HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

DRAFT

Hatchery Program	Big White Salmon Winter Steelhead (Skamania Outplant)
Species or Hatchery Stock	Winter Steelhead *(Oncorhynchus mykiss)* Skamania Hatchery Winter Steelhead Stock
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Big White Salmon Subbasin/Columbia Gorge Province
Date Submitted	nya
Date Last Updated	August 17, 2004

Section 1: General Program Description

1.1 Name of hatchery or program.

Big White Salmon River Winter Steelhead

1.2 Species and population (or stock) under propagation, and ESA status.

Winter Steelhead (*Oncorhynchus mykiss)*

ESA Status: Not listed and not a candidate for listing

1.3 Responsible organization and individuals.

Name (and title):	Richard Johnson
	Washougal-Skamania Hatcheries Complex Manager
Agency or Tribe:	Washington Department Fish and Wildlife
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program.

Co-operators	Role
National Marine Fisheries Service	Manager of Mitchell Act Funds

Clark Public Utility, through a M.O.U., provides funds and facilities for partial rearing of Skamania Winter Steelhead at Vancouver Hatchery.

1.4 Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources
Mitchell Act

Funding for this program is provided through the Mitchell Act via National Marine Fisheries Service (NMFS) and through Clark Public Utility.

Operational Information	Number
Full time equivalent staff	4.0
Annual operating cost (dollars)	$463,581

The above information for full-time equivalent staff and annual operating cost applies cumulatively to Washougal/Skamania Hatchery Anadromous Fish Programs and cannot be broken out specifically for costs associated with this program.

1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Skamania Hatchery- North Fork Washougal River
Broodstock collection location (stream, RKm, subbasin)	Skamania Hatchery/N.F. Washougal River/RKm 2.4/Washougal
Adult holding location (stream, RKm, subbasin)	Skamania Hatchery/N.F. Washougal River/RKm 2.4/Washougal
Spawning location (stream, RKm, subbasin)	Skamania Hatchery/N.F. Washougal River/RKm 2.4/Washougal
Incubation location (facility name, stream, RKm, subbasin)	Skamania Hatchery/N.F. Washougal River/RKm 2.4/Washougal; and Vancouver Hatchery/Off-Stream Near Vancouver, WA/Columbia Lower
Rearing location (facility name, stream, RKm, subbasin)	Skamania Hatchery/N.F. Washougal River/RKm 2.4/Washougal; and Vancouver Hatchery/Off-Stream Near Vancouver, WA/Columbia Lower
Release location (facility name, stream, RKm, subbasin)	Big White Salmon River/RKm 2.4/Big White Salmon

1.6 Type of program.

Isolated Harvest

1.7 Purpose (Goal) of program.

- Release 20,000 hatchery winter steelhead annually from the Skamania Hatchery into the Big White Salmon River.
- The goal is to mitigate for activities within the Columbia River basin, which has reduced salmonid populations.
- The purpose is to provide maximum sport harvest under the selective fishery regulations (retention of adipose-clipped fish only) while eliminating a directed harvest on wild winter steelhead.

For programs designed for selective steelhead harvest, WDFW tries to minimize natural escapement of hatchery fish to protect the genetic diversity of wild stocks and minimize impact on listed fish. The first most commonly used approach for steelhead management is to maximize the difference between hatchery and wild stocks, so that if hatchery fish spawn, they are not likely to interbreed with wild spawners. Strategies used by WDFW to limit genetic and ecological risks include these actions: 1) limit the number of hatchery spawners by providing intense selective fisheries, and maintaining high trapping efficiency at the hatcheries or adult traps that remove hatchery fish prior to spawning; 2) advance the spawning timing of Chambers Creek and Skamania type steelhead stocks, so these fish spawn three months earlier than wild stocks, minimizing interbreeding between these two groups; 3) keep hatchery steelhead spawners in the lower river away from prime wild steelhead spawning areas through lower river releases and acclimation; 4) since the reproductive success of Chambers Creek stock is 11% of wild winter steelhead and Skamania Stock is 18% of wild summer steelhead, the few fish that do survive to spawn will produce few offspring; 5) use hatchery management practices, acclimation, timing, and lower river

releases to limit steelhead residualism and the competition and predation that can occur when steelhead smolts residualize; and 6) follow the Integrated Hatchery Operations Team (IHOT 1995) guidelines to limit disease risks from hatchery steelhead.

1.8 Justification for the program.

- The program is authorized under the Columbia River Fisheries Development Program, Columbia River Fish Management Plan and U.S. vs. Oregon.
- Summer and winter hatchery steelhead are released into the White Salmon River as part of the U.S. vs. Oregon agreement. The winter Skamania hatchery stock originated from wild fish from the Washougal River and the Beaver Creek hatchery located on the Elochoman River. Skamania hatchery summer and winter steelhead are not considered part of the Middle Columbia River Steelhead ESU (64 FR 14517). The Skamania winter steelhead program is funded through the Mitchell Act via National Marine Fisheries Service (NMFS) for the purpose of mitigation for lost fish production due to development within the Columbia River Basin. The program is authorized under the Columbia River Fisheries Development Program, Columbia River Fish Management Plan and U.S. vs. Oregon and the parties to this program, plan and court case are therefore involved in short and long-term production planning.
- To provide selective fisheries WDFW protects listed fish and provides harvest opportunity through the Fish Management and Evaluation Plan (FMEP 2002). The objectives of the WDFW's FMEP are based on the WDFW Wild Salmonid Policy. In that policy, it states that harvest rates will be managed so that 1) spawner abundance levels abundantly utilize available habitat, 2) ensure that the number and distribution of locally adapted spawning populations will not decrease, 3) genetic diversity within populations is maintained or increased, 4) natural ecosystem processes are maintained or restored, and 5) sustainable surplus production above levels needed for abundant utilization of habitat, local adaptation, genetic diversity, and ecosystem processes will be managed to support fishing opportunities (WDFW 1997). In addition, fisheries will be managed to insure adult size, timing, distribution of the migration and spawning populations, and age at maturity are the same between fished and unfished populations. By following this policy, fisheries' impacts to listed steelhead, chinook salmon, and chum salmon in the Lower Columbia River (LCR) Evolutionary Significant Unit (ESU) will be managed to promote the recovery of these species and not at rates that jeopardize their survival or recovery.
- For programs designed for selective steelhead harvest, WDFW tries to minimize natural escapement of hatchery fish to protect the genetic diversity of wild stocks and minimize impact on listed fish. The most commonly used approach for steelhead management is to maximize the difference between hatchery and wild stocks, so that if hatchery fish spawn, they are not likely to interbreed with wild spawners. Strategies used by WDFW to limit genetic and ecological risks include: 1) limit the number of hatchery spawners by providing intense selective fisheries, and maintaining high trapping efficiency at the hatcheries or adult traps that remove hatchery fish prior to spawning; 2) advance the spawning timing of Chambers Creek and Skamania type steelhead stocks, so these fish spawn 3 months earlier than wild stocks, minimizing interbreeding between these two groups; 3) keep hatchery steelhead spawners in the lower river away from prime wild steelhead spawning areas through lower river releases and acclimation; 4) since the reproductive success of Chambers Creek stock is 11% of wild winter steelhead and Skamania stock is 18% of wild summer steelhead, the few fish that do survive to spawn will produce few offspring (WDFW Kalama River Research); 5) use hatchery

management practices, acclimation, timing, and lower river releases to limit steelhead residualism and the competition and predation that can occur when steelhead smolts residualize; and 6) follow the Integrated Hatchery Operations Team (IHOT 1995) guidelines to limit disease risks from hatchery steelhead.

In order to minimize impact on listed fish by the Big White Salmon River winter steelhead program, the following Risk Aversion are included in this HGMP:

Table 1. Summary of risk aversion measures for the Big White Salmon River winter steelhead program.

Potential Hazard	**HGMP Reference**	**Risk Aversion Measures**
Water Withdrawal	4.2	This is a direct river plant. For these risk aversion measures see Skamania Winter Steelhead HGMP.
Intake Screening	4.2	
Effluent Discharge	4.2	
Disease Transmission	7.9, 10.11	*Fish Health Policy in the Columbia Basin*. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin.
Competition & Predation	See also 2.2.3, 10.11	Current risk aversions and future considerations are being reviewed and evaluated for further minimizing impacts to listed fish.

1.9 List of program "Performance Standards".

See HGMP Section 1.10

1.10 List of program "Performance Indicators", designated by "benefits" and "risks".

1.10.1 Benefits:

Benefits		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Assure that hatchery operations support Columbia River fish Mgt. Plan *(US v Oregon)*, production and harvest objectives	Contribute to the harvest of hatchery summer steelhead on the Big White Salmons River. (current 10 yr. average is 85 fish, all programs combined). Contribution of this program cannot be identified independently.	Survival and contribution to fisheries will be estimated for each brood year released. Work with co-managers to manage adult fish returning in excess of broodstock need.
Maintain outreach to enhance public understanding, participation and support of Washington Department of Fish & Wildlife (WDFW) hatchery programs	Provide information about agency programs to internal and external audiences. For example, local schools and special interest groups tour the facility to better understand hatchery operations. Off station efforts may include festivals, classroom participation, stream adoptions and fairs.	Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program. Record on-station organized education and outreach events.
Program contributes to fulfilling tribal trust responsibility mandates and treaty rights	Follow pertinent laws, agreements, policies and executive and judicial orders on consultation and coordination with Native American tribal governments	Participate in annual coordination meetings between the co-managers to identify and report on issues of interest, coordinate management, and review programs (FBD process).
Implement measures for broodstock management to maintain integrity and genetic diversity Maintain effective population size.	A minimum of 100 adults are collected throughout the spawning run in proportion to timing, age and sex composition of return	Annual run timing, age and sex composition and return timing data are collected. Adhere to WDFW spawning guidelines. (WDFW 1983)
Region-wide, groups are marked in a manner consistent with information needs and protocols to estimate impacts to natural and hatchery origin fish	Use mass-mark (adipose-fin clip) for selective fisheries.	Returning fish are sampled throughout their return for length, sex, mark and
Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens. Follow Co-managers Fish Health Disease Policy (1998).	Necropsies of fish to assess health, nutritional status, and culture conditions	WDFW Fish Health Section inspects adult broodstock yearly for pathogens and parasites and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams for pathogens and parasites	1 to 6 weeks prior to transfer or release, fish are examined in accordance with the Co-managers Fish Health Policy
	Inspection of adult broodstock for pathogens and parasites	At spawning, lots of 60 adult broodstock are examined for pathogens
	Inspection of off-station fish/eggs prior to transfer to hatchery for pathogens and parasites	Controls of specific fish pathogens through eggs/fish movements are conducted in accordance to Co-managers Fish Health Disease Policy.

1.10.1 Risks:

Risks		
Performance Standard	**Performance Indicator**	**Monitoring & Evaluation**
Minimize impacts and/or interactions to ESA listed fish	Hatchery operations comply with all state and federal regulations. Hatchery juveniles are raised to smolt-size (5.0-5.5 fish/lb) and released from the hatchery at a time that fosters rapid migration downstream. Mass mark production fish to identify them from naturally produced fish (except CWT only groups)	As identified in the HGMP: Monitor size, number, date of release and mass mark quality. Additional WDFW projects: straying, instream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds, fish health documented.
Artificial production facilities are operated in compliance with all applicable fish health guidelines, facility operation standards and protocols including IHOT, Co-managers Fish Health Policy and drug usage mandates from the Federal Food and Drug Administration	Hatchery goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks and to produce healthy smolts that will contribute to the goals of this facility.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed
Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring	NPDES permit compliance WDFW water right permit compliance	Flow and discharge reported in monthly NPDES reports.
Water withdrawals and instream water diversion structures for hatchery facility will not affect spawning behavior of natural populations or impact juveniles.	Hatchery intake structures meet state and federal guidelines where located in fish bearing streams.	Barrier and intake structure compliance assessed and needed fixes are prioritized.
Hatchery operations comply with ESA responsibilities	WDFW completes an HGMP and is issued a federal and state permit when applicable.	Identified in HGMP and Biological Opinion for hatchery operations.
Harvest of hatchery-produced fish minimizes impact to wild populations	Harvest is regulated to meet appropriate biological assessment criteria. Mass mark juvenile hatchery fish prior to release to enable state agencies to implement selective fisheries.	Harvests are monitored by agencies and tribes to provide up to date information.

1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

See Skamania Winter Steelhead HGMP.

1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

Age Class	Max. No.	Size (ffp)	Release Date	Location			
				Stream	Release Point (RKm)	Major Water-shed	Eco-province
Yearling	20000 FBD	5.0	May 1st on	Big White Salmon River	1.5	Big White Salmon	Upper/Lower Columbia Gorge

1.12 Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Smolt-to adult survival rates are not available. Average harvest on this program has been 91 fish annually (WDFW Historical Database).

Return Year	Sport Harvest Hatchery	Smolt Releases
1993/94	137	34,200
1994/95	81	39,700
1995/96	25	40,200
1996/97	5	45,000
1997/98	6	41,900
1998/99	50	40,200
1999/00	94	25,700
2000/01	67	16,500
2001/02	315	23,900
2002/03	128	20,200
2003/04	Na	23,517

1.13 Date program started (years in operation), or is expected to start.

Outplants to the Big White Salmon River started in 1986.

1.14 Expected duration of program.

A hatchery winter steelhead program for selective fisheries in the Big White Salmon River is an on-going program.

1.15 Watersheds targeted by program.

White Salmon Subbasin/Columbia Gorge Province

1.16 Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

1.16.1 Brief Overview of Key Issues:

The Skamania Hatchery non-native winter steelhead program produces smolts for planting in many regional streams. Skamania stock winter steelhead are released into the Big White Salmon River to continue a winter steelhead sport fishery while eliminating a directed harvest on wild winter steelhead. Smolts are released low in the system to avoid competition and predation with natural stocks and to concentrate fish at the lower river portion and at the confluence of the mainstem so that they are highly susceptible to harvest. Any adults that escape the fishery may spawn in the system.

1.16.2 Potential Alternatives to the Current Program:

Alternative 1: Eliminate the non-local program and use the native stock for this program. WDFW is currently involved in a research project on the Kalama River that will provide information on the feasibility of using the native population. This alternative would require utilizing the local stock, which could not occur without better knowledge of the condition of the wild stock.

Alternative 2: Eliminate the program. This action would significantly reduce potential interaction with the natural population and eliminate impacts on other ESA listed species. This

alternative is not considered acceptable; currently this program supports a very popular sport fishery in the Big White Salmon River.

1.16.3 Potential Reforms and Investments

Reform/Investment 1:

Section 2: Program Effects on ESA-Listed Salmonid Populations

2.1 List all ESA permits or authorizations in hand for the hatchery program.

WDFW is writing HGMP's to cover all stock/programs produced at Washougal and Skamania Hatcheries including; fall Chinook, coho, summer and winter run steelhead. No ESA permits or authorizations exist for the locally adapted broodstock program identified in this HGMP. This HGMP will be submitted to the National Marine Fisheries Service for ESA review and approval.

2.2 Descriptions, status and projected take actions and levels for ESA-listed natural populations in the target area.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Summer Steelhead-Natural	L	L
Winter Steelhead-Natural	L	L
Bull Trout	Unk	Unk
H, M and L refer to high, medium and low ratings, low implying critical and high healthy.		

2.2.1 Description of ESA-listed salmonid population(s) affected by the program.

Identify the ESA-listed population(s) that will be directly affected by the program.
None.

Identify the ESA-listed population(s) that may be incidentally affected by the program.

Lower Columbia River fall chinook salmon *(Oncorhynchus tshawytsch*a) are federally listed as "threatened" under the ESA on March 24, 1999.
Lower Columbia River Steelhead *(Oncorhynchus mykis*s), were listed as threatened under the ESA on March 19, 1998. In Washington, the LCR steelhead ESU includes winter and summer steelhead in tributaries to the Columbia River between the Cowlitz River and Wind River.
Columbia Basin DPS Bull Trout *(Salvelinus confluentu*s) June 10, 1998 (63 FR 31647), Threatened.

2.2.2 Status of ESA-listed salmonid population(s) affected by the program.

Describe the status of the listed natural population (s) relative to "critical" and "viable" population thresholds.
Critical and Viable population thresholds have not been established for these ESUs and the populations within them. NMFS has formed a Lower Columbia River/Willamette River Technical Review Team to review population status within these ESUs and develop critical and viable population thresholds.

Lower Columbia River fall chinook salmon *(Oncorhynchus tshawytsch*a) within the Evolutionary Significant Unit (ESU) are federally listed as "threatened" under the Endangered Species Act effective May 24, 1999.
Status: Washington's Columbia River chinook salmon have been split into two split Major Ancestral Lineage (MAL): 1) Upper Columbia and Snake spring chinook and 2) Upper Columbia summer chinook and Columbia River fall chinook (Marshall et al 1994). Native fall chinook from the White Salmon River are part of the Mid-Columbia "tule" fall chinook GDU, and the native spring chinook salmon are part of the Lower and Mid-Columbia genetic diversity unit (GDU),

The recently established fall chinook "bright" population in the lower White Salmon is part of the Upper Columbia fall GDU, and the Carson stock hatchery spring chinook salmon released into this subbasin are part of Upper Columbia River GDU. NMFS included has included White Salmon "tule" fall chinook salmon and spring chinook salmon in the Lower Columbia River (LCR) EDU (Myers et al. 1997). Both races are isolated to the lower 3.4 miles of river below Condit Dam. Subpopulation structure of chinook salmon in the subbasin is unknown. Two separate fall chinook stocks, tules and brights, exist in the White Salmon River. Tule fall chinook are native to the system and are Washington's upper-most extent of the Lower Columbia River Chinook ESU. Although native, the current stock origin (origin of natural spawners) for the natural spawning tule fall chinook is considered mixed (WDF and WDW 1993). Hatchery tule fall chinook were last released into the White Salmon River in the 1980s, but strays are commonly recovered in the river. Most are probably from the Spring Creek NFH. The WDFW has monitored the White Salmon River tule fall chinook stock since 1964, and has noted a long-term decline in abundance. The average spawning escapement between 1964 and 1982 averaged 1,290 fish per year (Figure 4). Since 1982, the average spawning escapement estimate has dropped to approximately 210 fish per year (Figure 4). The WDFW updated the survey technique used to estimate escapement in 1980. This may account for some of the differences in estimates. Although recent spawning escapement has been considerably lower than the annual historic levels, it has been stable and more than double the critical threshold. In 2001 WDFW estimated the escapement at 2,007 fish, the fourth largest since 1965. Spring Creek Hatchery steelhead made up 82 percent of this escapement. Current habitat availability and conditions in the White Salmon River watershed is insufficient to support a self-sustaining tule fall chinook population. When built in 1912 the Condit Dam reduced available habitats to anadromous salmonids by more than 90 percent. The dam continues to degrade spawning and rearing habitats by preventing the recruitment of spawning gravel into the river downstream of the dam, and allowing the accumulation of fine sediments in the lower river reaches, choking spawning beds. Along with habitat degradation, native stocks of White Salmon River fall chinook and summer and winter steelhead are impacted by the introduction of hatchery fish. Stock origin of White Salmon tule fall chinook is mixed (WDFW MCMA FMEP).

Lower Columbia River Steelhead *(Oncorhynchus mykiss*), were listed as threatened under the ESA on March 19, 1998. The White Salmon steelhead are considered to be part of the Middle Columbia GDU, which includes Washington steelhead populations between the White Salmon and Walla Walla Rivers (Leider et al. 1995) and NMFS has included this population in the Middle Columbia River Evolutionary Significant Unit (ESU).

Status

Both summer and winter steelhead are found in the White Salmon River (WDF and WDW 1993). The Condit Dam blocks upstream migration at RM 3.3, eliminating more than 90 percent of the previously accessible steelhead habitat. A sub-basin plan study suggests that available habitat in the lower 3.3 miles of the river (below the dam) will support a population of only 50 wild summer and 50 wild winter adult steelhead (WDW et al. 1990b). Summer and winter hatchery steelhead are released into the White Salmon River as part of the U.S. vs. Oregon agreement. The winter Skamania hatchery stock originated from wild fish from the Washougal River and the Beaver Creek hatchery located on the Elochoman River. Skamania hatchery summer and winter steelhead are not considered part of the Middle Columbia River Steelhead ESU (64 FR 14517). Steelhead trout are native to the White Salmon River (WDF et al. 1993) and their historical distribution extended from the mouth up to RM 16 in the mainstem, and Buck, Spring, Indian, and Rattlesnake Creeks. The current distribution is limited to the area below Condit Dam (RM 3.4). The status of steelhead in the White Salmon River is listed as depressed due to the lack of access to historical spawning areas (WDF et al. 1993). Since population monitoring for the White Salmon River does not occur, the status may be inferred from estimates of wild Middle Columbia

River summer steelhead abundance, wild A-run abundance, and the EDT model. Summer steelhead above BON are considered B-run steelhead if they originate from portions of the Clearwater and Salmon rivers in Idaho, and are considered A-run if they originate from other areas. (TAC 1996). B-run fish tend to be later timed and larger then A-run steelhead. Wild steelhead abundance is estimated by US v Oregon TAC annually. A-run abundance declined from the mid 1980s to a low in the mid-1990s, and has recently rebounded. Middle Columbia steelhead appear to follow the same pattern and comprise about 25% of the A run abundance between 1997 and 2001. The portion of White Salmon summer steelhead in these counts is unknown but believed to be very small. Since steelhead and salmon in the White Salmon River basin are listed for protection under the ESA, tributary fisheries must be approved by NOAA-Fisheries. Although not monitored directly, the mortality of catch and release fisheries for steelhead in the White Salmon River is estimated from hooking mortality studies and fishing effort in other basins within southwest Washington (Rawding 1998). Estimates of wild steelhead harvest in the White Salmon are similar to those in the Kalama Subbasin. It is assumed sport fishery wild steelhead harvest rates in the White Salmon River are similar to the Kalama River. Wild summer steelhead impact were substantially reduced in 1986 after wild steelhead release regulation were enacted. Current impacts from tributary sport fisheries are estimated to be 4% for summer steelhead and 4% for winter steelhead (WDFW MCMP FMEP 2003).

Columbia Basin DPS Bull Trout *(Salvelinus confluentus*)

The status of bull trout in the White Salmon River is unknown. Bull trout have been observed in the mainstem below Condit Dam and managers believe these fish are part of an adfluvial population, which uses the Bonneville Reservoir. In 1993, bull trout presence/ absence surveys were conducted in the watershed as a cooperative project between the U.S. Forest Service (USFS) and WDFW. No bull trout were found in any stream during this limited sampling effort. The WDFW has initiated a bull trout-sampling project in the Columbia Gorge Province to more accurately determine the distribution of bull trout in the White Salmon River and other Washington tributaries. In the White Salmon River, surveys will focus on cold water habitats that can support bull trout. Until this project is completed, there is insufficient information to determine distribution, assess population status, or develop a recovery plan for these fish.

2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take.

Describe hatchery activities: The following activities listed below are identified as general hatchery actions that are identified in the ESA Section 7 Consultation "Biological Opinion on Artificial Propagation in the Columbia River Basin" (March 29, 1999).

Broodstock Program:

Broodstock Collection: Not applicable to this HGMP. See Skamania winter steelhead HGMP. Indirect take from this operation is unknown.

Genetic introgression: To reduce the number of hatchery fish that could interbreed with listed steelhead, WDFW uses a wild steelhead management strategy removing steelhead thru selective harvest. Strategies used by WDFW to limit genetic and ecological risks include these actions: 1) limit the number of hatchery spawners by providing intense selective fisheries, and maintaining high trapping efficiency at the hatcheries or adult traps that remove hatchery fish prior to spawning; 2) advance the spawning timing of Chambers Creek and Skamania type steelhead stocks, so these fish spawn three months earlier than wild stocks, minimizing interbreeding between these two groups; 3) keep hatchery steelhead spawners in the lower river away from prime wild steelhead spawning areas through lower river releases and acclimation; 4) since the

reproductive success of Chambers Creek stock is 11% of wild winter steelhead and Skamania Stock is 18% of wild summer steelhead, the few fish that do survive to spawn will produce few offspring; 5) use hatchery management practices, acclimation, timing, and lower river releases to limit steelhead residualism and the competition and predation that can occur when steelhead smolts residualize. Indirect take from genetic introgression is unknown.

Rearing Program:

Operation of Hatchery Facilities: Not applicable to this direct plant. Indirect take from this operation is unknown.

Disease: Over the years, rearing densities, disease prevention and fish health monitoring have greatly improved the health of programs. Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1994) Chapter 5 have been instrumental in reducing disease outbreaks. Although pathogens may cause post release mortality in fish from hatcheries but there is little evidence that hatchery origin fish routinely infect natural populations of salmon and steelhead in the Pacific Northwest (Enhancement Planning Team 1986; Stewart and Bjornn 1990; Foot et al. 2000). Indirect take from disease effects is unknown.

Release:

Hatchery Production/Density-Dependent Effects: Hatcheries can release numbers of fish that can exceed the density of the natural productivity in a limited area for a short period of time and can compete with listed fish. The current program release of 20,000 is a minimal level for plants used to generate harvest. Density effects are lessened when fish are transferred and planted in a smolted condition. Indirect take from density dependent effects is unknown.

Competition: Salmon and steelhead feed actively during their downstream migration (Becker 1973; Muir and Emmelt 1988; Sager and Glova 1988) and if they do not migrate they can compete with wild fish. WDFW is unaware of any studies that have empirically estimated the competition risks to listed species posed by the program described in this HGMP. Studies conducted in other areas indicate that this program is likely to pose a minimal risk of competition:

1) As discussed above, coho salmon and steelhead released from hatchery programs as smolts typically migrate rapidly downstream. The SIWG (1984) concluded that "migrant fish will likely be present for too short a period to compete with resident salmonids." On station release in large systems may travel even more rapidly – migration rates of approximately 20 river miles per day were observed by steelhead smolts in the Cowlitz River (Harza 1998).
2) NMFS (2002) noted that ".where interspecific populations have evolved sympatrically, chinook salmon and steelhead have evolved slight differences in habitat use patterns that minimize their interactions with coho salmon (Nilsson 1967; Lister and Genoe 1970; Taylor 1991). Along with the habitat differences exhibited by coho and steelhead, they also show differences in foraging behavior. Peterson (1966) and Johnston (1967) reported that juvenile coho are surface oriented and feed primarily on drifting and flying insects, while steelhead are bottom oriented and feed largely on benthic invertebrates."
3) Flagg et al. (2000) concluded, "By definition, hatchery and wild salmonids will not compete unless they require the same limiting resource. Thus, the modern enhancement strategy of releasing salmon and steelhead trout as smolts markedly reduces the potential for hatchery and wild fish to compete for resources in the freshwater rearing environment. Miller (1953), Hochachka (1961), and Reimers (1963), among others, have noted that this potential for competition is further reduced by the fact that many hatchery salmonids have developed different habitat and dietary behavior than wild salmonids." Flagg et al (2000) also stated "It is unclear whether or not hatchery and wild chinook salmon utilize similar or different resources in the estuarine environment."
4) Fresh (1997) noted that "Few studies have clearly established the role of competition and

predation in anadromous population declines, especially in marine habitats. A major reason for the uncertainty in the available data is the complexity and dynamic nature of competition and predation; a small change in one variable (e.g., prey size) significantly changes outcomes of competition and predation. In addition, large data gaps exist in our understanding of these interactions. For instance, evaluating the impact of introduced fishes is impossible because we do not know which nonnative fishes occur in many salmon-producing watersheds. Most available information is circumstantial. While such information can identify where inter- or intra specific relationships may occur, it does not test mechanisms explaining why observed relations exist. Thus, competition and predation are usually one of several plausible hypotheses explaining observed results."

Predation: Steelhead released from this program may prey upon listed species of salmonids, but the magnitude of predation will depend upon the characteristic of the listed population of salmonids, the habitat in which the population occurs and the characteristics of the hatchery program (e.g.. release time, location, number released and size upon release). The site specific nature of predation and the limited number of empirical studies that have been conducted, make it difficult to predict the predation effects of this specific hatchery release. WDFW is unaware of any studies that have been empirically estimated the predation risks to listed fish by this program. In the absence of site-specific empirical information, the identification of risk factors can be a helpful tool for reviewing hatchery programs while monitoring and research programs such as those on the Kalama River are developed and implemented.

Predation Risk Factors:

Environmental Characteristics: These characteristics can influence the level of predation (see SWIG (1984) for a review) with risk greatest in small systems during periods of low flow and high clarity. Environmental Characteristics: The mainstem White Salmon River has excellent flows and water temperatures year-round. The majority of flow is from glacial melt runoff and/or from springs and seeps from the porous basalts that are present through much of the watershed. Coupled with the geographic location of much of the White Salmon River (in a deeply incised canyon), water temperatures in the mainstem remain cold throughout the year (Haring 2003). Some tributaries only flow during high flow events and are dry the remainder of the year. Peak flows in the mainstem are generated by snowmelt runoff and occur in the spring, increasing from an average daily flow of 644 cubic feet per second (cfs) in the fall to flows of 1,538 cfs during the spring (Haring 2003).

Dates of Releases: Steelhead can be released starting April 15, but staff has been implementing release dates after May 1st when operational and environmental conditions permit. Hatchery steelhead releases timed after these dates are consistent with providing a high level of protection to listed salmon from yearling hatchery programs.

Relative Body Size: Studies and opinions on size of predator/prey relationships vary greatly and although there is evidence that salmonids can prey upon fish up to 50% of their body length, most prey consumed is probably much smaller. Keeley and Grant (2001) suggest that the mean prey size for 100-200 mm fl salmonids is between 13-15% of predator body size. Salmonid predators were thought to be able to prey on fish up to approximately 1/3 of their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length in aquarium environments (Pearsons et al. 1998). Artic char are well known as piscivorous predators, but recent studies suggest the maximum prey size is approximately 47% of their length (Finstad et al. 2002). The "33% of body length" criterion for evaluating the potential risk of predation in the natural environment has been used by NOAA Fisheries

and the USFWS in a number of biological assessments and opinions (c.f., USFWS 1994; NOAA 2002). Although predation on larger Chinook juveniles may occur under some conditions, WDFW believes that a careful review of the Pearson and Fritts (1999) study supports the continued use of the "33% of body length criterion" for listed species until further data for this system can be collected.

Release Location and Release Type: The likelihood of predation may also be affected by the location and type of release. Other factors being equal, the risk of predation may increase with the length of time that fish co-mingle. In the freshwater environment, this is likely to be affected by distribution of the listed species in the watershed, the location of the release and the speed at which fish released from the program migrate. Steelhead migration rates of approximately 20 river miles per day have been observed in the Cowlitz River (Harza 1998). This study indicated that smolt releases from acclimation sites migrate faster than those made from one system to another. Although this is not the case for this direct plant, the larger size of a receiving system also was a determining factor in the study.

We have provided a summary of empirical information an theoretical analysis of competition and predation interactions that may be relevant to the Big White Salmon steelhead program.

Potential Big White Salmon River winter steelhead predation and competition effects on listed salmonids:

The proposed annual production goal for this program is up to 20,000 fish at an average size of 5.0 fpp (approximately 208 mm fl). Steelhead released as actively migrating smolts would not likely compete for food or habitat with fingerling stocks of chinook or steelhead (Section 7). At 5.0 fpp steelhead pose an unknown risk on listed fish of 69 mm fl and smaller. The magnitude of predation will depend upon the characteristic of the listed population of salmonids and the habitat in which the population occurs. Steelhead releases average 5.0 fpp (approximately 208 mm fl). Below are some data available for chinook fry and fingerling lengths from area Lower Columbia streams. The current release poses a risk to fish less than 69 mm fl although as mentioned previously, the magnitude of predation will depend upon the characteristic of the listed population of salmonids and the habitat in which the population occurs. Data from White is unknown. Below are data available for some Columbia River Chinook:

- Lengths from the Lewis River system during the month of June indicate fish 48-55 mm fl (Columbia River Progress Report 2003-16).
- Average fork length by week from 26 sampling sites on the Kalama River by week indicate fish 44 mm fl on April 25, 46 mm fl on May 3, 56 mm fl on May 11, 62 mm fl by May 16, and ranges of 70 – 80 mm fl for the month of June and 77—89 mm fl for the month July (Pettit WDFW 1990).
- Fork lengths from Cedar Creek (tributary to the N.F. Lewis River) indicate that average Chinook lengths reach approximately 50 mm fl between the weeks of April 12 and April 19, 2004, with fish 55-60 mm fl by April 26 and May 3, 2004 and fish approaching 70 mm fl by mid-May (Rawding 2004).

Listed steelhead including emerging fry and migrating yearlings are present in the system. Depending on available temperature units, eggs will hatch in 4-7 weeks with fry emergence approximately 2-3 weeks after hatching (Table 3). Based on the migration and dispersal of the hatchery program, it is likely that a significant portion of this occurs before peak emergence of listed winter steelhead.

Table 3. Lower Columbia ESU Steelhead Spawn and Emergence Windows.

Race	Spawn Time	Peak Spawn Window	Incubation to Hatch	Swim-up Window	Swim-up @ 50% Date	Source
Winter	March – May	April 15 - 25th	May 13 – June 15	May 27- July 7	June 17	LCSI Draft 1998
Summer	February –April	March 20-30th.	April 14 – May 18	April 28 – June 2	May 15	Kalama Research Report

Indirect take on bull trout is unknown.

Indirect take due to competition and predation is unknown.

Residualism: To maximize smolting characteristics and minimize residual steelhead, WDFW adheres to a combination of acclimation, volitional release strategies, active pond management, size, and release guidelines (WDFW Steelhead rearing guidelines July 31, 2001). Condition factors of 0.90-0.99 (K factor) and co-efficient of variation on fork lengths (CVs) of less than 10% are steelhead the release guidelines. Recent research (Rhine et al. 1997, Bigelow 1997) indicates steelhead smaller than 180 mm are more prone to residualize, while smolting and survival are optimized for fish greater than 190 mm fl (WDFW Steelhead rearing guidelines July 31, 2001).

As a case in point, data from steelhead release programs on the Toutle River system are representative of the Lower Columbia steelhead programs at release that illustrates that few fish are <180 mm fl and greater than > 250 mm fl on release. Below are presented length frequency samples of 100 smolts from 20,000 summer steelhead released directly from the N.F.Toutle Hatchery and 20,000 summer steelhead released from the Cowlitz Game and Anglers Acclimation Pond located on the S.F. Toutle River. In both cases, few fish are outside these general guidelines for optimum steelhead size at release. Indirect take from residualism is unknown.

Figure 1. N.F. Toutle Summer Steelhead Plants (Hatchery Site Plants)

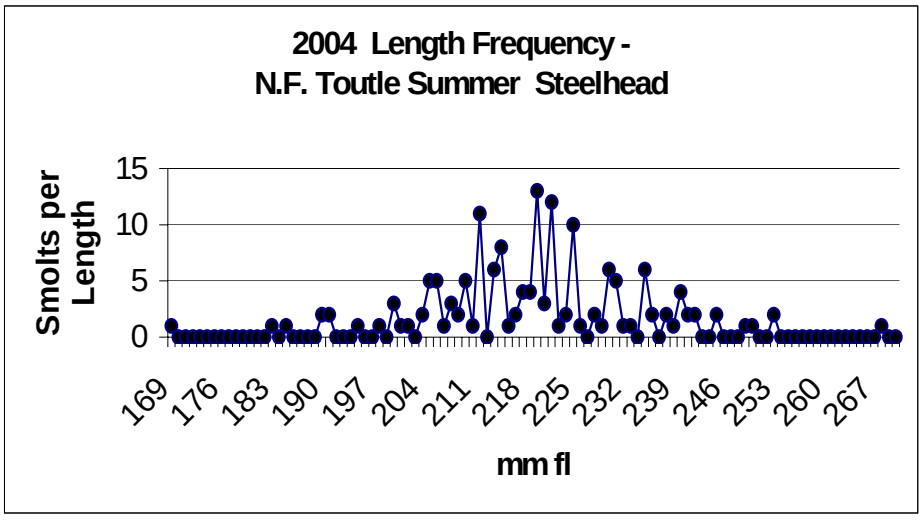
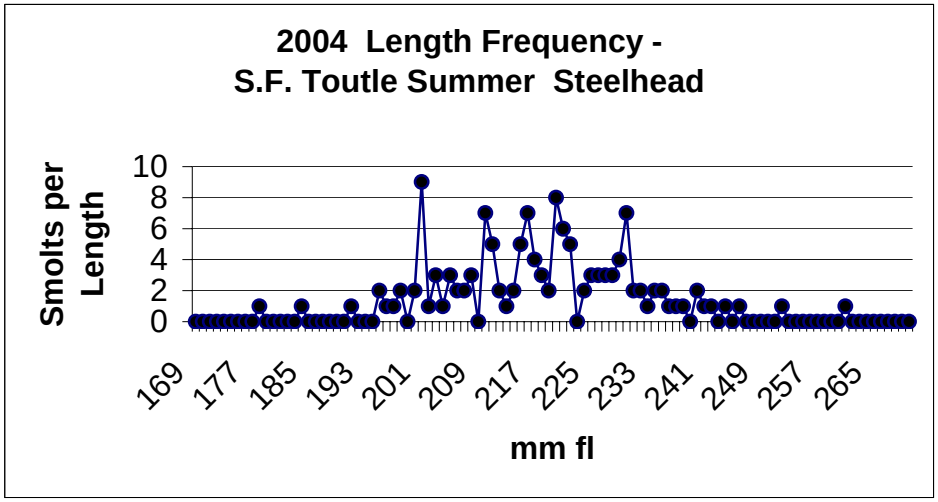


Figure 2. S.F. Toutle Summer Steelhead Plants (Acclimation Pond Program)



Indirect take from residualism is unknown.

Migration Corridor/Ocean: It is unknown to what extent listed fish are available both behaviorally or spatially on the migration corridor. Once in the main stem, Witty et al. (1995) has concluded that predation by hatchery production on wild salmonids does not significantly impact naturally produced fish survival in the Columbia River migration corridor. There appear to be no studies demonstrating that large numbers of Columbia system smolts emigrating to the ocean affect the survival rates of juveniles in the ocean in part because of the dynamics of fish rearing conditions in the ocean. Indirect take in the migration corridor or ocean is unknown.

Monitoring:

Associated monitoring and evaluation and research programs: The following monitoring baseline activities are conducted in the Lower Columbia Management Area (LCMA) for adult steelhead and salmon: redd surveys are conducted for winter steelhead in the SF Toutle, Coweeman, EF Lewis and Washougal rivers. Redd surveys are also conducted in the Cowlitz River for fall and spring chinook. Mark-recapture surveys provide data for summer steelhead populations in the Wind and Kalama rivers. Mark-recapture carcass surveys are conducted to estimate populations of chinook salmon in Grays, Elochoman, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis, rivers and Skamokawa, Mill, Abernathy, and Germany creeks and for all chum salmon populations. Snorkel surveys are conducted for summer steelhead in the EF Lewis, Washougal rivers. Trap Counts are conducted on the Cowlitz, NF Toutle, Kalama, and Wind rivers and on Cedar Creek a tributary of the NF Lewis River. Area-Under-the-Curve (AUC) surveys are conducted to collect population data for chum salmon in Grays River and Hardy and Hamilton Creeks. All sampling of carcasses and trapped fish include recovery of coded wide tagged (CWT) fish for hatchery or wild stock evaluation. Downstream migrant trapping occurs on the Cowlitz, Kalama, NF Lewis, and Wind rivers, Cedar Creek, and will expand to other basins as part of a salmonid life cycle monitoring program to estimate freshwater production and wild smolt to adult survival rates. Any take associated with monitoring activities is unknown but all follow scientific protocols designed to minimize impact.

Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from

hatchery releases such as predation and competition is highly uncertain and dependant on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. There will be no direct take tables included for this program.

Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

Any additional mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance. For other listed species, if significant numbers of wild salmonids are observed impacted by this operation, then staff would inform WDFW District Biologist along with the Complex Manager would determine an appropriate plan and consult with NOAA for adaptive management review and protocol.

Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

No data available.

Section 3: Relationship of Program to Other Management Objectives

3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the *NPPC Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

For ESU-wide hatchery plans, the plant of summer steelhead into the Klickitat River is consistent with:

- 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin
- 1999 Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin
- Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1994)
- The *U.S. vs. Oregon* Columbia River Fish Management Plan
- NWPPC Fish and Wildlife Program

For statewide hatchery plan and policies, hatchery programs in the Columbia system adhere to a number of guidelines, policies and permit requirements in order to operate. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. Following is a list of guidelines, policies and permit requirements that govern WDFW Columbia hatchery operations for the production of winter steelhead for the Big White Salmon River:

Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington. These guidelines define practices that promote maintenance of genetic variability in propagated salmon.. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995).

Spawning Guidelines for Washington Department of Fisheries Hatcheries. Assembled to complement the above genetics manual, these guidelines define spawning criteria to be use to maintain genetic variability within the hatchery populations.

Stock Transfer Guidelines. This document provides guidance in determining allowable stocks for release for each hatchery. It is designed to foster development of locally adapted broodstock and to minimize changes in stock characteristics brought on by transfer of non-local salmonids (WDF 1991).

Fish Health Policy in the Columbia Basin. Details hatchery practices and operations designed to stop the introduction and/or spread of any diseases within the Columbia Basin. Also, *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Fish Policy Chapter 5, IHOT 1995).

WDFW Steelhead Rearing Guidelines. Details rearing guidelines and rearing parameters statewide (July 31, 2001).

National Pollutant Discharge Elimination System Permit Requirements This permit sets forth allowable discharge criteria for hatchery effluent and defines acceptable practices for hatchery operations to ensure that the quality of receiving waters and ecosystems associated with those waters are not impaired.

3.2 List all existing cooperative agreements, memoranda of understanding, memoranda

of agreement, or other management plans or court orders under which program operates.

The program described in this HGMP is consistent with the following agreements and plans:

- The Columbia River Fish Management Plan
- U.S. vs. Oregon court decision
- Production Advisory Committee (PAC)
- Technical Advisory Committee (TAC)
- Integrated Hatchery Operations Team (IHOT) Operation Plan 1995 Volume III.
- Pacific Northwest Fish Health Protection Committee (PNFHPC)
- In-River Agreements: State, Federal, and Tribal representatives
- Northwest Power Planning Council Sub Basin Plans
- Washington Department of Fish and Wildlife Wild Salmonid Policy
- Lower Columbia Steelhead Conservation Initiative

Constraints on this facility relative to the IHOT Operation Plan are described in the Hatchery Evaluation Report Skamania Hatchery- Winter Steelhead 1997. The Clark Public Utility and the Department of Fish and Wildlife have a partnership (MOA) at the Vancouver Hatchery which provides rearing and incubation for the Skamania winter steelhead program. The Vancouver Hatchery provides pathogen free water, which provides IHN virus protection for Skamania Summer Steelhead during spring time rearing activities.

3.3 Relationship to harvest objectives.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Harvest objectives established by subbasin planners for sport and tribal fisheries in the White Salmon River were 500 spring chinook, 100 fall chinook, 100 coho, 4,800 summer steelhead, and 800 winter steelhead. However, it is important to note that these objectives were not based on the potential for anadromous fish production in the upper watershed. In addition, note that most summer steelhead harvested in and at the mouth of the White Salmon River are not produced in the basin. Steelhead migrating to upriver tributaries of the Columbia River typically “dip in” to the cooler waters of the White Salmon. Hatchery steelhead smolts, including both summer and winter runs from Skamania or Vancouver hatcheries, are released on an annual basis in the Big White Salmon River to provide for sport fisheries.

Mainstem Columbia River sport and commercial impacts are not estimated directly for White Salmon River steelhead but are estimated for the Middle Columbia River ESU, which includes the White Salmon steelhead population. Middle Columbia River impacts are less than 2% and these impacts occur mainly in the spring chinook tangle net fishery and the summer steelhead sport fishery. WDFW receives authorization for these fisheries through a section 7/10 consultation and biological opinion from NOAA-Fisheries. Tribal fisheries impact both summer and winter steelhead. These fisheries are authorized through a section 7/10 consultation and biological opinion from NOAA-Fisheries. Tribal fisheries target salmon stocks and steelhead are incidentally taken when salmon fishing. Winter steelhead are caught primarily in the winter fishery and the spring chinook fishery. Summer steelhead are caught primarily in the fall fishery, with fewer fish caught in other fisheries. Both winter and summer stocks are intercepted in ceremonial and subsistence fisheries. In 2003, the projected impacts to wild Middle Columbia River steelhead from tribal fisheries was 4% and the maximum impact was 9%. The annual cumulative impact from all fisheries are likely to range from 11% to a maximum of 16% of run size .

The WDFW will manage fisheries in the Klickitat and White Salmon river basins at an impact rate of 10 percent or less on wild steelhead populations. Without run size data, impacts can be estimated using fishery and run timing, estimates of encounters of wild fish, and hooking mortality. Based on local biologist's knowledge of the Klickitat and White Salmon rivers, the highest interception occurs on the White Salmon River winter steelhead, at 70 percent of the wild run (D. Rawding, WDFW, pers. comm). Using a hooking mortality rate of 5.1 percent, the highest impact rate in these two basins is estimated at 3.5 percent of the wild White Salmon winter steelhead run (0.70*5.1% = 0.0357).

Table 4. Annual Sport Catch

Return Year	Sport Harvest Hatchery	Smolt Releases
1993/94	137	34,200
1994/95	81	39,700
1995/96	25	40,200
1996/97	5	45,000
1997/98	6	41,900
1998/99	50	40,200
1999/00	94	25,700
2000/01	67	16,500
2001/02	315	23,900
2002/03	128	20,200
2003/04	Na	23,517

3.4 Relationship to habitat protection and recovery strategies.

Subbasin Planning and Salmon Recovery:
The current Skamania HGMP processes are designed to deal with existing hatchery programs and potential reforms to those programs. A regional sub-basin planning process (Draft Washougal River Subbasin Summary May 17, 2002, and White Salmon River Subbasin Plan May 24, 2004 are broad-scale initiatives that will provide building blocks of recovery plans use by recovery planners on listed fish and may well use HGMP alternative ideas on how to utilize hatchery programs to achieve objectives and harvest goals. In order to assess, identify and implement restoration, protection and recovery strategies, Region 5 staff is involved in fish and wildlife planning and technical assistance in concert through the recovery plans including the role of fish release programs originating from Skamania Hatchery and outplants to Region 5 streams.

Habitat Treatment and Protection:
WDFW along with other local government agencies is presently conducting or has conducted habitat inventories within the White Salmon subbasin. Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. It creates a model to predict fish population outcomes based on habitat modifications. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP) which document barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Limiting Factors Analysis:
A WRIA 29 (Wind-White Salmon River) habitat limiting factors report (LFA) has been completed by the Washington State Conservation Commission with the input of WDFW Region 5 staff. Hydroelectric development in the White Salmon river, construction of Bonneville Dam

with its associated pool, logging in the Gifford Pinchot National Forest, poorly designed and installed culverts, especially along state highway 14, and other factors have had a serious detrimental effect on the aquatic resources in WRIA 29. The Wind River remains as a viable anadromous fish producer even though its habitat has been severely impacted.

3.5 Ecological interactions.

Below are discussions on both negative and positive impacts relative to the Big White Salmon winter steelhead program and are taken from the Puget Sound listed and non-listed HGMP template (WDFW and NOAA 2003).

(1) Salmonid and non-salmonid fishes or species that could negatively impact the program: Big White Salmon River steelhead smolts can be preyed upon release thru the entire migration corridor from the river subbasin to the mainstem Columbia River and estuary. Northern pikeminnows and introduced spiny rays in the Columbia mainstem sloughs can predate on steelhead smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Mammals that can take a heavy toll on migrating smolts and returning adults include: harbor seals, sea lions, river otters, and Orcas.

(2) Salmonid and non-salmonid fishes or species that could be negatively impacted by the 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 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); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). Listed fish can be impacted thru a complex web of short and long term processes and over multiple time periods which makes evaluation of this a net effect difficult. WDFW is unaware of studies directly evaluating adverse ecological effects to listed salmon. See also Section 2.2.3 Predation and Competition.

3) Salmonid and non-salmonid fishes or other species that could positively impact the program. While not always desired from a production standpoint, these hatchery fish provide an additional food source to natural predators that might otherwise consume listed fish and may overwhelm established predators providing a beneficial, protective effect to co-occurring wild fish. Hatchery releases can also behaviorally encourage mass emigration of multiple species thru the watershed reducing residency. The nutrient enhancement from spawned adults from salmonid and non-salmonid species may contribute nutrients that increase overall productivity in the watershed, reducing inter-species interactions.

4) Salmonid and non-salmonid fishes or species that could be positively impacted by the program. Big White Salmon River steelhead smolts can be preyed upon release thru the entire migration corridor from the river subbasin to the mainstem Columbia River and estuary. Northern pikeminnows and introduced spiny rays in the Columbia mainstem sloughs can predate on steelhead smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Mammals that benefit from migrating smolts and returning adults include: harbor seals, sea lions, river otters, and Orcas.

Section 4. Water Source

4.1 Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile and natural limitations to production attributable to the water source. See Skamania Hatchery Winter Steelhead HGMP.

See Skamania Hatchery Winter Steelhead HGMP

4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

See Skamania Hatchery Winter Steelhead HGMP.

Section 5. Facilities

5.1 Broodstock collection facilities (or methods).

See Skamania Hatchery Winter Steelhead HGMP

5.2 Fish transportation equipment (description of pen, tank, truck, or container used).

The Skamania Hatchery has two fish transport trucks. One 1979 Chevrolet 1,500 gallon tanker truck and one 1991 International 2,000 gallon tanker truck. The International has the capacity for hauling and off-loading brood fish. We have plans to develop an overhead crane loading system using a water-to-water container for loading fish for re-cycle to the fishery downstream.

5.3 Broodstock holding and spawning facilities.

See Skamania Hatchery Winter Steelhead HGMP.

5.4 Incubation facilities.

See Skamania Hatchery Winter Steelhead HGMP.

5.5 Rearing facilities. .

See Skamania Hatchery Winter Steelhead HGMP

5.6 Acclimation/release facilities.

This is a direct plant. Not applicable to this HGMP. For acclimation and release, see Skamania Winter Steelhead HGMP.

5.7 Describe operational difficulties or disasters that led to significant fish mortality.

See Skamania Hatchery Winter Steelhead HGMP

5.8 Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

See Skamania Hatchery Winter Steelhead HGMP

Section 6. Broodstock Origin and Identity

6.1 Source. .

See Skamania Hatchery Winter Steelhead HGMP

6.2.1 History.

See Skamania Hatchery Winter Steelhead HGMP.

6.2.2 Annual size.

See Skamania Hatchery Winter Steelhead HGMP.

6.2.3 Past and proposed level of natural fish in the broodstock.

Natural fish are not integrated within the broodstock.

6.2.4 Genetic or ecological differences.

See Skamania Hatchery Winter Steelhead HGMP.

6.2.5 Reasons for choosing.

See Skamania Hatchery Winter Steelhead HGMP.

6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

See Skamania Hatchery Winter Steelhead HGMP. Natural fish are not used in broodstock selection and can be identified by adipose fin presence and are released in stream reaches as prescribed by Region 5 biologists.

Section 7. Broodstock Collection

7.1 Life-history stage to be collected (adults).

See Skamania Hatchery Winter Steelhead HGMP.

7.2 Collection or sampling design.

See Skamania Hatchery Winter Steelhead HGMP.

7.3 Identity.

See Skamania Hatchery Winter Steelhead HGMP.

7.4 Proposed number to be collected:

7.4.1 Program goal (assuming 1:1 sex ratio for adults):
See Skamania Hatchery Winter Steelhead HGMP.

7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years available.

See Skamania Hatchery Winter Steelhead HGMP.

7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.

See Skamania Hatchery Winter Steelhead HGMP.

7.6 Fish transportation and holding methods.

See Skamania Hatchery Winter Steelhead HGMP.

7.7 Describe fish health maintenance and sanitation procedures applied.

See Skamania Hatchery Winter Steelhead HGMP.

7.8 Disposition of carcasses.

See Skamania Hatchery Winter Steelhead HGMP.

7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

See Skamania Hatchery Winter Steelhead HGMP.

Section 8. Mating

8.1 Selection method.

See Skamania Hatchery Winter Steelhead HGMP.

8.2 Males.

See Skamania Hatchery Winter Steelhead HGMP.

8.3 Fertilization.

See Skamania Hatchery Winter Steelhead HGMP.

8.4 Cryopreserved gametes.

Not Applicable.

8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

See Skamania Hatchery Winter Steelhead HGMP. No listed natural fish are used in the mating scheme.

Section 9. Incubation and Rearing.

9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

See Skamania Hatchery Winter Steelhead HGMP.

9.1.2 Cause for, and disposition of surplus egg takes.

See Skamania Hatchery Winter Steelhead HGMP.

9.1.3 Loading densities applied during incubation.

See Skamania Hatchery Winter Steelhead HGMP.

9.1.4 Incubation conditions.

See Skamania Hatchery Winter Steelhead HGMP.

9.1.5 Ponding.

See Skamania Hatchery Winter Steelhead HGMP.

9.1.6 Fish health maintenance and monitoring.

See Skamania Hatchery Winter Steelhead HGMP.

9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

See Skamania Hatchery Winter Steelhead HGMP.

9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependable data are available.

See Skamania Hatchery Winter Steelhead HGMP.

9.2.2 Density and loading criteria (goals and actual levels).

See Skamania Hatchery Winter Steelhead HGMP.

9.2.3 Fish rearing conditions.

See Skamania Hatchery Winter Steelhead HGMP.

9.2.4 Indicate biweekly or monthly fish growth information (average program performance), including length, weight, and condition factor data collected during rearing, if available.

See Skamania Hatchery Winter Steelhead HGMP.

9.2.5 Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See Skamania Hatchery Winter Steelhead HGMP.

9.2.6 Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

See Skamania Hatchery Winter Steelhead HGMP.

9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

See Skamania Hatchery Winter Steelhead HGMP.

9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

See Skamania Hatchery Winter Steelhead HGMP.

9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

See Skamania Hatchery Winter Steelhead HGMP.

9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

- Listed fish are not under propagation.
- Steelhead are marked for broodstock identification.
- Holding pond procedures follow IHOT guidelines.
- Non-target listed fish will be released immediately, if encountered, during the brood stock collection process.

Section 10. Release

10.1 Proposed fish release levels.

20,00 yearlings 5.0-5.5 fpp.

10.2 Specific location(s) of proposed release(s).

In the past, fish were acclimated at the Norwestern Lake Co-op Net Pens and shipped downstream below Condit Dam. The net pen operation was suspended due to operational concerns and potential removal of Condit Dam. Beginning in 2002, fish are direct planted at Big White Salmon boat launch site at RKm 1.5.

10.3 Actual numbers and sizes of fish released by age class through the program.

	Yearling Release		
Release Year	No.	Date (MM/DD)	Avg Size (fpp)
1991	38000	April 15 -May	5.4
1992	41260	April 15 -May	6.0
1993	34271	April 15 -May	6.4
1994	29644	April 15 -May	5.5
1995	35090	April 15 -May	8.0
1996	44999	April 15 – May	6.5
1997	41900	April 15 – May	6.1
1998	40185	April 15 – May	5.4
1999	25680	April 15 – May	6.1
2000	30285	April 15 – May	5.6
2001	23858	April 15 – May	5.1
2002	20174	April 15 – May	5.1
2003	23517	April 15 - May	5.1

10.4 Actual dates of release and description of release protocols.

For the vast majority of the releases the smolts are trucked to a release site for direct release. All smolt releases begin on or after April 15.

10.5 Fish transportation procedures, if applicable.

A 1900 gallon capacity tanker truck is used for off-station release or transfer to acclimation ponds. Fish are in transit for 1.0 to 1.5 hours depending on the location of release. Loading densities are kept between 0.5 and 1.0 pounds per gallon. Salt is added to the tanker at a rate of 0.5% of the volume by weight. Temperature is monitored in the tank and tempering is performed at the release / transfer site if the difference between the tank and the release water is greater than 7 degrees F. Supplemental oxygen is administered at 2.5 liters per minute.

10.6 Acclimation procedures (*methods applied and length of time*).

This is a direct plant into the Big White Salmon River.

10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Winter steelhead are mass marked (adipose fin-clipped) so that they can be distinguished from the natural population.

10.8 Disposition plans for fish identified at the time of release as surplus to programmed or approved levels

If surplus exceeds 10% of the permitted release number, complex manager would contact regional manager. Regional manager would in turn contact appropriate the policy persons for determination in disposition of excess production. Resident lakes could be used where a clear expectation of sport harvest can occur.

10.9 Fish health certification procedures applied pre-release.

Prior to release, the population health and condition is established by the Area Fish Health Specialist. This is commonly done 1-3 weeks pre-release and up to 6 weeks on systems with pathogen free water and little or no history of disease. Prior to this examine, whenever abnormal behavior or mortality is observed, staff also conducts the Area Fish Health Specialist. The fish specialist examines affected fish, and recommends the appropriate treatment. Reporting and control of selected fish pathogens are done in accordance with the Co-managers Fish Disease Control Policy and IHOT guidelines.

10.10 Emergency release procedures in response to flooding or water system failure.

If the program is threatened by ecological or mechanical events, the Complex manager would contact and inform Regional management of the situation, and determination and directive per Section 7 guidelines and policy. Based on a determination of a partial or complete emergency release of program fish, personnel would pull screens and sumps to allow a force release of fish. No release of fish will occur without a review by WDFW Fish Management and a risk assessment is performed.

10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

- The production and release of smolts through fish culture and volitional release practices fosters rapid seaward migration, limiting freshwater interactions with naturally produced Chinook, steelhead and chum juveniles.
- WDFW uses acclimation and release of smolts in lower river reaches where possible. Smolt releases are in below known wild fish spawning and rearing habitat in the Big White Salmon.
- Returning hatchery fish are under heavy selective harvest and are identified by adipose fin-clip.
- Hatchery stock and wild fish are isolated by return timing.
- WDFW proposes to continue monitoring, research and reporting of hatchery smolt migration performance behavior, and intra and interspecific interactions with wild fish to assess, and adjust if necessary, hatchery production and release strategies to minimize effects on wild fish.
- WDFW fish health and operational concerns for Washougal Hatchery programs are communicated to Region 5 staff for risk management or needed treatment. See also section 9.7.

- Big White Salmon winter steelhead plant levels since 2001 (avg. 22,466) have been significantly reduced from levels (avg. 37,000) prior to 2000. This is a reduction of almost 39%. (WDFW Historical Database).

Section 11. Monitoring and Evaluation of Performance Indicators

11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Continue to calculate annual fisheries contribution rates based on coded-wire-tag recoveries in regional commercial and sport fisheries. Continue use of mass marked (ad clip) and coded-wire-tagged groups as effective management and research tools. Ongoing research by the Kalama Research Station may provide applicable methods for management of this steelhead program. Also see HGMP Section 1.10.Continue mass marking (ad clip). Also see HGMP Section 1.10.

11.1.2 Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

With the loss of Mitchell Act funding, staffing and logistical support may be lost to continue the monitoring and evaluation of this and other programs on the Columbia River. Current Fish program staff is available to complete monitoring and evaluation baseline Lower Columbia system needs while research is on-going for coho interaction in the Lewis River.

11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Capital requests are in place for screen replacements that will comply with current standards. Vougal creek (Skamania hatchery) has in place up-stream control devices that prevent adult fish passage to prevent IHN shedding into incubation waters and causing IHN epizootics WDFW will take risk aversion measures to eliminate or reduce ecological effects, injury, or mortality as a result of monitoring activities. Most trap mortalities are the result of extreme environmental conditions that flood traps or equipment failure. WDFW will take precautions to make sure the equipment is properly functioning during the season. If environmental conditions are forecast that will cause high mortality then traps will be removed or opened up to allow unobstructed passage without mortality. Any take associated with monitoring activities is unknown but all follow scientific protocols designed to minimize impact.

Section 12. Research

12.1 Objective or purpose.

No research is directly associated with the program. 4,000 steelhead from Skamania at 45/lb are sent to Willard Lab for research (August).

Ongoing research on the Kalama River will be used to evaluate steelhead programs in the Washougal system. The objectives of this work are to: 1) design and implement a wild broodstock hatchery program, 2) assess the reproductive success of hatchery fish from wild broodstock relative to that of wild fish, 3) measure interbreeding between wild fish and hatchery fish from wild broodstock and its effect on productivity of the naturally spawning population, and 4) assess the efficacy of wild broodstock hatchery programs in achieving natural production and other fishery management objectives including containment of risks to wild stocks. A thorough treatment of goals and objectives of the program as well as justification for and benefits of the work in the Kalama Basin is provided in Sharpe et al. (2000).

12.2 Cooperating and funding agencies.

See Kalama River wild summer and winter steelhead HGMPs.

12.3 Principle investigator or project supervisor and staff. NA

12.4 Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2. NA

12.5 Techniques: include capture methods, drugs, samples collected, tags applied. NA

12.6 Dates or time periods in which research activity occurs. NA

12.7 Care and maintenance of live fish or eggs, holding duration, transport methods. NA

12.8 Expected type and effects of take and potential for injury or mortality. NA

12.9 Level of take of listed fish: number of range or fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1). NA

12.10 Alternative methods to achieve project objects. NA

12.11 List species similar or related to the threatened species; provide number and causes of mortality related to this research project. NA

12.12 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury or mortality to listed fish as a result of the proposed research activities. NA

Section 13. Attachments and Citations

13.1 Attachments and Citations

1.) Becker, C.D. 1973. Food and growth parameters of juvenile Chinook salmon, *Oncorhynchus tshawytscha*, in central Columbia River. Fish. Bull. 71: 387-400.

2.) Berg, R. and D. Nelson. 2003. Mitchell Act hatcheries intake and fish passage study report. Washington Dept. of Fish and Wildlife. Olympia, Wa.

3.) Bigelow, P.E. and R.S. Bowen. 1997. Emigration of wild A-run and straying Dworshak National Fish Hatchery steelhead. Pages IV-1 to IV-24 *in* Interactions of hatchery and wild steelhead in the Clearwater River of Idaho. 1995 Progress Report. Fisheries Stewardship Project. U.S. Fish and Wildlife Service and Nez Perce Tribe, Ahsahka, Idaho.

4.) Busby, P.J., T.C. Wainwright, G.J. Bryant, L. Lierheimer, R.S. Waples, F.W. Waknitz and I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon and California. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-NWFSC-27, 261 pp.

5.) Chilcote, M.W., S.L. Leider, and J.J. Loch. 1986. Differential reproductive success of hatchery and wild summer-run steelhead under natural conditions. Trans. Amer. Fish. Soc. 115:726-735.

6.) Crawford, B.A. 1979. The origin and history of the trout broodstocks of Washington Department of Game. Fishery Research Report, Washington Department of Game. Olympia, Wa.

7.) Finstad, A.G., P.A. Jansen, and A. Langeland. 2001. Production and predation rates in a cannibalistic arctic char (*Salvelinus alpinus* L.) population. Ecol. Freshw. Fish. 10: 220-226.

8.) Flagg, T.A., B.A. Berejikian, J.E. Colt, W.W. Dickhoff, L.W. Harrell, D.J. Maynard, C.E. Nash, M.S. Strom, R.N. Iwamoto, and C.V.W. Mahnken. 2000. Ecological and behavioral impacts of artificial production strategies on the abundance of wild salmon populations. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-41: 92p.

9.) Fresh, K.L. 1997. The role of competition and predation in the decline of Pacific salmon and steelhead. *In* D.J. Stouder, P.A. Bisson, and R.J. Naiman (editors), Pacific salmon and their ecosystems: status and future options, p. 245-275. Chapman Hall, New York.

10.) Fuss, H.J., J. Byrne, and C. Ashbrook. 1998. Stock characteristics of hatchery-reared salmonids and Washington Department of Fish and Wildlife Columbia River Hatcheries. Washington Department of Fish and Wildlife, Annual Report H98-03. 65 pp.

11.) Harza. 1999. The 1997 and 1998 technical study reports, Cowlitz River Hydroelectric Project. Vol. 2, 35-42.

12.) Hershberger, W.K., and R.N. Iwamoto. 1981. Genetics Manual and Guidelines for the Pacific Salmon Hatcheries of Washington. Univ. of Wash. College of Fisheries. Seattle, Wa. 83 pp.

13.) Hochachka, P.W. 1961. Liver glycogen reserves of interacting resident and introduced trout populations. Can. J. Fish. Aqua. Sci. 48: 125-135.

14.) Hulett, P., C.S. Sharpe and C.W. Wagemann. 1998. Evaluations of broodstock performance including natural reproductive success for non-local and local wild broodstock hatchery steelhead stocks in the Kalama River, Washington. *In* Proceedings of the 49th Annual Pacific Northwest Fish Culture Conference, Boise, ID. pp. 125-130.

15.) IHOT (Integrated Hatchery Operations Team), 1995. Operations Plans for Anadromous Fish Production Facilities in the Columbia River Basin. Volume III-Washington. Annual Report 1995. Bonneville Power Administration, Portland, Oregon. Project Number 92-043. 536 pp.

16.) Johnston, J.M. 1967. Food and feeding habits of juvenile coho salmon and steelhead trout in Worthy Creek, Washington. Master's thesis, University of Washington, Seattle,Wa.

17.) Keeley, E.R. and J.W.A. Grant. 2001. Prey size of salmonid fishes in streams, lakes and oceans. Can. J. Fish. Aquat. Sci. 58: 1122-1132.

18.) Leider, S. A., M. W. Chilcote, and J. J. Loch. 1986. Comparative life history characteristics of hatchery and wild steelhead trout (Salmo gairdneri) of summer and winter races in the Kalama River, Washington. Canadian Journal of Fisheries and Aquatic Sciences 43:1398-1409

19.) Levy, S. 1997. Pacific salmon bring it all back home. BioScience 47: 657-660.

20.) Lister, D.B., and H.S. Genoe. 1970. Stream habitat utilization by cohabiting underyearlings of Chinook (Oncorhynchus tshawytscha) and coho (O. kisutch) in the Big Qualicum River, British Columbia. J. Fish. Res. Board. Can. 27: 1215-1224.

21.) Lower Columbia Fish Recovery Board (LCFRB). 2004. Lower Columbia salmon and steelhead recovery and sub-basin plan. Lower Columbia Fish Recovery Board, Washington state.

22.) NMFS (National Marine Fisheries Service). 1999. Biological Opinion On Artificial Propagation in the Columbia River Basin. National Marine Fisheries Service, Northwest Region

23.) Miller, R.B. 1953. Comparative survival of wild and hatchery-reared cutthroat trout in a stream. Trans. Am. Fish. Soc. 83: 120-130.

24.) Muir, W.O. and R.L. Emmelt. 1988. Food habits of migrating salmonid smolts passing Bonneville Dam in the Columbia River, 1984. Regulated River 2: 1-10.

25.) NMFS (National Marine Fisheries Service). 2002. Biological opinion on artificial propagation in the Hood Canal and eastern Strait of Juan de Fuca regions of Washington State. National Marine Fisheries Service, Northwest Region.

26.) Nilsson, N.A. 1967. Interactive segregation between fish species. *In* The biological basis for freshwater fish production. *Edited by* S.D. Gerking. Blackwell Scientific Publications, Oxford. pp. 295-313

27.) Pearsons, T.N., G.A. McMichael, K.D. Ham, E.L. Bartrand, A. l. Fritts, and C. W. Hopley. 1998. Yakima River species interactions studies. Progress report 1995-1997 submitted to Bonneville Power Administration, Portland, Oregon. DOE/BP-64878-6.

28.) Peterson, G.R. 1966. The relationship of invertebrate drift abundance to the standing crop of benthic drift abundance to the standing crop of benthic organisms in a small stream. Master's thesis, Univ. of British Columbia, Vancouver, B.C.

29.) Pettit, R. 1990. Fall Chinook juvenile test seining on the Kalama River. Washington Department of Fisheries. Col. Riv. Lab Prog. Rept. 90-21.

30.) Phelps, S.R., B.M. Baker, P.L. Hulett and S.A. Leider. 1994. Genetic analysis of Washington steelhead: Initial electrophoretic analysis of wild and hatchery steelhead and rainbow trout. Washington Department of Fish and Wildlife, Report No. 94-9.

31.) Piper, R. et al. 1982. Fish Hatchery Management. United States Dept. of Interior, Fish and Wildlife Service. Washington, D.C.

32.) Reimers, N. 1963. Body conditioning, water temperature and over-winter survival of hatchery-reared trout in Convict Creek, California. Trans. Amer. Fish. Soc. 92: 39-46

33.) Rhine, T.D., J.L. Anderson and R.O. Osborne. 1997. Length of hatchery steelhead smolts released in Idaho with implications on residualism. Idaho Dept. of Fish and Game, Boise, ID.

34.) Sager, P.M. and G.J. Glova. 1988. Diet feeding periodicity, daily ration and prey selection of a riverine population of juvenile Chinook salmon, *Oncorhynchus tshawytscha*. J. Fish. Biol. 33: 643-653.

35.) Seidel, Paul. 1983. Spawning Guidelines for Washington Department of Fish and Wildlife Hatcheries. Washington Department of Fish and Wildlife. Olympia, Wa.

36.) Sharpe, C., P. Hulett and C. Wagemann. 2000. Studies of hatchery and wild steelhead in the lower Columbia Region. Progress Report for fiscal year 1998, Report No. FPA 00-10. Washington Department of Fish and Wildlife, Olympia, Wa.

37.) Smith, R. Z., 1999. Biological Assessment For The Operation Of Hatcheries Funded By the National Marine Fisheries Service Under the Columbia River Fisheries Development Program.

38.) SIWG (Species Interaction Work Group). 1984. Evaluation of potential species interaction effects in the planning and selection of salmonid enhancement projects. J. Rensel, chairman and K. Fresh, editor. Report prepared for the Enhancement Planning Team for implementation of the Salmon and Steelhead Conservation and Enhancement Act of 1980. Washington Department of Fisheries. Olympia, WA. 80pp

39.) Steward, C. and T.C. Bjornn. 1990. Supplementation of salmon and steelhead stocks with hatchery fish: a synthesis of published literature. Tech. Rpt. 90-1. Idaho Cooperative Fish and Wildlife Research Unit. University of Idaho, Moscow, ID.

40.) Taylor, E.B. 1991. A review of local adaptation in Salmonidae with particular reference to Pacific and Atlantic salmon. Aquaculture 98: 185-207.

41.) USFWS (U.S. Fish and Wildlife Service). 1994. Biological assessment for operation of U.S. Fish and Wildlife Service operated or funded hatcheries in the Columbia River Basin in 1995-1998. Submitted to National Marine Fisheries Service (NMFS) under cover letter, dated August 2, 1994, from William F. Shake, Acting USFWS Regional Director, to Brian Brown, NMFS.

42.) Washington Department of Ecology. 2002. A guide to instream flow setting in Washington state. Olympia, Wa.

43.) Washington Department of Fisheries. 1991. Stock Transfer Guidelines. Hatcheries Program, Washington Department of Fisheries. Olympia, Wa.

44.) Washington Department of Fisheries (WDF), Washington Department of Wildlife (WDW), and Western Washington Treaty Indian Tribes (WWTIT). 1992. 1992 Washington State salmon and steelhead stock inventory (SASSI). Washington Dept. Fish and Wildlife, 600 Capitol Way N, Olympia, WA. 98501-1091. 212 pp.

45.) Washington Department of Fisheries (WDF) and Washington Department of Wildlife (WDW). 1993. 1992 Washington State salmon and steelhead stock inventory - Appendix three Columbia River stocks. Washington Dept. Fish and Wildlife, 600 Capitol Way N, Olympia, WA. 98501-1091. 580 pp.

46.) Washington Department of Fish and Wildlife (WDFW). 1997. Wild Salmonid Policy, draft environmental impact statement. Washington Dept. of Fish and Wildlife. Olympia, Wa.

47.) Washington Department of Fish and Wildlife (WDFW). 2001 (updated Oct, 2003). Fisheries Management and Evaluation Plan (FMEP), Lower Columbia River. Washington Dept. of Fish and Wildlife. Olympia, Wa.

48.) Washington Department of Fish and Wildlife (WDFW). 2001. Steelhead rearing guidelines. Fish Program, Science Division, Washington Department of Fish and Wildlife. Olympia, Wa.

49.) Washington Department of Fish and Wildlife (WDFW). 1987-2003. Semi-Annual Operations Reports for Lower Columbia Fisheries Development Program Mitchell Act Hatcheries (Washington State). Washington Dept. of Fish and Wildlife. Olympia, Wa.

50.) Washington Joint Natural Resources Cabinet and Washington Department of Fish and Wildlife. 1998. Lower Columbia Steelhead Conservation Initiative (LCSCI). State of Washington. Olympia, Wa.

51.) Witty, K., C. Willis and S. Cramer. 1995. A review of potential impacts of hatchery fish on naturally produced salmonids in the migration corridor of the Snake and Columbia Rivers. S.P. Cramer and Associates, Inc., 600 NW Fariss, Gresham, Oregon.

Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

14.1 Certification Language and Signature of Responsible Party

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____