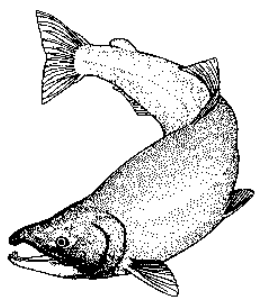
HATCHERY AND GENETIC MANAGEMENT PLAN

HGMP

Upriver Bright Fall Chinook Salmon

Little White Salmon/Willard NFH Complex



U.S. Fish & Wildlife Service
Columbia River Fisheries Program Office
Little White Salmon/Willard National Fish Hatchery Complex

December 14, 1999

The purpose of this hatchery and genetic management plan (HGMP) template is to provide a single source of hatchery information for comprehensive planning by federal, state, and tribal managers, and for permitting needs under the Endangered Species Act (ESA).

Section 1. General Program Description

1.1) Name of Program: Upriver Bright Fall Chinook Program - Little White Salmon/Willard NFH Complex

1.2) Population (or stock) and species: Upriver Bright Fall Chinook Salmon (*Oncorhynchus tshawytscha*)

1.3) Responsible organization and individual:

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Other organizations involved, and extent of involvement in the program:

- National Marine Fisheries Service (NMFS) - funding agency via Mitchell Act.
- Yakama Indian Nation receives production for tribal restoration program.
- U.S. *v* Oregon parties - co-managers of fisheries.

1.4) Location(s) of hatchery and associated facilities:

Little White Salmon NFH is located on the Little White Salmon River at river kilometer 2, approximately 19 kilometers east of Stevenson, Washington. The hatchery is situated just above Drano Lake, a water body where the Little White Salmon River joins the Columbia River at river kilometer 261. Site elevation is about 27 meters above sea level. Willard NFH is located on the Little White Salmon River approximately 6.5 kilometers upstream from the Little White Salmon NFH. These two hatcheries are operated as the Little White Salmon/Willard NFH Complex (Complex).

1.5) Type of program: Mitigation

1.6) Purpose (Goal) of program:

Little White Salmon River Program:

Little White Salmon NFH was originally constructed in 1898 and was remodeled and expanded in 1958. Willard NFH was authorized by the Mitchell Act in 1946 and constructed in 1952. The Complex currently operates as part of the Columbia River Fisheries Development Program (U.S. *v* Oregon) and is funded through the Mitchell Act—a program to provide for the conservation of Columbia River fishery resources. The purpose is to successfully rear and release upriver bright fall chinook salmon into the Little White Salmon River to provide mitigation (production for fisheries) for federal hydro-power construction, and other development, and to meet obligations under the U.S. *v* Oregon court agreement. A total of 2 million sub-yearling upriver bright fall chinook salmon are reared and released from Little White Salmon National Fish Hatchery as part of the Army Corps of Engineers (COE) John Day Dam mitigation program. This project is partial mitigation for habitat loss resulting from flooding, siltation, and fluctuating water levels caused by the construction and operation of the John Day Dam. It also provides fish to reaffirm tribal treaty granted fishing rights as mandated by U.S. *v* Oregon. Hatchery operations strive to meet mitigation requirements of John Day Dam and the Columbia River Fish Management Plan goals (U.S. *v* Oregon). The Columbia River Fish Management Plan is currently under renegotiation, however, current production goals are generally consistent with the production goals in the expired plan.

Yakima Program:
Upriver bright fall chinook are reared and transferred to tribal acclimation ponds on the Yakima River to assist the Yakama Nation tribal restoration effort and develop self-sustaining populations of fish. A total of 1.7 million upriver bright fall chinook are reared at the Little White Salmon/Willard National Fish Hatchery Complex and transferred by Service personnel to acclimation ponds on the Yakima River, WA. This project is a critical component of the Service's obligation under the U.S. *v* Oregon agreement to assist with the development of naturally spawning fish stocks on tribal lands in the mid-Columbia River basin. Funding received from the COE is used to provide feed to the tribal fisheries program to assist with the off-site rearing of these fish following transfer and during the acclimation period. Funds are also used to feed an additional 1.7 million upriver bright fall chinook salmon located at the Priest Rapids Hatchery under co-manager agreement and to meet U.S. *v* Oregon agreement obligations. Returning adult fish are designated for the development of locally adapted, naturally spawning populations within the Yakima River Basin. The Yakima program is not evaluated in this HGMP. It should be covered under a separate HGMP for the BPA funded Yakama tribal program.

Klickitat Program:
Mark and transfer Klickitat Hatchery fall chinook that have a history of straying into the Snake River to allow removal when returning as adults and avoid hybridization with ESA-listed stocks. Approximately 500,000 upriver bright fall chinook salmon from the Klickitat Hatchery, WA, are transported to Little White Salmon National Fish Hatchery for marking using funds provided by the National Marine Fisheries Service (NMFS) under authority of the Mitchell Act. The physical layout and logistical constraints of the Klickitat facility preclude large scale mass marking. The NMFS has mandated the mass marking of Klickitat upriver bright fall chinook salmon using standard length blank wire tags to allow mechanical removal at the Lower Granite Dam fish ladder. The NMFS' intent is to prevent these fish, that have a propensity to stray, from entering the Snake River and possibly hybridize with ESA-listed Snake River fall chinook. Allowing a greater than 5% stray rate into the Snake River is counter to recommendations made in the proposed Snake River Salmon Recovery Plan. As a result, 500,000 fish are transferred to Little White Salmon National Fish Hatchery for marking. Approximately 300,000 of the Klickitat fish receive the blank wire and 200,000 Little White Salmon upriver bright fall chinook receive

standard coded-wire tags and are transferred back to the Klickitat Hatchery for release. Data collected from these coded-wire tagged fish will help co-managers determine whether stock genetics is a potential cause of the high straying rate exhibited by Klickitat fall chinook. The Klickitat fish are on-station for about one week for marking. In exchange for the 200,000 Little White Salmon upriver bright fall chinook transferred to the Klickitat program, the remaining 200,000 unmarked Klickitat upriver bright fall chinook are kept on-station to provide a full 2 million on-station sub-yearling release. All of the Klickitat upriver bright fall chinook come from out of basin egg sources, primarily from Priest Rapids State Fish Hatchery. The Klickitat transfer and marking program is not evaluated in this HGMP. It should be covered under a separate HGMP for the Klickitat program.

1.7) Specific performance objective(s) of program:
The following objectives are adapted from IHOT (1995).

Objective 1: Hatchery Production
Produce 2.0 million subyearling smolts for on-station release.
Produce 1.7 million subyearling smolts for transfer to the Yakima River.

Objective 2: Minimize interactions with other fish populations through proper rearing and release strategies.

Objective 3: Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

Objective 4: Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.

Objective 5: Conduct environmental monitoring to ensure that hatchery operations comply with water quality standards and to assist in managing fish health.

Objective 6: Communicate effectively with other salmon producers and managers in the Columbia River Basin.

1.8) List of Performance Indicators designated by "benefits" and "risks":
Information is not required at this time and may be provided at a later date, per guidance by NMFS on October 5, 1999.

1.9) Expected size of program:
The following is a program summary adapted from IHOT (1996).

Measures	Hatchery Goal	5-Year Average	Range
Adult Capture[1]	1,860	5,725	1,628 - 7,699
Fish Releases[1]	2 Million	2.0M	1.8M - 2.2M

Egg Transfers[1]	0	0	0
Fish Transfers[1]	1.7 Million	2.8M	2.2M - 3.2M
Adults Passed Upstream[1]	0	0	0
Percent Survival, Juvenile to Adult[2]	1.0%	0.27%	0.18% - 0.33%
Smolt Size at Release (fish/lb)[1]	100	81	56 - 98.6

[1] Five year average and range from calendar years1995-1999
[2] Five year average and range from completed brood years1989-1992

1.10) Date program started or is expected to start:
The program began in 1983 with the release of 1982 brood year fish.

1.11) Expected duration of program:
Ongoing program.

1.12) Watersheds targeted by program:
Little White Salmon River Program:
The Little White Salmon River below Little White Salmon NFH (i.e. Drano Lake) is the target watershed. Little White Salmon NFH, the release point for the upriver bright fall salmon reared at the Complex, is located at river kilometer 2 on the Little White Salmon River, entering the Columbia River at river kilometer 261. This position is approximately 45° 42' 30" North Latitude and 121° 37' 30" West Longitude (pers. comm. Steve Vigg, NMFS).

1.13) Future program direction:
The future direction of this program may change as regional decision makers address salmon and steelhead restoration needs. As changes occur in hydro, habitat and harvest, and as hatchery reform is implemented, adaptive management strategies may include redirection of this program. As such changes occur, or where new information becomes available that may potentially effect listed salmon and steelhead species, the Service will reinitiate consultation by supplementing this HGMP.

Section 2. Relationship of Program to Other Management Objectives

2.1) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.

The upriver bright fall chinook program is consistent with:

- U.S. *v* Oregon Columbia River Fish Management Plan (currently under re-negotiation)
- U.S. Army Corps of Engineers John Day Dam Mitigation
- Mitchell Act
- NPPC Little White Salmon River Subbasin Salmon and Steelhead Production Plan - hatchery production strategy
- NMFS 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin
- 1999 Management Agreement for Upper Columbia River Fall Chinook, Steelhead and Coho (under U.S. *v* Oregon)
- IHOT Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries

This HGMP is consistent with these plans and commitments.

2.2) Status of natural populations in target area.

The backwater from Bonneville Dam covers all of the area that was originally suitable for salmon spawning in the Little White Salmon River (Bryant 1949, WDFW 1990). See Section 5.2.3 below.

2.2.1) Geographic and temporal spawning distribution.

2.2.2) Annual spawning abundance for as many years as available.

2.2.3) Progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for as many brood years as available.

2.2.4) Annual proportions of hatchery and natural fish on natural spawning grounds for as many years as possible.

2.2.5) Status of natural population relative to critical and viable population thresholds.

2.3) Relationship to harvest objectives.

All of the upriver bright fall chinook production at the Complex is part of the John Day Dam Mitigation (COE funded) program that was transferred from Spring Creek NFH in the mid 1980's. There is no natural spawning population of upriver bright fall chinook in the Little White Salmon River. The hatchery barrier dam, as well as an impassable falls just upstream, precludes access of anadromous species into the upper basin, and there is virtually no natural spawning area for upriver bright fall chinook salmon below the hatchery in the river (see 5.2.3). Therefore all returning fish above brood stock needs are harvestable. Upriver bright fall chinook production contributes to ocean, and inriver sport, commercial, and tribal fisheries. Most of the ocean fishery contribution occurs in the northern Pacific Salmon Commission area fisheries. Most of the inriver fishery impacts occurs in the Zone 6 fishing area above Bonneville Dam because of restrictions in lower river fisheries directed at achieving tribal/non-tribal harvest allocations and the management goal of remaining within the harvest rate jeopardy standards for Snake River wild fall chinook and wild Group B steelhead. The average total exploitation rate for brood years 1982-1989 was 0.68 (CTC 1994) for the Columbia River upriver bright stock which is the same stock released from the Complex. Exploitation rates declined during the later part of this period as more restrictions were applied to the fisheries. The 1987-1989 average brood year exploitation rate was 0.553. Appendix A1-A10 (from Pastor 1999) provides a history of the survival, estimated catch, and catch distribution for the Complex's upriver bright fall chinook for brood years 1983-1985 and 1989-1992. Percent survival during this period ranged from 0.1801 percent (BY 1991) to 1.9769 percent (BY 1984), and averaged 0.7409 percent.

The current jeopardy standards for ocean fisheries are a 30 percent reduction in the average exploitation rate for Snake River fall chinook from the 1988-1993 base period. The jeopardy standards for inriver fisheries are a 30 percent reduction in Snake River wild fall chinook impacts from the 1988-1993 base period and a 15 percent and 2 percent harvest rate cap on mainstem treaty Indian and non-Indian fishery impacts, respectively, for wild Group B steelhead (NMFS 1999a). Because harvest rate jeopardy standards for Snake River fall chinook dictate the management of both ocean and inriver fisheries under a weak stock management approach, it is not expected that the Complex's fall chinook production program will have a significant adverse impact on listed species relative to a harvest management context. The 1999 fall season harvest biological opinion determined that fisheries managed to stay within the Snake River wild fall chinook and wild Group B steelhead jeopardy standards would not jeopardize any of the other listed species (NMFS 1999a).

Detailed survival and contribution information for those brood years coded-wire tagged from 1983 through 1992 (last completely returned brood year) is in Appendix A1-A10. Percent survival for sub-yearling releases during this period ranged from 0.246 percent (BY 1989) to 1.977 percent (BY 1984), and averaged 0.741 percent.

2.4) Relationship to habitat protection and recovery strategies.
The backwater from Bonneville Dam covers all of the area that was originally suitable for salmon spawning in the Little White Salmon River (Bryant 1949, WDFW 1990). See section 5.2.3 below. Habitat restoration for anadromous salmonids outside of the Little White Salmon River basin will be a long term effort. The John Day Dam mitigation program is in place precisely because habitat was lost to upriver bright fall chinook. If mitigation goals for lost and degraded habitat are to be achieved, continued hatchery production will be required.

2.5) Ecological interactions.
Salmonid and non-salmonid fishes or other species that could:

1) negatively impact program;

A variety of freshwater and marine predators such as northern pikeminnows, Caspian terns, and pinnipeds, can significantly reduce overall survival rates of program fish. Predation by northern pikeminnow poses a high risk of significant negative impacts on the productivity of hatchery chinook (SWIG 1984). Based on PIT tags recovered at a large Caspian tern nesting colony on Rice Island, a dredge material disposal island in the Columbia river estuary, 6-25 million of the estimated 100 million out-migrating juvenile salmonids reaching the estuary were consumed by the terns in 1997 (Roby, et al. 1997). The Fish Passage Center (Berggren 1999) estimates, from about 57,000 PIT tag recoveries from Rice Island, that through 1991, about 0.2% of all PIT tagged fish released into the Columbia River showed up on Rice Island. That percentage had increased by a factor of ten by the 1997 and 1998 juvenile salmonid out-migrations, with hatchery and wild steelhead having been the most effected by the increased predation. A NMFS Working Group (NMFS 1997) determined that California sea lion and Pacific harbor seal populations in the three west coast states have risen by 5-7% annually since the mid-1970s. Their predation on salmonids may now constitute an additional factor on salmonid population declines and can effect recovery of depressed populations in some situations. See the ecological interactions discussion below.

2) be negatively impacted by program;

Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run chinook salmon ESU (threatened); Snake River spring/summer-run chinook salmon ESU (threatened); Lower Columbia River chinook salmon ESU (threatened); Upper Willamette River chinook salmon ESU (threatened); Upper Columbia River spring-run chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Upper Willamette River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). An additional concern is the Southwestern Washington/Columbia River coastal cutthroat trout ESU proposed for listing as threatened. See the ecological interactions discussion below.

3) positively impact program;

Returning chinook and other salmonid species that naturally spawn in the target stream and surrounding production areas may positively impact program fish. Decaying carcasses may contribute nutrients that increase productivity of the overall system.

4) be positively impacted by program;

A host of freshwater and marine species that depend on salmonids as a nutrient and food base may be positively impacted by program fish. The hatchery program may be filling an ecological niche in the freshwater and marine ecosystem. A large number of species are known to utilize juvenile and adult salmon as a nutrient and food base (Groot and Margolis 1991; and McNeil and Himsworth 1980). Pacific salmon carcasses are also important for nutrient input back to freshwater streams (Cederholm et al. 1999). Reductions and extinctions of wild populations of salmon could reduce overall ecosystem productivity. Because of this, hatchery production has the potential for playing an important role in population dynamics of predator-prey relationships and community ecology. The Service speculates that these relationships may be particularly important (as either ecological risks or benefits) in years of low productivity and shifting climactic cycles.

In addition, wild co-occurring salmonid populations might be benefitted as schools of hatchery fish migrate through an area. The migrating hatchery fish may overwhelm predator populations, providing a protective effect to the co-occurring wild populations. See the ecological interactions discussion below.

The 1999 Biological Assessment for the Operation of Hatcheries Funded by the National Marine Fisheries Service under the Columbia River Fisheries Development Program (NMFS 1999b) and the 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin (NMFS 1999c) present a discussion of the potential effects of hatchery programs on listed salmon and steelhead populations. The reader is referred to the discussion in those documents.

Nine generalized types of effects that artificial propagation programs can have on listed salmon and steelhead populations were identified. These effects include: 1. Hatchery operation, 2. Brood stock collection, 3. Genetic introgression, 4. Hatchery production (density-dependent), 5. Disease, 6. Competition, 7. Predation, 8. Residualism, and 9. Migration corridor/ocean. Potential effects in these categories may apply to all hatchery programs to one degree or another depending on the particular program design.

A discussion of ecological interactions relative to the Complex's upriver bright fall chinook program follows:

1. Hatchery operation- The water source for the Little White Salmon NFH is withdrawal from the Little White Salmon River, a series of springs, and a well. An impassable falls immediately upstream from the hatchery site precludes anadromous fish passage into the upper basin. Water withdrawals for hatchery operation do not impact listed anadromous species because there is essentially no natural spawning or rearing habitat accessible to anadromous species in the basin. Hatchery effluents meet established NPDES release standards criteria and are diluted by the flow in the Little White Salmon River, reducing potential negative impacts to natural stocks.
2. Brood stock collection- Upriver bright fall chinook are not native to the Little White Salmon River basin and are not a part of the lower Columbia River chinook ESU. This stock was introduced as part of the John Day Dam mitigation program in the early 1980s. Because upriver brights are an introduced stock for this area, there is a higher level of concern regarding potential ecological effects, especially hatchery introgression effects, if wide spread straying of this stock occurs. Returning upriver bright fall chinook are collected for brood stock at the Little White Salmon NFH rack near the mouth of the river. Stray tule fall chinook, presumably from Spring Creek NFH, are also collected but not spawned unless there is an identified shortfall at Spring Creek NFH, at which time Little White Salmon NFH may collect tule fall chinook eggs and

transfer them to Spring Creek NFH. Numbers of tule fall chinook returning and spawned for this purpose are generally very low. Temporal separation of spawning times (tules generally spawn about a month earlier) as well as differing visual characteristics of the two stocks assist in avoiding hybridization of the two stocks. Little White Salmon NFH also receives stray upriver bright fall chinook from Bonneville Hatchery releases (same stock) based on CWT recoveries. CWT recoveries from upper Columbia and Snake River basin upriver bright fall chinook are rare.

3. Genetic introgression- Complex upriver bright fall chinook are known to contribute to natural spawning populations in the local tributaries of the Wind and Big White Salmon rivers. CWT recoveries from Complex upriver bright fall chinook have been recovered in annual spawning ground surveys and upriver bright fall chinook have been colonizing these local tributaries since the mid 1980s (Harlan 1999). There is essentially very little, if any, productive spawning habitat below Little White Salmon NFH at the mouth of the Little White Salmon River (Drano Lake). Historical fall chinook habitat was inundated by Bonneville Pool when Bonneville Dam was constructed in 1938.

Although upriver bright fall chinook are colonizing the local Wind and Big White Salmon tributaries, the potential for genetic introgression with the local tule populations is diminished by the temporal separation in spawn timing of the two stocks, with tules spawning in September and early October and upriver brights spawning in late October and November. It is believed that the tule populations in the Wind and Big White Salmon rivers may be largely supported by Spring Creek NFH strays (NMFS 1999a). Thus, It appears that both the tule and upriver bright naturally spawning populations of fall chinook in the Wind and Big White Salmon rivers may be heavily influenced by hatchery strays. However, the fall chinook natural production areas in these tributaries is very limited and comprise a very minor part of the lower Columbia River chinook ESU as a whole. Therefore, the potential negative effect on the ESU as a whole is likely to be relatively minor. It would be advantageous to begin collecting genetic samples from the naturally spawning populations of tules and upriver brights in the two tributaries for comparison with samples from Spring Creek tules and Complex upriver brights as well as for comparison with samples from other natural populations in the lower Columbia River to determine and monitor the genetic stock structure of the various populations.

4. Hatchery production (density dependent effects)- Complex upriver bright fall chinook releases from the facility are moderate in magnitude (typically about 2.0 million fall chinook smolts) relative to other Columbia River fall chinook production programs. This level of release is not expected to cause serious density dependent effects in the mainstem Columbia River. Complex fall chinook are assumed to migrate rapidly after release. PIT tagging would help to test this assumption, but would require additional funding.

5. Disease- Hatchery programs routinely treat fish in response to disease outbreaks that occur, in part, because large numbers of fish are maintained under crowded conditions. Most pathogens now enter hatcheries through returning adult fish, surface water supplies, and other mechanisms involving direct contact with naturally spawning fish. Crowding and stress decrease the physiological resistance of salmonid fishes to disease and increase the likelihood of infection (Salonius and Iwama 1993; Schreck et al. 1993). Consequently, concern exists that the release of

hatchery fish may increase the risk of disease in naturally spawning populations.

Fish managers largely understand the kinds, abundance and virulence (epidemiology) of pathogens and parasites in hatchery fish. Recent studies suggest that the incidence of some pathogens in naturally spawning populations may be higher than in hatchery populations (Elliot and Pascho 1994). Indeed, the incidence of high ELISA titers for *Renibacterium salmoninarum*, the causative agent of Bacterial Kidney Disease (BKD), appears, in general, to be significantly more prevalent among wild smolts of spring/summer chinook salmon than hatchery smolts (Congleton et al. 1995; Elliot et al. 1997). For example, 95% versus 68% of wild and hatchery smolts, respectively, at Lowere Granite Dam in 1995 had detectable levels of *R. salmoninarum* (Congleton et al. 1995). Although pathogens may cause significant post-release mortality among hatchery fish, there is little evidence that hatchery origin fish routinely infect naturally produced salmon and steelhead in the Pacific Northwest (Enhancement Planning Team 1986; Steward and Bjornn 1990). Many biologists believe disease-related losses often go undetected, and that the impact of disease on naturally spawning populations may be underestimated (Goede 1986; Steward and Bjornn 1990). Nevertheless, we are unaware of any studies or documentation in the scientific literature where hatchery fish have infected a naturally spawning population of salmon or steelhead in the Pacific Northwest (see also Campton 1995).

The Complex follows Integrated Hatchery Operations Team (IHOT 1995) and Pacific Northwest Fish Health Protection Committee protocols for disease sampling and treatment. The Lower Columbia River Fish Health Center is located nearby at Spring Creek NFH so fish health sampling, diagnosis, and treatment are readily available as fish health issues arise. See section 10.4.3 for fish health details. The fish health goal for Complex upriver bright fall chinook is to release healthy fish that are physiologically ready to migrate. Complex upriver bright fall chinook are released directly into the Little White Salmon River at the hatchery site near the river mouth and pass only one mainstem Columbia River dam (Bonneville Dam) en route to the ocean. Complex upriver bright fall chinook have a much reduced potential for transmission of disease to other populations relative to other upriver programs which are subjected to the high density impacts and stresses of collection for transport and/or diversion through multiple bypass systems.

Our general conclusion at this time is that the Complex, as are all federal hatcheries in the Columbia River Basin, is currently taking extensive measures to control disease and the release of diseased fish. As a consequence, infection of natural fish by hatchery fish does not appear to be a problem. Based on the relative prevalence of BKD among hatchery and wild chinook salmon (Elliot et al. 1997; Congleton et al. 1995), the crowding and handling of fish at transportation dams at the time of barging or bypass may have a greater likelihood of increasing the incidence of disease among naturally produced fish than direct infection from hatchery fish.

6. Competition- The impacts from competition are assumed to be greatest in the spawning and nursery areas at points of highest density (release areas) and diminish as hatchery smolts disperse (USFWS 1994). Salmon and steelhead smolts actively feed during their downstream migration (Becker 1973; Muir and Emmelt 1988; Sager and Glova 1988). Competition in reservoirs could occur where food supplies are inadequate for migrating salmon and steelhead. However, the degree to which smolt performance and survival are affected by insufficient food supplies is

unknown (Muir and Coley 1994). On the other hand, the available data are more consistent with the alternative hypothesis that hatchery-produced smolts are at a competitive disadvantage relative to naturally produced fish in tributaries and free-flowing mainstem sections (Steward and Bjornn 1990). Although limited information exists, available data reveal no significant relationship between level of crowding and condition of fish at mainstem dams. Consequently, survival of natural smolts during passage at mainstem dams does not appear to be affected directly by the number - or density - of hatchery smolts passing through the system at present population levels. While smolts may be delayed at mainstem dams, the general consensus is that smolts do not normally compete for space when swimming through the bypass facilities (Enhancement Planning Team 1986). The main factor causing mortality during bypass appears to be confinement and handling in the bypass facilities, not the number of fish being bypassed.

Juvenile salmon and steelhead, of both natural and hatchery origin, rear for varying lengths of time in the Columbia River estuary and pre-estuary before moving out to sea. The intensity and magnitude of competition in the area depends on location and duration of estuarine residence for the various species of fish. Research suggests, for some species, a negative correlation between size of fish and residence time in the estuary (Simenstad et al. 1982).

While competition may occur between natural and hatchery juvenile salmonids in - or immediately above - the Columbia River estuary, few studies have been conducted to evaluate the extent of this potential problem (Dawley et al. 1986). The general conclusion is that competition may occur between natural and hatchery salmonid juveniles in the Columbia River estuary, particularly in years when ocean productivity is low. Competition may affect survival and growth of juveniles and thus affect subsequent abundance of returning adults. However, these are postulated effects that have not been quantified or well documented.

The release of hatchery smolts that are physiologically ready to migrate is expected to minimize competitive interactions as they should quickly migrate from the release site. The Complex's upriver bright fall chinook are released into the Little White Salmon River at the Little White Salmon NFH site. It is assumed that they migrate quickly through Drano Lake and into the mainstem Columbia River migration corridor en route to the ocean, reducing the potential for competitive interactions with listed stocks. There have been no mortalities recorded during saltwater challenges conducted during the last three brood years at the Complex. Released fish have been fully smolted and begin their downstream migration immediately following release. PIT tagging would also provide valuable confirmation information on the timing and speed of emigration. This would require additional funding. Because Complex upriver bright fall chinook releases occur "low" in the Columbia Basin system relative to many other upriver programs, there is reduced opportunity for competitive interactions among juveniles. However, competitive interactions between the Complex's adult upriver and tule fall chinook may be occurring in local spawning tributaries.

Coded-wire tag recovery data is used to document straying rates of program fish. The information in Table 1 is indicative of straying and homing of program fish. This data was extracted from the Columbia River Information System (CriS) and Pacific States Marine Fish Commission (PSMFC) databases (Pastor 1999). Refer to Appendix A for more details.

Table 1. Coded-wire tag recoveries from brood years 1990-1992.

Species	Brood Year	Where Recovered	Expanded No.
URB Fall Chinook	1990	ODFW Columbia R. Gillnet	1,042
		FWS Hatchery	7,052
		ODFW Hatchery	80
		ADFG Ocean Sport	80
		CDFO Ocean Sport	401
		ADFG Ocean Troll (non-treaty)	2,084
		CDFO Ocean Troll (non-treaty)	1,443
		WDFW Spawning Ground	1,042
	1991	ODFW Columbia R. Gillnet	917
		FWS Hatchery	2,464
		CDFO Ocean Sport	344
		ADFG Ocean Troll (non-treaty)	859
		CDFO Ocean Troll (non-treaty)	229
		WDFW Spawning Ground	344
	1992	ODFW Columbia R. Gillnet	1,140
		ODFW Columbia River Sport	275
		WDFW Fish Trap (freshwater)	39
		FWS Hatchery	3,893
		ADFG Ocean Sport	39
		ADFG Ocean Troll (non-treaty)	708
		CDFO Ocean Troll (non-treaty)	118

Data included in the Table 1 show that the straying, as a measure of homing ability, occurred when coded-wire tagged upriver bright fall chinook originating from brood years 1990 and 1991 from the Complex were recovered at ODFW hatchery facilities and in WDFW spawning ground surveys. The ODFW facilities were probably located in the vicinity of Bonneville Dam. Based on data in Harlan (1999), the WDFW spawning ground survey recoveries appear to be primarily from the Wind and Big White Salmon rivers.

The natural spawning upriver bright fall chinook in the Wind and Big White Salmon rivers are not targeted by the Complex's program. The WDFW (WDF et al. 1993) considers the naturally spawning population in the Wind River as a healthy stock of unknown origin with composite production (wild and hatchery fish). In the Wind River, NMFS lists a five year geometric mean natural spawning population size of 241 fish. The short term abundance trend (the most recent 7-10 years, based on total escapement) is negative, - 12.6 % per year. The long term abundance trend (1988-1996) is also negative, - 12.6 % per year (Myers et al. 1998). The WDFW (WDF et al. 1993) considers the naturally spawning population in the Big White Salmon River as a healthy stock of mixed origin with composite production (wild and hatchery fish). In the Big White

Salmon River, NMFS lists a five year geometric mean natural spawning population size of 1,225 fish. The short term abundance trend (the most recent 7-10 years, based on total escapement) is negative, - 5.2 % per year. The long term abundance trend (1988-1996) is also negative, - 5.2 % per year (Myers et al. 1998). The NMFS (Myers et al. 1998) considers both of these populations as non ESA issues, as these fish were not historically present in the watershed.

As mentioned above in the genetic introgression section, upriver bright fall chinook are colonizing the Wind and Big White Salmon River tributaries. Available fall chinook spawning areas are very limited in these two tributaries and the two fall chinook stocks appear to be competing for the same limited spawning habitat. There is some concern that the later spawning upriver brights may be excavating earlier spawning tule redds. However, even if this is occurring, the tule populations in those tributaries are believed to be largely supported by Spring Creek strays and the natural populations in those tributaries comprise a very small portion of the overall lower Columbia River chinook ESU. Therefore, negative impacts to the overall ESU are likely to be relatively minor. Columbia River managers should continue to monitor the local spawning areas for competitive interactions between upriver bright and tule fall chinook. Program changes may be appropriate if upriver bright fall chinook colonization expands beyond the local spawning area.

7. Predation- The Complex's releases of upriver bright fall chinook occur at the hatchery site near the mouth of the river and are sub-yearling size fish. Predation effects would therefore be limited to the migration corridor where effects are likely to be reduced relative to spawning and nursery areas. It is likely that Complex upriver bright fall chinook have much reduced predatory impacts on natural stocks relative to other yearling releases in natural production spawning and rearing areas. Depending on species and population, hatchery smolts are often released at a size that is greater than their naturally-produced counterparts. In addition, for species that typically smolt at one year of age or older (e.g. steelhead, spring chinook salmon), hatchery-origin smolts may displace younger year classes of naturally-produced fish from their territorial feeding areas. Both factors could lead to predation by hatchery fish on naturally produced fish, but these effects have not been extensively documented, nor are the effects consistent (Steward and Bjornn 1990). The USFWS (1994) presented information that salmonid predators are generally thought to prey on fish approximately one-third or less their size.

The southwestern Washington/Columbia River coastal cutthroat trout ESU is proposed for listing as threatened under the ESA. While there is no population of coastal cutthroat trout in the Little White Salmon River, program fish from the Complex could potentially encounter out-migrants of the sea-run form of the cutthroat in the mainstem or estuary of the Columbia River. Trotter (1997) states that the time of seaward movement of sea-run cutthroat in Oregon and Washington streams begins as early as March and peaks in mid-May. In some lower Columbia River tributaries in Washington, the USFWS found a similar run timing as presented in Trotter (1997) and also found that the size of the sea-run cutthroat trout smolts ranged from 100mm-260mm (S. Barndt, USFWS, pers. comm.). Sea-run cutthroat out-migrants are very earlier in timing and larger in size to the sub-yearling upriver bright smolts released from the Complex. Instances of predation by these hatchery smolts are not anticipated.

In general, the extent to which salmon and steelhead smolts of hatchery origin prey on fry from naturally reproducing populations is not known, particularly in the Columbia River basin. The available information - while limited - is consistent with the hypothesis that predation by hatchery-origin fish is, most likely, not a major source of mortality to naturally reproducing populations, at least in freshwater environments of the Columbia River basin (Enhancement Planning Team 1986). For example, peak emergence of listed chum salmon at Ives Island, a natural production area below Bonneville Dam, was estimated to occur during the latter half of March in 1999 (2/19/99 fax to Donna Allard from Wayne Vander Naald, ODFW). Out-migrant sampling conducted by the USFWS in 1998 and 1999 in Hardy Creek, which is adjacent to the mainstem Pierce/Ives Island natural production area, indicated that peak emigration of chum fry from this tributary occurred during the first two weeks of March (unpublished data). Based on life history traits, it is expected that most of the chum fry would have emigrated from the natural production area before the June release of upriver bright chinook occurs at the Complex. The potential for the Complex smolts to prey on emerging chum fry would not be virtually non-existant. However, virtually no information exists regarding the potential for such interactions in the marine environment.

The presence of large numbers of hatchery fish may also alter the listed species behavioral patterns, which may influence vulnerability and prey susceptibility (USFWS 1994). Releasing large numbers of hatchery fish may lead to a shift in the density or behavior of non-salmonid predators, thus increasing predation on naturally reproducing populations. Conversely, large numbers of hatchery fish may mask or buffer the presence of naturally produced fish, thus providing sufficient distraction to allow natural juveniles to escape (Park 1993). Prey densities at which consumption rates are highest, such as northern pikeminnow in the tailraces of mainstem dams (Beamesderfer et al. 1996; Isaak and Bjornn 1996), have the greatest potential for adversely affecting the viability of naturally reproducing populations, similar to the effects of mixed fisheries on hatchery and wild fish. However, hatchery fish may be substantially more susceptible to predation than naturally produced fish, particularly at the juvenile and smolt stages (Piggins and Mills 1985; Olla et al. 1993).
Predation by birds and marine mammals (e.g. seals and sea lions) may also be significant source of mortality to juvenile salmonid fishes, but functional relationships between the abundance of smolts and rates of predation have not been demonstrated. Nevertheless, shorebirds, marine fish, and marine mammals can be significant predators of hatchery fish immediately below dams and in estuaries (Bayer 1986; Ruggerone 1986; Beamish et al. 1992; Park 1993). Unfortunately, the degree to which adding large numbers of hatchery smolts affects predation on naturally produced fish in the Columbia River estuary and marine environments is unknown, although many of the caveats associated with predation by squawfish in freshwater are true also for marine predators in saltwater.

8. Residualism- Complex upriver bright fall chinook releases are not known to residualize in the Little White Salmon or Columbia rivers. PIT tagging would help to provide more information relative to hatchery out-migration questions. This would require additional funding.

9. Migration corridor/ocean- The hatchery production ceiling called for in the Proposed Recovery Plan for Snake River Salmon of approximately 197.4 million fish (1994 release levels)

has been incorporated by NMFS into their recent hatchery biological opinions to address potential mainstem corridor and ocean effects as well as other potential ecological effects from hatchery fish. Although hatchery releases occur throughout the year, approximately 80 percent occur from April to June (NMFS 1999b). The Complex's upriver bright fall chinook production is typically released in June, during the middle of the general out-migration season for other hatchery and natural populations. The total number of hatchery fish released in the Columbia River basin has declined by about 26 percent since 1994 (NMFS 1999a) reducing potential ecological interactions throughout the basin.

Ocean rearing conditions are dynamic. Consequently, fish culture programs might cause density-dependent effects during years of low ocean productivity, especially in nearshore areas affected by upwelling (Chapman and Witty 1993). To date, research has not demonstrated that hatchery and naturally produced salmonids compete directly in the ocean, or that the survival and return rates of naturally produced and hatchery origin fish are inversely related to the number of hatchery origin smolts entering the ocean (Enhancement Planning Team 1986). If competition occurs, it most likely occurs in nearshore areas when (a) upwelling is suppressed due to warm ocean temperatures and/or (b) when the abundance or concentration of smolts entering the ocean is relatively high. However, we are only beginning to understand the food-chain effects of cyclic, warm ocean conditions in the eastern north Pacific Ocean and associated impacts on salmon survival and productivity (Beamish 1995; Mantua et al. 1997). Consequently, the potential for competition effects in the ocean cannot be discounted (Emlen et al. 1990).

Section 3. Water Source

Water rights total 33,868 gpm from the Little White Salmon River and springs. Water use for fish production ranges from 11,221 gpm to 28,232 gpm. The river supplies most of this water flow. The water intake structure was rebuilt in 1994. A water re-use system was constructed in 1967 for egg incubation. An independent hatchery audit (Montgomery Watson 1997) measuring hatchery operations against IHOT standards (IHOT 1995) reported a remedial action was needed to provide disease-free water for incubation and early rearing (4,700 gpm). The estimated cost was $2.7 million. Such a system would also benefit the incubation and early rearing of upriver bright fall chinook and the incubation of coho.

The Complex's water intake structure was examined during the independent audit (Montgomery Watson 1997). The structure was in compliance when measured against NMFS's screening criteria for approach velocity and screen openings at that time. Subsequently, the screening criteria have been updated by NMFS and the structure has not been evaluated against the new criteria. If the structure is now out of compliance with the current screening criteria, there would be no impact on listed, or proposed to be listed, species. The intake structure is located well above the hatchery barrier dam. There are no reproducing populations of bull trout (*Salvelinus confluentus*) in the Little White Salmon River watershed (WDFW 1997).

Section 4. Facilities

Information is not required at this time and may be provided at a later date, per guidance by NMFS on October 5, 1999.

Section 5. Origin and Identity of Brood Stock

5.1) Source.
On-station releases into the Little White Salmon River:
- Adult fall chinook returning to the Little White Salmon River.

Yakima Program:
- Adult fall chinook returning to the Little White Salmon River.

5.2) Supporting Information.

5.2.1) History.
Following an unsuccessful attempt to rear upriver bright fall chinook, along with tule fall chinook, at Spring Creek NFH, the John Day Dam upriver bright mitigation program was moved to the Little White Salmon/Willard NFH Complex in 1988. The "mid-Columbia Bright" brood stock was developed in 1977 when upriver bright fall chinook were trapped from the Bonneville Dam fish ladder and spawned at Bonneville Hatchery (CRFMP All-Species Review 1997).

The following lists all the fall chinook stocks that have been transferred to the Little White Salmon/Willard NFH Complex during the last 5 brood years. All stocks were received during 1998 to meet production shortfalls due to a mechanical-caused loss of progeny from fish that had returned to the Complex:

January 23	13,000 upriver bright fall chinook (URB) from Klickitat SFH, WA
January 27	13,168 URB from Lyons Ferry SFH, WA
February 10	504,000 URB from Bonneville SFH, OR
February 13	800,000 URB from Bonneville SFH, OR
February 18	600,000 URB from Klickitat SFH, WA
February 24	600,000 URB from Klickitat SFH, WA
March 3	600,000 URB from Priest Rapids SFH, WA
April 1	200,000 URB from Umatilla SFH, OR
April 27	500,000 URB from Bonneville SFH, OR
June 9	250,000 URB from Bonneville SFH, OR

5.2.2) Annual Size.
Adult upriver bright fall chinook enter the hatchery holding ponds from mid-October through mid-November. Spawning occurs from late October to mid November. A summary of total returns and numbers spawned from 1980 through 1999 is found in Appendix B. Adult returns ranged from 68 to 7,839, averaging 3,172, for this period. The annual escapement goal is 1,860 adults returning to the hatchery (see Section 1.9).

5.2.3) Past and proposed level of natural fish in brood stock.
As stated in Bryant (1949), the backwater from Bonneville Dam covers all of the area that

was originally suitable for salmon spawning. In addition, a natural waterfall located about 0.8 kilometers above the hatchery barrier dam (built in 1974) had historically blocked access to spawning habitat located above the hatchery. Fluctuations in the level of the Bonneville Pool are seen immediately below the barrier dam. Historical literature reviews indicate that the only original native stock were the tule fall chinook and late-run coho (Nelson and Bodle 1990). Both are extinct from the watershed and there are no naturally spawning populations. Remnants of the original Tule stock were transferred to Spring Creek NFH during the mid-1980's. There has been no past or proposed future level of natural fish used as brood stock for the upriver bright fall chinook currently produced at the Little White Salmon/Willard NFH Complex.

5.2.4) Genetic or ecological differences.
As stated in section 5.2.3 above, there are no natural stocks in the Little White Salmon River.

5.2.5) Reason for choosing.
All stocks of upriver bright fall chinook were chosen due to their availability. All natural stocks (except the tule fall chinook) within the Little White Salmon River watershed had become extinct prior to 1938. The loss of tule fall chinook habitat following the closure of Bonneville Dam and the subsequent transfer of this stock to Spring Creek NFH removed the last remnant natural population from this watershed.

5.2.6) Unknowns.
Extinction of natural stocks and the current practice of managing brood stocks by large geographic regions (other than on a watershed basis, e.g. mid-Columbia Brights, early-run coho, Carson-stock spring chinook, etc.) has lead to decisions effecting choice of brood stock. Although not endemic to the Little White Salmon River watershed, one would expect local adaptation of the existing hatchery stocks over time.

Section 6. Brood Stock Collection

Brood stock collection practices are consistent with the guidelines established by IHOT (1995).

6.1) Prioritized goals.

1. Collect an adequate number of adult fish at the Little White Salmon/Willard NFH Complex to achieve the following production goals:

   - 2,000,000 sub-yearling upriver bright fall chinook for on site release.
   - 1,700,000 sub-yearling upriver bright fall chinook transferred released off site on the Yakima Indian Reservation as part of mitigation for John Day Dam and to restore this stock to historic levels.

2. For all species collected at the Little White Salmon/Willard NFH Complex, collect enough adult fish to assure a 1:1 spawning ratio.

3. For all upriver bright fall chinook collected at the Little White Salmon/Willard NFH Complex, operate the hatchery fish ladder to assure collection of fish for brood stock is representative of the entire spectrum of the run.

4. For all upriver bright fall chinook collected at the Little White Salmon/Willard NFH Complex, treat as needed with formalin to control fungus and maintain pre-spawning mortality below 2.5%.

6.2) Supporting information.
The following information is based on historical data and updated annually as new brood year information is collected.

6.2.1) Proposed number of each sex.
The annual escapement goal is 1,860 adults returning to the hatchery. The expected sex ratio and eggs per female are as follows:

% Male	% Female	Eggs/Female	Spawning Ratio	No. Males Needed	No. Females Needed
51.8	48.2	4,800	1:1	963	897

Not all females are spawned, and not all eggs taken result in released smolts. There is up to 5 percent adult pre-spawn mortality, up to 8 percent mortality from green egg to egg eye-up, up to 1.5 percent mortality from eye-up to ponding, and up to 5 percent mortality from ponding to smolt release.

6.2.2) Life-history stage to be collected (e.g. eggs, adults, etc.).
The upriver bright fall chinook production program is derived from the collection of adult fish returning to the Little White Salmon/Willard NFH Complex.

6.2.3) Collection or sampling design.
All fish production for the Complex is initiated by adult collection at Little White Salmon NFH. An impassable natural waterfall, located approximately 0.8 kilometers upstream of the Little White Salmon facility prevents adult passage to Willard NFH.

Returning adult fish migrate through Drano Lake (backwater of the Bonneville Pool at the mouth of the Little White Salmon River) and up the Little White Salmon River, before entering the hatchery ladder. To facilitate and maximize adult collection, further migration is prevented by a concrete barrier dam. Constructed in 1974, the fish ladder and barrier dam were built in anticipation of new peaking levels at Bonneville Dam (USFWS 1987). River water is supplied to 2- 30' wide X 90' long X 6' deep adult holding ponds. Water exiting the ponds, in addition to a separate attraction water intake, supplies water to the fish ladder. Adult fish migrating up the ladder enter the ponds through a finger weir.

The collection of upriver bright fall chinook occurs concurrently with the collection of coho salmon. Run timing for fall chinook and coho is greatly compressed when compared to spring chinook salmon. Ladder operations begin during the third week of September. Historical records indicate that coho are the first fish collected and that an earlier ladder opening results in the collection of stray tule fall chinook from Spring Creek NFH. Upriver bright fall chinook begin their upstream migration in the Little White Salmon River later than coho, with the first fish collected near mid-October. Migration of both species occurs in extremely large numbers in some years, and it is not uncommon to collect more than 500 adult fish in a 24 hour period. The hatchery ladder is operated until maximum densities are achieved. If this occurs, the ladder is closed until excess fish are randomly removed from the ponds or spawning occurs. The ladder is then reopened to continue collecting adults from the full spectrum of the return run. Generally, the hatchery ladder is closed by mid-November at which time very few fish remain below the hatchery barrier dam.

6.2.4) Identity.

There are no naturally spawning populations of upriver bright fall chinook within the Little White Salmon River watershed. As a result, differential marking is not required. An index group of juveniles released into the Little White Salmon River is marked with coded-wire tags and adipose clips. This mark is used to distinguish a tagged hatchery fish at spawning time. The collection of an un-marked (non-adipose clipped) salmon does not equate to the collection of a “wild” fish. Approximately 90% of the Complex’s upriver bright fall chinook production program is left unmarked. All adult fish that have an adipose clip are sampled to retrieve the coded-wire tags for stock assessment purposes. Tag code recoveries are reported following the spawning season.

6.2.5) Holding.

The holding period for upriver bright fall chinook salmon is very short and uneventful. An aluminum bar-grader is installed between the two adult holding ponds to allow segregation by size. It is important to attempt to separate the large fall chinook from the smaller coho salmon. The common crowding of these fish normally results to damage in the smaller coho, being most evident by increases in broken eggs and bloody females. The Complex goal for all species is to achieve a 2.5% or less pre-spawning mortality rate during the holding period.

6.2.6) Disposition of carcasses.

Upriver bright fall chinook salmon are not chemically treated during spawning. Carbon dioxide is used to induce anesthesia. These fish are fit for human consumption. First priority for excess and spawned carcasses is provided to the Yakama Indian Nation ceremonial and subsistence program. All other excess carcasses are processed by contractors for the U.S. Department of Justice, Federal Prisons Program. Those fish treated with formalin are held for a minimum of 5 days prior to the excess process. Following any erythromycin treatment, all fish are either rendered using a commercial based rendering company or buried on station.

6.3) Unknowns.
There are no data gaps that have lead to uncertainties about brood stock collection.

Section 7. Mating

7.1) Selection Method.
As mentioned in section 6.2.3, brood stock are collected that represent the entire spectrum of the run. Fish are sorted and ripe females spawned until 100% of the fish have been checked. Green females are passed back to the holding ponds with an adequate number of males to assure a 1:1 mating ratio. The eggs collected during a given sort are considered an egg "take". Male spawners are randomly selected during the sort. Jack males are used in proportions representative of their return rate. In years of high jack returns, a larger proportion of jacks are used as spawners up to a five percent maximum. The number of jacks to be spawned on a given day is subjectively defined by hatchery staff and is subject to jack availability and ripeness. After all of the adult fish being held have been sorted once and ripe females spawned, a maximum one week period is allowed to pass before the fish are re-sorted and newly ripened females spawned. The objective is to achieve maximum fertilization by spawning fish soon after ovulation and yet avoid the needless handling of green females. The re-sorting process continues until all fish are spawned. Since there are no naturally spawning upriver bright fall chinook in the watershed, differentiating spawners based on natural stock origin from within the watershed is not a criteria.

7.2) Males.
If the hatchery escapement goal is met, then a 1:1 spawning ratio will be achieved. Achieving this spawning ratio is one of the highest brood stock program goals at the Complex. During low escapement years, males have been re-used on an as-needed basis to maximize the total number of females available to spawn. In low escapement years it is better to spawn the available females (and not lose that genetic material), than discard them. Under these conditions, reusing male fish does not compromise the genetic diversity of the hatchery stocks. It was determined that, in all instances, a minimum escapement need had been met to maintain genetic diversity, although some male fish had to be reused to achieve production goals.

7.3) Fertilization.
It is important to note that at no time in the recent past has the Complex pooled the eggs of females prior to fertilization. Again, as mentioned in section 7.2 above, an intense effort is made to achieve a 1:1 spawning ratio. The following is a detailed description of the spawning protocol.

Adults are crowded from holding ponds and anesthetized using carbon dioxide. Anesthetized adults are then sexed and checked for ripeness. Ripe adults are killed with a blow to the head. Tails of all females spawned are cut to allow bleeding for approximately 3-5 minutes. Eggs are then removed using a Wyoming knife and collected in iodophor-disinfected colanders to drain ovarian fluid. The eggs are then transferred to iodophor-disinfected stainless steel buckets and sperm is added directly to the eggs. A 1:1 random spawning ratio is maintained and male jacks are used proportionally to their percentage of the run. The buckets containing eggs and sperm of individual (paired) fish are then transferred to the Little White Salmon hatchery nursery building (0.3 kilometers away) where water is added to activate the sperm. This process takes from 5-10 minutes. The fertilized eggs are stirred and allowed to rest for a minimum of thirty seconds, then washed and water hardened for one half hour in a 75 mg/L iodophor solution in individual Heath incubator trays. The eggs are incubated using single pass spring or well water.

Aseptic procedures are followed to assure the disinfection of equipment throughout the egg handling process. Samples are collected by fish health specialists to determine the incidence of infectious hematopoetic necrosis (IHN), erythrocytic inclusion body syndrome (EIBS), *Ceratomyxa shasta*, and screening for other pathogenic bacteria. Refer to section 10.4.3 for more fish health details.

Upriver bright fall chinook salmon are not sampled for *Renibacterium salmoninarum*. Segregation and culling by titre group is not performed since bacterial kidney disease is not a chronic problem with this run of salmon.

7.4) Cryopreserved gametes.
Cryopreservation of gametes is not performed at the Little White Salmon/Willard NFH Complex.

Section 8. Rearing and Incubation

Information is not required at this time and may be provided at a later date, per guidance by NMFS on October 5, 1999.

Section 9. Release

9.1) Life history stage, size, and age at release.
Size at release information is provided for upriver bright fall chinook released from the Complex directly into the Little White Salmon River from 1990 through 1999 in Appendix C. Releases have ranged in size from 115 fish per pound (brood year 1996) to 56 fish per pound (brood year1998), averaging 92 fish per pound.

9.2) Life history stage, size and age of natural fish of same species in release area at time of release.
As reported in sections 2.2 and 5.2.5, there are no naturally produced anadromous salmonid fish species in the Little White Salmon River watershed.

9.3) Dates of release and release protocols.
For the last three generations, sub-yearling upriver bright fall chinook have been released during the third week of June. The exact day of the week has varied in an attempt to maximize survival by planning releases on known spill days at Bonneville Dam. All releases are forced.

9.4) Location(s) of release.
Upriver bright fall chinook sub-yearlings are released directly into the Little White Salmon River at the Little White Salmon facility below the hatchery barrier dam.

9.5) Acclimation procedures.
Spring water (warmer than Little White Salmon River water) is used in an attempt to accelerate the growth of sub-yearling upriver bright fall chinook. This spring water is replaced with river water at least one month prior to release to assure the proper acclimation of upriver bright fall chinook released into the Little White Salmon River.

9.6) Number of fish released.
Release information is provided for fish released from the Complex directly into the Little White Salmon River from 1990 through 1999 in Appendix C. Sub-yearling smolt releases during this period ranged from 308,760 (BY 1996) to 4,029,158 (BY 1991), and averaged 2,032,926 upriver bright fall chinook. Refer also to section 1.9.

9.7) Marks used to identify hatchery adults.
An adipose clip is used to designate the presence of a coded-wire tag in upriver bright fall chinook. No other marking is performed on these species. Coded-wire tagging is performed as part of the Complex's stock assessment marking program.

Section 10. Monitoring and Evaluation of Performance Indicators

10.1) Marking.
As stated in section 9.7, an adipose clip is used to designate the presence of a coded-wire tag in upriver bright fall chinook. No other marking is performed on these fish. The following table summarizes the Complex's stock assessment marking program.

Species	Release No.	No. Marked	Mark
Fall Chinook	2,000,000	200,000	Ad-CWT

10.2) Genetic data.
Information is not required at this time and may be provided at a later date, per guidance by NMFS on October 5, 1999.

10.3) Survival and fecundity.
Information is not required at this time and may be provided at a later date, per guidance by NMFS on October 5, 1999.

10.4) Monitoring of performance indicators in Section 1.8.

10.4.1) Proportions of hatchery spawners in natural populations in target area.

As reported is sections 2.2 and 5.2.5, there are no natural anadromous salmonid populations located in the Little White Salmon River watershed. Washington Department of Fish and Wildlife conducts spawning ground surveys in the local tributary systems (Wind River, Little White Salmon River, Big White Salmon River, Klickitat River). Recovered CWT data are reported annually.

10.4.2) Ecological interactions between program fish and natural fish (same and other species) in target area.

In-stream ecological interaction studies need to be developed and projects funded. These should compliment projects under section 10.4.6

10.4.3) Disease control in the hatchery, and potential effects on natural populations.

Aseptic procedures are followed to assure the disinfection of equipment throughout the egg handling process (see section 7.3). Fish health samples are collected to determine the incidence of infectious hematopoetic necrosis (IHN), erythrocytic inclusion body syndrome (EIBS), other reportable viruses, *Ceratomyxa shasta*, and pathogenic bacteria. Other contributions to improved fish health in the upriver bright fall chinook at the Complex include: maintaining optimal rearing densities, routine monthly fish health examinations, and formalin treatments on an as-needed basis to control external parasites and fungal infections.

The following procedures are in place to monitor and maintain the health of the fish at the Complex:

<u>General Fish Health Monitoring</u>

- After fish are hatched, a 60 fish sample is examined for reportable viruses.

- On at least a monthly basis, both healthy and clinically diseased fish from each fish lot are given a health exam. The sample includes a minimum of 10 fish per lot.

- At spawning, a minimum of 150 ovarian fluids and 60 kidney/spleens are examined for viral pathogens from each species.

- Prior to transfer or release, fish are given a health exam. This exam may be in conjunction with the routine monthly visit. This sample consists of a minimum of 60 fish per lot.

- Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures.

- Reporting and control of specific fish pathogens are conducted in accordance with the Co-Managers Salmonid Disease Control Policy and the USFWS Fish Health

Policy and Implementation Guidelines.

Fish and Egg Movements

- Movements of fish and eggs are conducted in accordance with the Co-Managers Salmonid Disease Control Policy and the USFWS Fish Health Policy and Implementation Guidelines.

Therapeutic and Prophylactic Treatments

- At spawning, eggs are water-hardened in iodophor as a disinfectant.

- Juvenile fish are administered antibiotics orally when needed for the control of bacterial infections.

- Formalin (37% formaldehyde) is dispensed into water for the control of fungus on eggs and the control of parasites on juveniles and adult salmon. Treatment dosage and time of exposure varies with species, life-stage and condition being treated.

- Therapeutants approved by the U.S. Food and Drug Administration or those under Investigative New Animal Drug permits are used for treatments. Under special circumstances, extra-label usage of other animal drugs may be prescribed by a veterinarian to control resistant disease organisms.

Sanitation

- All eggs brought to the facility are surface-disinfected with iodophor as per the USFWS Fish Health Policy.

- All equipment (nets, tanks, rain gear) is disinfected with iodophor between different fish/egg lots.

- Different fish/egg lots are kept in separate ponds or incubation units. Water is not reused.

- Tank trucks or tagging trailers are disinfected when brought onto the station. Foot baths containing iodophor are strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

All of the above practices would minimize potential negative effects on natural populations of fish by lessening the chance for horizontally transmitted diseases when encountering Complex fish in the migration corridor or in the ocean.

10.4.4) Behavior (migration, spawning, etc.) of program fish.

- Time of migration and spawning of upriver bright fall chinook at the Complex is tracked to determine if any noticeable shift in run and spawn timing is occurring

- Immediately prior to release, a representative sample of 100 fish are subjected to a

24 hour saltwater challenge at a salinity concentration of 30 parts per thousand (3%). Observations regarding visibility of parr marks, coloration and overall survival are used to evaluate degree of smoltification are recorded.

10.4.5) Homing and straying rates for program fish.
Coded-wire tag recovery data are used to document straying and homing rates of program fish.

- A minimum of one marked group of fish (CWT and adipose fin clipped) for each production group is released. Release information is reported to the Pacific States Marine Fisheries Commission (PSMFC) coast wide database.
- Heads from all marked returns to the Complex are recovered during spawning operations.
- CWT recovery data at the Complex is compiled and reported to the PSMFC coast wide database. CWT recovery data from various ocean and freshwater fisheries, stream spawning ground surveys, and other hatcheries are reported to the PSMFC coast wide database by the recovering agency.
- Estimates of survival, distribution, and contribution for Complex released fish are summarized in an Annual Stock Assessment report. Data from off site recoveries of Complex released fish, downloaded from the PSMFC coast wide database, are used in the analysis.

10.4.6) Gene flow from program fish into natural populations.
As mentioned is several previous sections, there are no natural anadromous salmonid populations located in the Little White Salmon River watershed. As a result, gene flow from program fish into natural populations within this watershed is not a concern. Gene flow into naturally spawning tule fall chinook populations in other local production areas (i.e. Wind and Big White Salmon rivers) is unknown, but assumed to be low because of differential spawning time. Natural upriver bright fall chinook spawners in these same areas are believed to be largely supported by hatchery strays and comprise a very minor component of the lower Columbia River chinook ESU. See discussion in section 2.5 for further details on hatchery introgression.

A systematic program to annually monitor baseline genetic data of the fish produced at the Complex needs to be developed and funded. This genetic monitoring would include the use of DNA (e.g. microsatellite) markers and evaluation of life history characters (e.g., run timing, age, and size class distribution of adults). For example, the use of DNA markers could entail the sampling and analysis of approximately 50-75 adults each from the early, middle, and late spawn groups, at least initially. At a minimum cost of $50 per fish, the overall cost of initializing such a genetic monitoring program for the hatchery spawners alone would be at least $10,000 per stock. A genetic database for Complex production would provide needed information within the Complex to monitor the genetic traits and viability of the stock produced. Genetic profile comparisons between carcasses and naturally produced juveniles, with DNA markers, is highly desired. The information would be available to compare to natural stocks in local tributary systems to monitor any introgression or ecological interactions between program fish and natural fish (section

10.4.2).

Section 11. Research

Information is not required at this time and may be provided at a later date, per guidance by NMFS on October 5, 1999.

Section 12. Attachments and Citations

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