek prior to mid-April. Any production above the 20,000 smolt objective, will be planted into other Okanogan River tributaries (e.g. Tunk or Bonaparte creeks).

Program Success

Summer/fall Chinook
The Similkameen Pond program has been operated consistently with the planned objective of managing the Okanogan and Methow summer/fall Chinook as a single population. The program has been successful in maintaining at least minimum numbers of spawning fish through years of poor freshwater and marine survival. In more recent years, the program has supported revitalized recreational and tribal fisheries throughout the Columbia River. Recent dispersal of production to Bonaparte Pond should improve the program contribution to population diversity in the Okanogan Basin.

The propagation of summer Chinook in the Okanogan subbasin was initiated with the 1989 brood year and a subsequent release of 352,600 yearling smolts in 1991. Since that time, releases have varied about the 576,000 program objective (WDFW 1999). Through 2003, all releases were made from Similkameen Pond. However, this has resulted in excessive use of the spawning habitat in the Similkameen and upper Okanogan rivers while other historical habitats are under utilized. In 2004, 100,000 of the Chinook historically released from Similkameen Pond may be released from Bonaparte Pond. If successful, this release may be increased to 200,000 yearlings (depending on modifications to the pond – see above).

The summer/fall Chinook destined for the Okanogan River has recently experienced a substantial increase. From runs of under 5,000 fish passing Wells Dam, returns since 2001 have ranged from about 40,000 to 69,000 adults. The proportion of hatchery-origin fish in the naturally spawning population is substantial ranging from just under 50% in the lower runs of recent years to over 70% in the last few larger runs.

The smolt-to-adult return rate for the Similkameen rearing pond has averaged 0.74 for brood years 1989 through 1997, ranging from 0.001-2.11.

Spring Chinook
Adults are not expected to start returning until May or June of 2005. Therefore no measurements of program success are available. Performance standards and indictors have been developed for the program and will be the basis for a monitoring and evaluation program.

Rearing in the new acclimation ponds has not been without mishap, however. At St Mary's Mission Pond, 10,000 fish were lost just prior to release. In 2004, all 45,000 fish were lost when the gravity water supply iced up and the auxiliary pump failed.

Steelhead
From brood year 1981 through brood year 1996, smolt-to-adult survival for Wells Hatchery stock has ranged from 0.29% to 7.54 %, with a median survival of 0.92% and a mean survival of 1.63 % (WDFW 2002).

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