Appendix A. Hatchery and Genetic Management Plan, Skamania Winter Steelhead Program

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Skamania Winter Steelhead Program
Species or Hatchery Stock:	Skamania Winter Steelhead (Onchorynchus mykiss)
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Washougal River & various lower Columbia River streams Washington state
Date Submitted:	February ??, 2001
Date Last Updated:	October 17, 2000

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Skamania Winter Steelhead

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

Skamania Winter Steelhead (*Oncorhynchus mykiss*)

1.3) Responsible organization and individuals

Name (and title):	Chuck Johnson, Region 5 Hatchery Operations Manager Richard Johnson, Washougal Complex Manager	
Agency or Tribe:	Washington Department of Fish and Wildlife	
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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

The 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.

Clark Public Utility, through a M.O.U., provides funds and facilities for partial rearing of Skamania Winter Steelhead at Vancouver Hatchery as well as acclimation at Klineline Pond for smolts released into Salmon Creek. The Northwestern Lake net pen project is a joint effort with the White Salmon Steelheaders Club and PacificCorp.

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

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

Appendix A

1.5) Location(s) of hatchery and associated facilities.

Skamania Hatchery: Located on the North Fork Washougal River (28.0232), Skamania County, Washington in the SE 1/4 section 29 T-2N, R-5E and NE 1/4 Sec 32 T-2N, R-5E.

GIS coordinates for Skamania Hatchery X=122.216, Y=45.622

Northwestern Lake Net Pens: White Salmon River (29.0160), Klickitat County, Washington; T-4N, R-10E, S-35.

Klineline Pond: Salmon Creek (28.0059); T-2N, R-1E, S-27.

1.6) Type of program.

Integrated Harvest

1.7) Purpose (Goal) of program.

Mitigation

The goal of the Skamania Winter Steelhead Program is to mitigate for activities within the Columbia River basin and to produce adult fish for harvest opportunity.

1.8) Justification for the program.

This program will be operated to provide fish for harvest while minimizing adverse effects on listed fish. This will be accomplished in the following manner:

1. Hatchery fish will be released as smolts at a time to minimize or eliminate adverse interactions with listed fish.

2. Only appropriate stocks will be propagated.

3. Hatchery fish will be externally marked to distinguish them from wild fish.

4. Fish will be acclimated before release when possible.

5. Hatchery fish will be propagated using appropriate fish culture methods and consistent with the Co-Managers' Disease Policy, spawning and genetic guidelines and state and federal water quality standards.

6. These hatchery fish will be harvested at a rate that does not adversely effect wild fish.

7. Juvenile fish produced in excess to production goals will be dealt with appropriately.

1.9) List of program "Performance Standards".

1. Produce adults for harvest.

2. Meet hatchery production goals.

3. Allow adequate escapement.

4. Minimize interactions with other fish populations through proper broodstock management.

5. Minimize interactions with other fish populations through proper rearing and release strategies.

6. Maintain stock integrity and genetic diversity of each unique stock through proper management of genetic resources.

7. Maximize survival of hatchery broodstock and their progeny from egg fertilization throughout rearing until release as smolts.

8. Limit the impact, on fish outside the hatchery, of pathogens associated with hatchery stocks and prevent the transfer of regulated viral pathogens between watersheds.

9. Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring.

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

1.10.1) "Performance Indicators" addressing benefits.

The following will be monitored and measured:

1. Smolt-to-adult survival and fishery contribution rates.

2. Number of juveniles released.

3. Adult hatchery/wild return rates.

4. Total broodstock collection.

5. Age and sex ratio of broodstock.

6. Measure hatchery stray rates.

7. Wild fish passed upstream.

8. Timing of adult collection.

9. Ratio of hatchery/wild broodstock.

10. Return timing of hatchery vs. wild fish adult.

11. Follow broodstock collection and spawning guidelines.

12. Size at release.

13. Outmigration timing of hatchery vs. wild fish.

14. Monitor divergence of hatchery fish morphology and behavioral characteristics from natural populations.

15. Hatchery-origin spawners.

16. Effective population size (to maintain stock integrity and genetic diversity).

17. Area fish pathologists will monitor and diagnose fish health problems and minimize their impact according to Co-Managers Fish Health Policy.

18. NPDES monitoring at facilities.

1.10.2) "Performance Indicators" addressing risks.

1.11) Expected size of program.

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

200 males and 200 females are needed to reach production goals.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Smolt	Washougal River	60,000*

Life Stage	Release Location	Annual Release Level
	E.F. Lewis River	90,000*
	Salmon Creek	20,000*
	White Salmon River	20,000*

*** Release numbers reflect program for 2001.**

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

Refer to section 2.2 and the tables.

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

1957.

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.

Lewis River (27.0168)	East Fork (27.0173)	RM 14
Washougal River (28.0159)	North Fork (28.0232)	RM 1.5
	Washougal (28.0159)	RM 8
Salmon Creek (28.0059)	Klineline Pond	RM 5
White Salmon River(29.0160)	Big White (29.0160)	RM 4
Rock Creek (29.0001)	Rock Creek (29.0001)	RM 8

Watersheds targeted above reflect 2001 program.

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

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

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

Section 7 and 10's for Mitchell Act and other programs.

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

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

The National Marine Fisheries Service has designated Evolutionary Significant Units (ESU) for steelhead populations in Washington. Steelhead from the mouth of the Columbia to Coal Creek are part of the Southwest Washington ESU. While WDFW considers these populations depressed, these fish are not listed under the Endangered Species Act. Steelhead located in tributaries from the Cowlitz River to the Wind River, inclusive, are considered part of the Lower Columbia ESU and these fish are listed as threatened under the Endangered Species Act (ESA). WDFW also considers most of these population as depressed. However, Kalama winter steelhead are considered healthy.

Wild winter steelhead in the lower Columbia River enter tributaries from November through June with peak entry in April. Spawning take place from February through June with peak spawning from late-April though mid-May depending on environmental conditions. Peak spawning time for hatchery winter steelhead is in mid-January, at least two months earlier than these wild stocks.

In general, wild winter steelhead spawn in the upper mainstem and tributaries. Release sites for hatchery steelhead at a hatchery/acclimation site with collection facilities, or unacclimated releases occur in the lower mainstem or lower tributaries away from primary wild steelhead spawning areas.

- Identify the ESA-listed population(s) that will be directly affected by the program.

None. WDFW is currently monitoriong wild steelhead populations and if the need arises WDFW, with concurreance from NMFS, will move forward with hatchery recovery actions including supplementation to recover listed fish. WDFW is evaluating the use of locally adapted broodstocks in the Kalama and other basins. If this program is successful at minimizing ecological and genetic risks and providing an enhanced sport fishery, WDFW will consider expanding this program to others rivers in the ESU including the Lewis, Washougal, Wind, and White Salmon.

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

Lower Columbia River Steelhead
Lower Columbia Chinook
Lower Columbia River Chum
Mid-Columbia Steelhead
Snake River Chinook
Snake River Steelhead
Snake River Sockeye
Upper Columbia Steelhead
Upper Columbia Spring Chinook
Willamette Steelhead
Willamette Chinook
Columbia River Bull Trout

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 (*see definitions in "Attachment 1").*

Lower Columbia River Steelhead
Lower Columbia Chinook
Lower Columbia River Chum
Mid-Columbia Steelhead
Snake River Chinook
Snake River Steelhead
Snake River Sockeye
Upper Columbia Steelhead
Upper Columbia Spring Chinook
Willamette Steelhead
Willamette Chinook
Columbia River Bull Trout

Critical and viable population thresholds have not been established for these ESUs and the populations within them. NMFS has formed a Lower Columbia River/Williamette River Technical Review Team to review population status within these ESU and develop critical and viable population thresholds.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

The progeny to parent ratio are available in Busby et al. (1997). Survival data is not available for these stocks. For most stocks the progeny to parent ratios are less than one. This is due to the short-term data set (less than 10 years for most stocks) which was initiated during a period of short-term decline.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Since Skamania Winter Steelhead smolts are released out-of-basin, natural spawning escapements are included where Skamania Winter Steelhead smolts are released. Escapement is measured at adult traps or during redd surveys.

Table ?. Wild steelhead escapement in the area Skamania Hatchery Steelhead are released.

Brood Year	**Index** NF Lewis River (Cedar Creek)	**Index** EF Lewis River (mainstem)	**Index** Washougal River
1977			
1978			
1979			
1980			
1981			
1982			

1983			
1984			
1985			
1986		282	
1987		192	
1988		258	
1989		140	
1990		102	
1991		72	114
1992		88	142
1993		90	118
1994		78	158
1995		53	206
1996	70		
1997	78		

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Since it is difficult to monitor the number of hatchery spawners due to high and turbid water, a model was developed using hatchery smolts released, hatchery smolt to adult survival, hatchery sport harvest, and hatchery trap catch. The % hatchery spawners was developed from this model. The results from the model are preliminary since they have not been field verified. Also, listed is a temporal spawner adjustment

= (Ph*Ohw)/(Ph*Ohw)+(1-Ph)

where Ph = proportion of all spawners that are hatchery fish, and Ohw = the proportion of the hatchery spawning escapement that spawns at the same time as the wild population. For more information see WDFW 1997. WDFW has identified a need to improve and install adult collection facilities on most basins where hatchery fish are released. Improved trapping efficiency will further decrease genetic risks to wild stocks.

Table ?. Proportion of Skamania Hatchery spawners on the spawning grounds in local rivers.

Brood Year	**Index** NF Lewis River (Cedar Creek)	**Index** EF Lewis River (mainstem)
1977		
1978		
1979		
1980		
1981		
1982		
1983		
1984		
1985		
1986		~51%
1987		~51%
1988		~51%

1989		~51%
1990		~51%
1991		~51%
1992		~51%
1993		~51%
1994		~51%
1995		~51%
1996	NA	
1997	NA	

Table ?. A temporal adjustment to the % of hatchery spawners that spawn at the same time as natural spawners.

Brood Year	**Index** NF Lewis River (Cedar Creek)	**Index** EF Lewis River (mainstem)
1977		
1978		
1979		
1980		
1981		
1982		
1983		
1984		
1985		
1986		~21%
1987		~21%
1988		~21%
1989		~21%
1990		~21%
1991		~21%
1992		~21%
1993		~21%
1994		~21%
1995		~21%
1996	NA	
1997	NA	

Since 1997 WDFW has made some significant changes in hatchery production for some basins. These include reduction of smolts released, shifting of hatchery release site to the lower river where angler harvest is high, and releasing smolts away from wild steelhead production areas. These benefits of these changes on wild steelhead are likely to be realized in 2000 or later.

2.2.3) <u>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</u> *(see "Attachment 1" for definition of "take")*.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Broodstock collection directed at Skamania winter steelhead poses a "low" potential for take of any of the listed species in the area. On an average, 10-20 natural spawning fish (with adipose fin) are passed upstream at the Skamania Hatchery.

Broodstock collection occurs at Skamania Hatchery. Adult salmonids volitionally enter the hatchery ladder and holding ponds. Since this is not a river wide weir,wild salmonids by-pass the hatchery ladder and continue their migration. There is a "low' potential for take of listed species.

Both Vogel Creek and the North Fork Washougal River serves as watersources for Skamania Hatchery. During periods of downstream migration it is possible for wild steelhead to enter the hatchery through the water intake. The extent of wild fish entering the hatchery is unknown. Young of the year steelhead can move through the facility; older fish may remain in the facility and would become part of the hatchery program.

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

At Skamania Hatchery approximately 5 unclipped steelhead volitionally swim into the trap. The origin of these fish is unclear. They maybe are hatchery steelhead that were poorly clipped and have regenerated an adipose or they may be wild steelhead. All unclippped steelhead are returned immediately to the river and their survival is 100%.

-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).
*Complete the appended "take table" (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.*

See table 1.

- 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.

The level of take requested is based on the recent range of observed conditions. If take exceeds these levels, it is likely that run size is much higher than observed and maybe approaching delisting. If run sizes are within the recent range, then the level of lethal take should be within the requested range. However, extreme environmental conditions that flood traps or equipment failure can cause the level of take to approach the top of the range or exceed this in rare cases.

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.

Salmon and Steelhead Production Plan. Washougal River Subbasin. September, 1990.

Operations Plans for Anadroumous Fish Production Facilities in the Columbia River Basin. Volume III Washington. 1995.

The Washington State Wild Salmonid Policy directs hatchery production to local brood stocks which will, when accomplished, be a dramatic change from the plans mentioned above.

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 Skamania Winter Steelhead program is part of the CRFD program funded through the National Marine Fisheries Service. This program also operates under the (IHOT) Operation Plan 1995 Volume III. 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 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 Winter Steelhead during spring time rearing activities.

3.3) Relationship to harvest objectives.

Selective fisheries were initiated for winter steelhead in 1986 in the lower Columbia River tributaries. This regulation requires the release of all wild steelhead. The estimated mortality for wild winter steelhead for these fisheries in lower Columbia River tributaries ranges from 4% to less than 7% per basin depending on the fishing regulations. Harvest rates have been as high as 70% for hatchery steelhead in the Cowlitz River. On the Kalama River harvest rates for hatchery fish are believed to range from 40% to 70% and averaged near 50%. Until wild steelhead populations have recovered, wild steelhead release regulations will be in effect with incidental mortality limited to less than 7% on wild stocks. The harvest rate of hatchery fish is expected to remain greater than 40% for most stocks.

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

The sport fishery in the Lower Columbia River is the primary harvester of the hatchery winter steelhead. Few hatchery fish are caught in the mainstem and most are caught in the tributaries such as the White Salmon, Washougal, EF Lewis, Kalama and Salmon Creek. Specific river harvests are produced in the annual steelhead harvest summaries. It is expected that harvest rates will continue to range from 40% to 70%. Wild steelhead release regulations will remain and expected incidental sport fish mortality will remain under 7%. In most populations it is estimated to be less than 3%.

3.4) Relationship to habitat protection and recovery strategies.

The extended freshwater residency of steelhead and the anadromous forms migratory patterns require specific and varied freshwater and estuary habitat types. These ecosystems have been degraded by past and present human activities that have reduced the habitat quality, quantity, and complexity. The primary land use activities responsible for these include: road building, timber harvesting, agriculture, and rural development. These upslope and riparian activities have increased sediment, altered woody debris availability and recruitment, increased water temperatures, changed runoff patterns, and reduced river flow.

Most lands in these watersheds are managed for timber production. The riparian zone is simple and in early sucessional stages and as a result summer time temperatures are elevated and large woody debris is lacking. For example, North Fork Elochoman River Watershed Analysis indicated that increased fine sediment limits fish production (DNR 1995). Increases in fine sediment decreases survival of trout eggs and alevins, reduces stream productivity and ultimately food availability, and decrease the size and depth of pools. Large pools (> 50 yds square and > 6 ft. deep) have been reduced by 84% on the Elochoman River since 1945 (USFS et al, 1993). Increases in large woody debris would increase fish productivity by forming and maintaining pools, providing fish cover, and trapping spawning gravel.

Winter steelhead use the Columbia River estuary primarily during the winter and spring. It was estimated that the tidelands, swamps, and wetlands in the Columbia River estuary were reduced by 40% from 1870 to 1970 (Sherwood et al. 1990). The recent changes in ocean current patterns, such as El Nino have reduced smolt to adult survival of all Columbia River salmonids. Smolt to adult survival of hatchery steelhead in the lower Columbia have decreased since the 1980's. Reduction in estuary habitat and poor ocean conditions have contributed to the recent decline of steelhead trout.

Recent changes in the Forest Practices Act and proposed habitat enhancement and restoration projects by the Cowlitz and Wahkiakum Conservation District and private groups will improve anadromous production. However, restoring ecosystem function will take decades (Dan Rawding, personal communication).

3.5) Ecological interactions.

(1) negatively impact program

Smolts are released volitionally and clear the river quickly, with only a small portion remaining as residuals (Fuss et. al 1999). Competition with native and non-native species is low. For example, the appearance of Northern Pikeminnow in the Elochoman River does not occur until after the smolt migration, thus, there is no significant predation loss. However, avian predation, common merganser, double crested comorant, and caspian tern, does pose a large threat.

Acclimation facilities exist in the Elochoman, Kalama River, Green River, SF Toutle River, White Salmon River, Washougal River, and the NF Lewis River. We expect that impacts are as listed above. However, impacts are likely greater in the EF Lewis and other sites due to the lack of acclimation facilities. WDFW has identified a need to improve and install acclimation facilities on most basins where hatchery fish are released. Improved acclimation will further decrease ecological risks to wild stocks.

(2) be negatively impacted by program

Minor. As mentioned above there is low level of residualism and those fish that do reside are not active predators on natural fry in the Elochoman River (Fuss et. al. 1999). A small number of ripe, precocious males that are released during the spring allow the possibility for interbreeding to occur. However, we believe this risk is low because most wild spawning occurs well above the area that the precocious males would occupy after release. The release occurs at the very end of the native spawning period, and the number of males is small compared to the natural spawning population.

Spawn timing differences are significant between adult hatchery steelhead and wild steelhead. However, there is evidence that hatchery steelhead are reproducing naturally. Competition among wild and hatchery smolts appears to be minimal however. Large numbers of both steelhead and salmon smolts present in the river during the spring may attract avian predators and cause additional mortality to wild smolts. However, wild smolt outmigration appears to be slightly later than hatchery smolt outmigration and slightly behind the major abundance of avian predators, so this risk may not be great.

(3) positively impact program

None

(4) be positively impacted by program

Releases of large masses of hatchery reared fish may overwhelm established predators providing a beneficial, protective effect to co-occurring wild fish. Hatchery fish spawning naturally could provided additional nutrients upon dying that would benefit the productivity of the other salmonid species.

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.

Water rights total 11,670 gpm from two sources: West Fork Washougal River and Vogel Creek. The Washougal River provides most water used. Actual water use averages 9,800 gpm and ranges from 6,650 to 11,460 gpm. Vogel Creek water is used for incubation and early rearing while Washougal River water is used thereafter until spring release.

Environmental monitoring is conducted at WDFW facilities to ensure that these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. Discharges from the cleaning treatment system are monitored as follows:

-*Total Suspended Solids (TSS)*—1 to 2 times per month on composite effluent,maximum effluent and influent samples.
-*Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples.
-*In-hatchery Water Temperatures*—daily maximum and minimum readings.

This facility is not in compliance with the current WDFW screening criteria. Measures are under way to develop a proposal for changing the screening system to a modern system that will meet the current Agency criteria for in stream withdrawal permits.

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.

Capitol requests are in place for screen replacements that will comply with current standards. Vougal creek has in place up-stream control devices that prevent adult fish passage to prevent IHN shedding into incubation waters and causing IHN epizoodic's

Environmental monitoring is conducted at WDFW facilities to ensure that these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. Discharges from the cleaning treatment system are monitored as follows:

-*Total Suspended Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples.
-*Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples.
-*In-hatchery Water Temperatures*—daily maximum and minimum readings.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

A fish ladder approximately 80' long leads from the West Fork Washougal River to a 20' X 20' trap area where returning fish are routed to one of the three holding ponds. All flow for these ponds and the fish ladder is re-use water from the raceways. The Skamania facility does not have a barrier at the entrance to the fish ladder and a portion of the hatchery fish pass up-stream during the winter and spring migration periods.

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.

Three concrete raceways 12' X 135' X 3.5' (5606 cubic foot) each are used for holding brood fish. These holding ponds have a cover building over the center portion for sorting and spawning adult fish. These ponds are very effective at holding summer steelhead with annual mortality at less than 1%. All flow for these ponds and the fish ladder is re-use water from the raceways.

5.4) Incubation facilities.

The incubation facilities consists of 64 shallow troughs and 6-8 tray vertical stack incubators. All steelhead eggs are incubated in shallow trough baskets. A portion of the building is isolated with plastic curtains for eyeing eggs by take.

5.5) Rearing facilities.

The rearing facilities consists of 64 shallow troughs, six indoor 135 cubic foot fiberglass tanks, thirty-two 1,913 cubic foot concrete raceways and ten 216 cubic foot concrete raceways.

5.6) Acclimation/release facilities.

Acclimation for the Skamania Hatchery release occurs on site. The White Salmon River release is acclimated in the Northwestern Lake net pens while the Salmon Creek plant is acclimated in Klineline pond net pens. E.F. Lewis River release has no acclimation (direct release).

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

Disaster can strike with winter ice or spring virus; two problems that could be disastrous to fish populations. We have gravity flow water and back-up power with 24 hour personnel available to handle these problems.

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.

As stated above we have 24 hour personnel ready to react to system failure and we have emergency procedures and plans in place. All systems are alarmed to alert us of failure. As for the threat of a virus outbreak, we have very strict disinfection procedures and comprehensive lab analysis of all egg takes for culling, if needed. And we follow a strict disease policy regulating fish health monitoring.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

The Skamania Hatchery Winter Steelhead stock used for brood is from fish trapped at Skamania Hatchery (West Fork Washougal River) and Beaver Creek Hatchery stock. The Beaver Creek stock was derived from Chambers Creek, Tokul Creek, and Cowlitz stocks

6.2) Supporting information.

6.2.1) History.

The first fish captured at the Skamania Hatchery for brood began in about 1982. Releases have occurred every year since. Short falls of brood were made up from Beaver Creek Hatchery.

6.2.2) Annual size.

Because hatchery fish have been fin marked at Skamania for over ten years the brood stock selection is considered all from hatchery fish. The needs for brood have been consistent at approximately 300 to 400 adult fish returning to the hatchery. The average hatchery return for 1987 through 1996 was 385 fish with the highest year in 1996 (693 fish) and the lowest year 1995 (135 fish). The sex ratio for winter steelhead at Skamania is typically 51.3% males and 48.62% females. A comprehensive view of adult fish returns is found in *"Preliminary Stock Status For Steelhead in the Lower Columbia River, Washington, November 1997, WDFW"*.

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

At present no natural or unmarked fish are used for broodstock.

6.2.4) Genetic or ecological differences.

Skamania winter steelhead pool with other hatchery winter steelhead of common ancestral origin which is Chambers Creek in Puget Sound (Phelps et. al. 1994). Wild winter steelhead in the Lower Columbia cluster with each other and not with Skamania fish (Leider et al. 1996 and Busby et al. 1997). The difference in spawn timing (3 months earlier for Beaver Creek hatchery fish), poor reproductive success for these fish in the wild (Hulett et al. 1998), and spatial separation at spawning have helped to maintain genetic differences between hatchery and wild fish. Fish are released as age-1+ smolts whereas wild steelhead are predominantly age-2+ smolts. Outmigration timing for both life history types is similar but is slightly earlier for hatchery component (Fuss et. al. 1999).

6.2.5) Reasons for choosing.

Since steelhead spawn from January to June, hatchery personnel selected the earliest returning and spawning steelhead to develop the Chambers Creek winter steelhead stock in the 1940's. This stock was transplanted to the lower Columbia when Beaver Creek Hatchery opened in the 1950's and subsequently used to develop the winter steelhead broodstock at Skamania. Spawning time and return time are approximately three months earlier for hatchery fish when compared to wild fish. WDFW views these as management opportunities that reduce mixed stocked fishery impacts and genetic risks to wild fish.

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.

No listed natural fish are used in broodstock selection.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adults

7.2) Collection or sampling design.

The intent of the adult collection procedure at Skamania Hatchery is to collect enough adults to maintain the hatchery production program. Hatchery fish enter the subbasin from mid November through February, with a peak in December. Adults captured are spawned at the hatchery. Adult fish are trapped at the hatchery while very few ever escape to the upper portion of the West Fork Washougal River. Wild fish that become

trapped are moved in live boxes or tubes to tankers for hauling or direct release for up-stream passage. The Skamania Hatchery has no weir for trapping. The natural falls below the entrance to the fishway has proven to be a natural barrier for winter steelhead.

7.3) Identity.

All hatchery-origin Skamania winter steelhead are adipose fin clipped. Only adipose fin-clipped adults are used for broodstock..

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

200 males and 200 females

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995	20	20		60,000	
1996	116	116		348,000	
1997	42	43		155,000	
1998	26	26		91,000	
1999	120	123		404,400	

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

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

All fish in surplus of broodstock needs are either recycled (if in robust condition), planted into lakes (sport harvest), or used for food banks. Also, they may be used for watershed nutrient enhancement.

7.6) Fish transportation and holding methods.

The first adult winter steelhead begin arriving at the hatchery in November and are held until spawning is completed around the end of February. Pre-spawning mortality is typically 1 to 2 %.

7.7) Describe fish health maintenance and sanitation procedures applied.

The adult holding area is separated from all other hatchery operations. All equipment and personnel use disinfection (chlorine) procedures upon entering or exiting the area. Fish treatments are rare and only for fungus control using formalin bath treatments.

7.8) Disposition of carcasses.

Carcasses fit for human consumption are donated to local food banks. Treated carcasses are taken to a local rendering plant. Recycling of early returning adults for additional sport harvest opportunity is an option if returns to the hatchery are great enough.

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.

No listed natural fish are used for broodstock collection. The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines. The trap area is monitored daily for enumeration and wild fish release.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Spawning occurs (95%) in December and January. Each weeks' egg take will be represented in the production. 5 fish pools for gametes and sperm are used as isolation units.

8.2) Males.

Spawning protocol as described in the IHOT 1995 Volume III. The intent is to utilize a spawning population of at least 200 adults and spawn fish at a 1:1 male-to-female ratio. However, difficulty in obtaining sperm may sometimes result in using two males per female.

8.3) Fertilization.

Fertilization occurs using a 5 fish pool method and tracking pools with viral sampling during incubation

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.

No listed natural fish are used in the mating scheme.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

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

BY	Viable Eggs	Egg Loss	Eggs Destroyed	Total Eggs Taken
96	347,321	53,966	32,013	433,300
97	305,625	66,268	140,848	512,741
98	356,175	44,224	180,000	580,399
99	339,152	130,537	86,167	555,856
00	49,376	9,399	13,948	72,723
Avg.	279,529	60,878	90,595	431,000
%	64.8	14.1	21.0	

9.1.2) Cause for, and disposition of surplus egg takes.

Due to IHN virus possibilities excess eggs are taken to safegaurd against potential incubation/rearing losses.

9.1.3) Loading densities applied during incubation.

Winter steelhead eggs range in size from 2,800 eggs/lb to 3,000 eggs/lb. Standard loading of eyed eggs per shallow trough basket is 20,000. Trough flow is varied from 8 to 12 gallons per minute depending on the stage of the egg or fry.

9.1.4) Incubation conditions.

All of the flow to the incubation room is from Vogle Creek. This water is saturated with oxygen at 12 ppm. Silt in this water source is a common occurrence during rain events and is handled by standard daily trough cleaning techniques. The water temperature is monitored continuously with a thermograph during all phases of incubation.

9.1.5) Ponding.

Ponding / feeding begins on a volitional basis when the fry are 100% at the swim-up stage. At this point very little, if any, yolk sack will be present. All feed start and early rearing occurs in the incubation troughs.

9.1.6) Fish health maintenance and monitoring.

Formalin (37% formaldehyde) is dispensed into water for control of ecto-parasites on juvenile fish and for fungus control on eggs. Egg mortality ranges from 6 to 16 % and all eggs are processed through an automated egg picking machine and to some degree by hand.

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.

All phases of incubation are monitored by alarm systems for flow interruptions. Daily trough inspections and maintenance procedures are performed. Silt in the water system is very manageable. All eggs incubated are from hatchery-origin marked adults.

9.2) <u>Rearing</u>:

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 (1988-99), or for years dependable data are available..

Green egg to fry survival average 90%, fry to smolt survival 95%. This is typical of survival rates for Skamania Hatchery Wummer Steelhead for the past five years.

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

In all facilities our goal is to keep densities at or below 3.3 lbs /gpm and 0.5 lbs /cu ft. before the last loading reduction in the fall of the year. Trough maximum loading is 40 lbs at 12 gpm (3.33 lbs/gpm). Tank and raceway maximum loading for early rearing is 132 lbs for the tanks at 40 gpm (3.3 lbs/gpm) and 800 lbs per raceway at 300 gpm.(2.66

lbs/gpm). The final loading per raceway is approximately 3200 lbs. at 300 gpm (10.6 lbs/gpm).

9.2.3) Fish rearing conditions

Environmental monitoring is conducted at WDFW facilities to ensure that these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. Discharges from the cleaning treatment system are monitored as follows:

-*Total Suspended Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples.
-*Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples.
-*In-hatchery Water Temperatures*—daily maximum and minimum readings.

All ponds are broom cleaned every other day and pressure washed between broods. The raceways are not covered to protect the fish from birds and we see the effects in fish loss. We use demand feeders on all raceways throughout the fall and winter months.

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.

Monthly fish growth rates are as follows:

Month:	Fish per pound:	month growth rate / % gain
March 1	2,200	feed start
April 1	1,000	54%
May 1	400	60%
June 1	175	56%
July 1	90	48%
August 1	45	50%
September 1	17	62%
October 1	13	23%
November 1	10	23%
December 1	9	10%
January 1	8	11%
February 1	7	12%
March 1	6	14%
April 1	5	8%

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

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*).

Growth rates are driven by water temperatures and fish size. The fish food of choice is Moore Clark with a small amount of Bio starter diet used each year. Over all conversion of food to fish is approximately 1.4/ 1. Average feed ration per period is listed below.

Period:	Average % body weight feed per day:
March thru May:	2 to 6 %
June thru September:	2 to 2.5 %
October thru January:	1.5 to 1.8 %
February thru April:	1 to .5 %

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

Health Monitoring

-Necropsies of diseased and dead fish are conducted by Area Fish Health Specialist to diagnose the cause of loss. Appropriate treatments are prescribed.

-The Co-Managers Fish Disease Control Policy is used to determine how specific disease problems will be addressed and what restrictions may be placed on movement of diseased stocks.

Sanitation

-All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

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

-Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

-Tank trucks are disinfected between the hauling of adult and juvenile fish.

-Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

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

Gill ATPase activity is not routinely checked on smolts.

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

None as yet.

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.

No listed fish are under propogation.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels. *(Use standardized life stage definitions by species presented in **Attachment 2**. "Location" is watershed planted (e.g. "Elwha River").)*

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Smolts	60,000	5	April	Washougal River
	20,000	5	April	Salmon Creek
	90,000	5	April	E.F. Lewis River
	20,000	5	April	White Salmon River

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

Stream, river, or watercourse: See Below
Release point: See Below
Major watershed: See Below
Basin or Region: Columbia River

Lewis River (27.0168)	East Fork (27.0173)	RM 14
Washougal River (28.0159)	West Fork (28.0232)	RM 1.5
	Washougal (28.0159)	RM 8
Salmon Creek (28.0059)	Klineline Pond	RM 5
White Salmon River(29.0160)	Big White (29.0160)	RM 4
Rock Creek (29.0001)	Rock Creek (29.0001)	RM 8

Watersheds targeted above reflect 2001 program.

10.3) Actual numbers and sizes of fish released by age class through the program.
*For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in **Attachment 2**. Cite the data source for this information.*

Appendix A

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Smolt	Avg size
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995							264,776&	6.14
1996							307,261*	5.83
1997							271,739**	5.32
1998							321,183@	5.53
1999							315,061#	5.00
Average								

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

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 or forced from rearing ponds and raceways. All smolt releases begin on or after April 15.

10.5) Fish transportation procedures, if applicable.

Fish are loaded with 6" fish pumps and oxygen is supplied through diffuser stones in the tanks. Densities are always less than one pound per gallon. Time of transport can vary from two hours to twenty minutes (avg. time is one hour). Primary truck is insulated while the other transport trucks are not. No problems with elevated temperatures during hauling.

10.6) Acclimation procedures.

Acclimation occurs at Skamania Hatchery (West fork Washougal), Klineline Pond (Salmon Creek), and Northwestern Lake (White Salmon River).

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

All Skamania winter steelhead are adipose fin clipped.

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

Resident lakes where a clear expectation of sport harvest can occur.

10.9) Fish health certification procedures applied pre-release.

Prior to release, fish are given a fish health exam. Whenever abnormal behavior or mortality is observed, the Area Fish Health Specialist examines the affected fish, makes a diagnosis and recommends the appropriate treatment. Reporting and control of selected fish pathogens are done in accordance with the Co-managers Fish Disease Control Policy**.**

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

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.

All winter steelhead will be released as smolts after April 15. Any additional smolts or sub-smolts will be lake planted for resident fish harvest.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

This section describes how "Performance Indicators" listed in Section 1.10 will be monitored. Results of "Performance Indicator" monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet "Performance Standards".

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

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

1. Smolt-to-adult survival and fishery contribution rates.
   -monitoring catch and measuring survivals by periodical CWT data-
2. Number of juveniles released.

- estimating number of fish planted (weighing/counting fish), monitoring proximity to hatchery production goals, number released recorded on hatchery divisions "plant reports", data available on WDFW data base-

3. Adult hatchery/wild return rates.
   -monitoring hatchery/wild return rates through trapping (at the hatchery or at weir) and redd and snorkel surveys on the spawning grounds
4. Total broodstock collection.
   -measuring number of fish actually spawned and killed to meet egg take goal at the hatchery-
5. Age and sex ratio of broodstock.
   -recording sex and measuring periodically length ansd weight to age fish-
6. Hatchery stray rates.
   -periodically coded-wire tagging (CWT) hatchery steelhead and evaluating straying through recovery of CWT's from creel surveys or from traps, monitoring for hatchery fish on the spawning grounds-
7. Wild fish passed upstream.
   -monitoring/enumerating all wild fish entering weirs/traps and passing upstream-
8. Timing of adult collection.
   - start trapping prior to historical start of the run, continue trapping throughout the run, dates and times are recorded on hatchery divisions "adult reports", data available on WDFW data base-
9. Ratio of hatchery/wild broodstock.
   -number of hatchery and wild fish used for broodstock will be recorded on the hatchery divisions "adult reports", data available on WDFW data base-
10. Return timing of hatchery vs. wild adult fish
   -return timing of hatchery fish recorded on the hatchery divisions "adult reports", data available on WDFW data base, hatchery and wild fish return timing to the spawning grounds estimated by weir/trap counts-
11. Broodstock collection and spawning guidelines.
   -adhering to the genetic and spawning guidelines established by WDFW-
12. Size at release.
   - weigh and count fish prior to release, size-at-release recorded on hatchery divisions "plant reports", data available on WDFW data base-
13. Outmigration timing of hatchery vs. wild fish.
   -monitoring outmigration timing by using downstream migrant traps (hatchery fish marked vs. wild fish non-marked)-
14. Monitor divergence of hatchery fish morphology and behavioral characteristics from natural populations.
15. Hatchery-origin spawners.
   -monitoring hatchery-origin spawners through weir counts and a model developed specifically to estimate number of hatchery spawners-
16. Effective population size (to maintain stock integrity and genetic diversity).
   -meeting egg take goals that are large enough to maintain effective population size-
17. Area fish pathologists will monitor and diagnose fish health problems and minimize their impacts according to Co-Managers Fish Health Policy.

-perform necropsies of diseased and dead fish to diagnose cause of loss, prescribe appropriate treatments, prescribe optimal nutritional needs and environmental conditions in the hatchery rearing containers based on historical disease events, use vaccines to avoid disease problems, use sanitation procedures to prevent introduction of pathogens into and/or within facility, use fish health policy to restrict the introduction of stocks that may result in the introduction of a new disease or use policy to restrict movement of stocks outside the watershed, utilize pond management strategies to help optimize quality of the aquatic environment and to reduce fish stress-

18. NPDES compliance.

-check NPDES reports and identifying non-compliance-

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.

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.

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.

SECTION 12. RESEARCH

Note: directed research being done on Skamania winter steelhead.

12.1) Objective or purpose.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

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

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

12.6) Dates or time period in which research activity occurs.

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

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

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

12.10) Alternative methods to achieve project objectives.

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

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.

SECTION 13. ATTACHMENTS AND CITATIONS

Fuss, H. J. and J. Byrne, 1998. Stock Characteristics of Hatchery Reared Salmonids at Washington Department of Fish and Wildlife Columbia River Hatcheries. Washington Department of Fish and Wildlife Annual Report H98-03. 65 pp.

Salmon and Steelhead Production Plan, 1990 (Washougal River Subbasin)

Biological Opinion On Artificial Propagation in the Columbia River Basin,1999 (Section 7 Consultation).

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.

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.

Semi-Annual Operations Reports for Lower Columbia Fisheries Development Program Mitchell Act Hatcheries (Washington State). 1987 thru 1999.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information 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:_____

Appendix A

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Steelhead ESU/Population: lower Columbia Steelhead **Activity: Hatchery Operations**				
Location of hatchery activity:Skamania/Washougal hatcheries Dates of activity:November-May Hatchery program operator:WDFW				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			50	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown	5	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).

Appendix A

Attachment to "take table" (per monitoring and evaluation)

At Trout Creek, a tributary to the Wind River, all the wild steelhead that return to the trap are handled. These fish are enumerated and passed upstream. Returns to the trap have ranged from 3 to 33 fish since 1992. No adult mortalities have been observed at Trout Creek. Redd surveys in the mid-1980's indicate that wild steelhead escapement into Trout Creek exceeded 300 individuals.

The adult trap on Shipherd Falls on the Wind River began operation in June 1999. A total of 100 wild summer and winter steelhead were handled at this facility. There was one mortality when part of the trap broke shortly after installation. Historical data from NMFS indicates that over 1,000 wild steelhead were trapped at Shipherd Falls in 1960.

WDFW operates an adult trap on Cedar Creek, a tributary to the North Fork Lewis River. The trap was installed in January 1998. The wild steelhead count peaked for the 2000 brood year at 80 fish.

The existing smolt population monitoring program tries for trap efficiencies from 20 to 50% on a small stream and up to 10% on large basins. For example the level of take on a larger system like the Wind River has exceeded 5,000 steelhead parr and smolt in a season. On smaller systems, such as Cedar Creek, the level of take has reached 2,000.

Potential take of adult steelhead and lethal take:

Facility	Handle	Lethal Take
Shipherd Falls	100 -1000 ~ 75% of run size	<10 adults or < 2%
Trout Creek	10-400 100% of run size	<4 adults or < 2%
Cedar Creek	50-500 50%-75% of run size	<4 adults or < 2%
Other Basins	<75% of run size	< 2%

Proposed level of take for juvenile steelhead:

Site - project	Level of Take	Mortality
Wind River - migrant trap	10,000 parr and smolts	<2%
E.F. Lewis River- migrant trap	10,000 parr and smolts	<2%
Cedar Creek - migrant trap	10,000 parr and smolts	<2%
Other basins - migrant trap	10,000 parr and smolts/basin	<2%
Other basins - migrant trap	10,000 fry and parr	<2%

Appendix A

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chinook ESU/Population: lower Columbia Chinook **Activity: Hatchery Operations**				
Location of hatchery activity:Skamania/Washougal traps Dates of activity:November-May Hatchery program operator:WDFW				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			Unknown	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown	Unknown	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.

Appendix A

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chum ESU/Population: lower Columbia Chum **Activity: Hatchery Operations**				
Location of hatchery activity:Skamania/Washougal hatcheries Dates of activity:November-May Hatchery program operator:WDFW				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			Unknown	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown	Unknown	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.

Appendix B. Hatchery and Genetic Management Plan, Skamania Summer Steelhead Program

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Skamania Summer Steelhead Program
Species or Hatchery Stock:	Skamania Summer Steelhead (Onchorynchus mykiss)
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Washougal River & various lower Columbia River streams
Date Submitted:	February ??, 2001
Date Last Updated:	October 18, 2000

Appendix B

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Skamania Summer Steelhead

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

Skamania Summer Steelhead (*Oncorhynchus mykiss*)

1.3) Responsible organization and individuals

Name (and title): Chuck Johnson, Region 5 Hatchery Operations Manager
Richard Johnson, Washougal Complex Manager
Agency or Tribe: Washington Department of Fish and Wildlife
Address: 600 Capitol Way North, Olympia, WA 98501-1091
Telephone: (360) 902-2653
(360) 837-1020
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Also contact: Dan Rawding (360)906-6747
rawdidr@dfw.wa.gov
Fax: (360)906-6776

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

The 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.

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

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

1.5) Location(s) of hatchery and associated facilities.

The Skamania Hatchery is located on the North Fork Washougal River (28.0232), Skamania County, Washington in the SE 1/4 section 29 T-2N R-5E and NE 1/4 Sec 32 T-2N R-5E.

GIS coordinates for Skamania Hatchery X=122.216, Y=45.622

1.6) Type of program.

Integrated Harvest

1.7) Purpose (Goal) of program.

The goal of the Skamania Summer Steelhead Program is to mitigate for activities within the Columbia River basin and to produce adult fish for harvest opportunity.

Note: The Yakima/Klickitat Fisheries Project (YKFP) Transition Plan (Oshie and Ferguson, 1998) calls for phasing out Skamania Hatchery stock and shifting to supplementation of naturally spawning Klickitat stock. Implementation of this new effort would be conducted at the Klickitat Hatchery.

1.8) Justification for the program.

This program will be operated to provide fish for harvest while minimizing adverse effects on listed fish. This will be accomplished in the following manner:

1. Hatchery fish will be released as smolts at a time to minimize or eliminate adverse interactions with listed fish.

2. Only appropriate stocks will be propagated.

3. Hatchery fish will be externally marked to distinguish them from wild fish.

4. Fish will be acclimated before release when possible.

5. Hatchery fish will be propagated using appropriate fish culture methods and consistent with the Co-Managers' Disease Policy, spawning and genetic guidelines and state and federal water quality standards.

6. These hatchery fish will be harvested at a rate that does not adversely effect wild fish.

7. Juvenile fish produced in excess to production goals will be dealt with appropriately.

1.9) List of program “Performance Standards”.

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

1.11) Expected size of program.

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

600 males and 600 females are needed to reach production goals.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Smolt	Green River	12,000
	SF Toutle River	12,000
	NF Lewis River	50,000
	EF LewisRiver	25,000
	Klickitat River	100,000
	Kalama River	30,000
	Washougal River	60,000
	Drano Lake	20,000

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

Refer to section 2.2 and the tables

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

1957.

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.

WRIA 26	Cowlitz River (26.0002)	Toutle River SF (26.0248)	RM 6
WRIA 26	Cowlitz River (26.0002)	Toutle River NF (26.0314)	RM 23
		Green River (26.0323)	RM 7
WRIA 27	Kalama River (27.0002)	Gobar Creek (27.0073)	RM 6
		Kalama River (27.0002)	RM 3
WRIA 27	Lewis River (27.0168)	East Fork (27.0173)	RM 14
		North Fork (27.0168)	RM 10
WRIA 28	Washougal River (28.0159)	North Fork (28.0232)	RM 1.5
		Washougal (28.0159)	RM 8
WRIA 29	White Salmon (29.0160)	Big White (29.0160)	RM 4
	Drano Lake	Little White (29.0131)	RM 0
WRIA 30	Klickitat River (30.0001)	Klickitat River (30.0001)	RM 27, 22, 20, 18, 10

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

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

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

Section 7

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

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

The National Marine Fisheries Service has designated Evolutionary Significant Units (ESU) for steelhead populations in Washington. Steelhead from the mouth of the Columbia to Coal Creek are part of the Southwest Washington ESU. While WDFW considers these populations depressed these fish are not listed under the Endangered Species Act. Steelhead located in tributaries from the Cowlitz River to the Wind River, inclusive, are considered part of the Lower Columbia ESU and these fish are listed as threatened under the Endangered Species Act (ESA). WDFW also considers most of these population as depressed. However, Kalama winter steelhead are considered healthy.

Wild summer steelhead in the lower Columbia River enter tributaries from April through November with peak entry in July. Spawning takes place from February through June with peak spawning from March though mid-May depending on environmental condition. Peak spawning time for hatchery summer steelhead is in mid-January, at least two months earlier than these wild stocks.

In general, wild summer steelhead spawn in the upper mainstem and tributaries. Release sites for hatchery steelhead at a hatchery/acclimation site with collection facilities, or unacclimated releases occur in the lower mainstem or lower tributaries away from primary wild steelhead spawning areas.

- Identify the ESA-listed population(s) that will be directly affected by the program.

None. WDFW is currently monitoriong wild steelhead populations and if the need arises WDFW, with concurreance from NMFS, will move forward with hatchery recovery actions including supplementation to recover listed fish. WDFW is evaluating the use of locally adapted broodstocks in the Kalama and other basins. If this program is successful at minimizing ecological and genetic risks and providing an enhanced sport fishery, WDFW will consider expanding this program to others rivers in the ESU including the Lewis, Washougal, Wind, and White Salmon.

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

Lower Columbia River Steelhead
Lower Columbia Chinook
Lower Columbia River Chum
Mid-Columbia Steelhead
Snake River Chinook
Snake River Steelhead
Snake River Sockeye
Upper Columbia Steelhead
Upper Columbia Spring Chinook
Willamette Steelhead
Willamette Chinook
Columbia River Bull Trout

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 (*see definitions in "Attachment 1").*

Lower Columbia River Steelhead
Lower Columbia Chinook
Lower Columbia River Chum
Mid-Columbia Steelhead
Snake River Chinook
Snake River Steelhead
Snake River Sockeye
Upper Columbia Steelhead
Upper Columbia Spring Chinook
Willamette Steelhead
Willamette Chinook
Columbia River Bull Trout

Critical and Viable population thresholds have not been established for these ESUs and the populations within them. NMFS has formed a Lower Columbia River/Williamette River Technical Review Team to review population status within these ESU and develop critical and viable population thresholds.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

The progeny to parent ratio are available in Busby et al. (1997). Survival data is not available for these stocks. For most stocks the progeny to parent ratios are less than one. This is due to the short-term data set (less than 10 years for most stocks) which was initiated during a period of short-term decline.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Since Skamania Summer Steelhead smolts are released out-of-basin, natural spawning escapements are included where Skamania Summer Steelhead smolts are released. Escapement is measured at adult traps during redd surveys and during snorkel surveys.

Table ?. Wild steelhead escapement in the area Skamania Hatchery Steelhead are released.

	Trap Index	**Snorkel Index**	**Snorkel Index**	**Snorkel Index**	**Redd Index**
Brood Year	Kalama River	EF Lewis River	Washougal River	Wind River	Wind River
1977	400				
1978	1015				
1979	484				
1980	718				
1981	2926				
1982	1385				
1983	869				
1984	247				
1985	461				434
1986	473		54		428
1987	445		169		608
1988	848		197		826
1989	492		140	274	464
1990	731		156	116	228
1991	704		31	123	294
1992	1075		77	129	287
1993	2283		71	161	
1994	1041		49	104	
1995	1302		70	136	84
1996	614	85	44	96	
1997	598	93	57	106	
1998		61		44	

Appendix B

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

The proportion of hatchery spawners is determined from trap counts or during snorkel surveys. Since hatchery fish may be harvested after the snorkel surveys these numbers should be viewed as a maximum. Also, listed is a temporal spawner adjustment

= (Ph*Ohw)/(Ph*Ohw)+(1-Ph)

where Ph = proportion of all spawners that are hatchery fish and Ohw = the proportion of the hatchery spawning escapement that spawns at the same time as the wild population (for more information see WDFW, 1997). WDFW has identified a need to improve and install adult collection facilities on most basins where hatchery fish are released. Improved trapping efficiency will further decrease genetic risks to wild stocks.

Table ?. Proportion of Skamania Hatchery spawners on the spawning grounds in local rivers.

	Trap Index	**Snorkel Index**	**Snorkel Index**	**Snorkel Index**
Brood Year	Kalama River	EF Lewis River	Washougal River	Wind River
1977	73%			
1978	78%			
1979	81%			
1980	73%			
1981	75%			
1982	90%			
1983	84%			
1984	79%			
1985	71%			
1986	84%		4%	
1987	91%		1%	
1988	72%		6%	
1989	85%		8%	48%
1990	56%		3%	42%
1991	59%		0%	51%
1992	60%		0%	55%
1993	68%		5%	45%
1994	73%		0%	56%
1995	57%		3%	53%
1996	65%	71%	0%	60%
1997	80%	68%	2%	60%
		62%		41%

Table ?. A temporal adjustment to the % of hatchery spawners that spawn at the same time as natural spawners.

	Trap index	**Snorkel Index**	**Snorkel Index**	**Snorkel Index**
Brood Year	Kalama River	EF Lewis River	Washougal River	Wind River

1977	29%			
1978	34%			
1979	40%			
1980	29%			
1981	31%			
1982	57%			
1983	43%			
1984	36%			
1985	26%			
1986	43%		1%	
1987	61%		0%	
1988	28%		1%	
1989	45%		1%	12%
1990	16%		0%	10%
1991	18%		0%	13%
1992	18%		0%	15%
1993	24%		1%	11%
1994	29%		0%	16%
1995	17%		0%	15%
1996	22%	27%	0%	18%
1997	38%	24%	0%	19%
		19%		10%

Since 1997 WDFW has made some significant changes in hatchery production for some basins. These include reduction of smolts released, shifting of hatchery release site to the lower river where angler harvest is high, and releasing smolts away from wild steelhead production areas. These benefits of these changes on wild steelhead are likely to be realized in 2000 or later.

2.2.3) <u>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</u> *(see "Attachment 1" for definition of "take")***.**

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Broodstock collection directed at Skamania summer steelhead poses a "low" potential for take of any of the listed species in the area. On an average, 5-20 natural spawning fish (with adipose fin) are passed upstream at the Skamania Hatchery. At the Washougal Hatchery, 10-15 fish are released up above Dougan (sp) falls.

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

To the best of our knowledge we have not seen any wild steelhead adult or juvenile mortality during the routine handling of fish at Skamania in the past 10 years.

-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).
*Complete the appended "take table" (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.*

See Table 1.

- 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.

If run sizes are within the recent range, then the level of lethal take should be within the requested range. However, extreme environmental conditions that flood traps or equipment failure can cause the level of take to approach the top of the range or exceed this in rare cases.

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.

Salmon and Steelhead Production Plan. Washougal River Subbasin. September, 1990. Operations Plans for Anadroumous Fish Production Facilities in the Columbia River Basin. Volume III Washington. 1995. The Washington State Wild Salmonid Policy directs hatchery production to local brood stocks which will, when accomplished, be a dramatic change from the plans mentioned above.

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 Skamania Summer Steelhead program is part of the CRFD program funded through the National Marine Fisheries Service. This program also operates under the (IHOT) Operation Plan 1995 Volume III. Constraints on this facility relative to the IHOT Operation Plan are described in the "Hatchery Evaluation Report Skamania Hatchery-Summer Steelhead" 1997. The Clark Public Utility and the Department of Fish and Wildlife have a partnership at the Vancouver Hatchery which provides rearing and incubation for the Skamania Summer 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.

Selective fisheries were initiated for winter steelhead in 1986 in the Lower Columbia River tributaries. This regulation requires the release of all wild steelhead. The estimated mortality for wild winter steelhead for these fisheries in lower Columbia River tributaries ranges from 4% to less than 7% per basin depending on the fishing regulations. Harvest rates have been as high as 70% for hatchery steelhead in the Cowlitz River. On the Kalama River harvest rates for hatchery fish are believed to range from 40% to 70% and averaged near 50%. Until wild steelhead populations have recovered, wild steelhead release regulations will be in effect with incidental mortality limited to less than 7% on wild stocks. The harvest rate of hatchery fish is expected to remain greater than 40% for most stocks.

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

3.4) Relationship to habitat protection and recovery strategies.

The extended freshwater residency of steelhead and the anadromous forms migratory patterns require specific and varied freshwater and estuary habitat types. These ecosystems have been degraded by past and present human activities that have reduced the habitat quality, quantity, and complexity. The primary land use activities responsible for these include: road building, timber harvesting, agriculture, and rural development. These upslope and riparian activities have increased sediment, altered woody debris availability and recruitment, increased water temperatures, changed runoff patterns, and reduced river flow.

Most lands in these watersheds are managed for timber production. The riparian zone is simple and in early sucessional stages and as a result summer time temperatures are elevated and large wood debris is lacking. For example, North Fork Elochoman River Watershed Analysis indicated that increased fine sediment limits fish production (DNR 1995). Increases in fine sediment decreases survival of trout eggs and alevins, reduces stream productivity and ultimately food availability, and decrease the size and depth of pools. Large pools (> 50 yds square and > 6 ft. deep) have been reduced by 84% on the Elochoman River since 1945 (USFS et al, 1993). Increases in large woody debris would increase fish productivity by forming and maintaining pools, providing fish cover, and trapping spawning gravel.

Winter steelhead use the Columbia River estuary primarily during the winter, and spring. It was estimated that the tidelands, swamps, and wetlands in the Columbia River estuary were reduced by 40% from 1870 to 1970 (Sherwood et al. 1990). The recent changes in ocean current patterns, such as El Nino have reduced smolt to adult survival of all Columbia River salmonids. Smolt to adult survival of hatchery steelhead in the lower Columbia have decreased since the 1980's. Reduction in estuary habitat and poor ocean conditions have contributed to the recent decline of steelhead trout.

Recent changes in the Forest Practices Act and proposed habitat enhancement and restoration projects by the Cowlitz and Wahkiakum Conservation District, and private

groups will improve anadromous production. However, restoring ecosystem function will take decades.

3.5) Ecological interactions.

(1) negatively impact program

Smolts are released volitionally and clear the river quickly, with only a small portion remaining as residuals (Fuss et. al 1999). Competition with native and non-native species is low. For example, the appearance of Northern Pikeminnow in the Elochoman River does not occur until after the smolt migration, thus, there is no significant predation loss. However, avian predation, common merganser, double crested comorant, and caspian tern, does pose a large threat.

Acclimation facilities exist in the Elochoman, Kalama River, Green River, SF Toutle River, White Salmon River, Washougal River, and the NF Lewis River. We expect that impacts are as listed above. However, impacts are likely greater in the EF Lewis and the Klickitat Rivers due to the lack of acclimation facilities. WDFW has identified a need to improve and install acclimation facilities on most basins where hatchery fish are released. Improved acclimation will further decrease ecological risks to wild stocks.

(2) be negatively impacted by program

Minor. As mentioned above there is low level of residualism and those fish that do reside are not active predators on natural fry in the Elochoman River (Fuss et. al. 1999). A small number of ripe, precocious males that are released during the spring allow the possibility for interbreeding to occur. However, we believe this risk is low because most wild spawning occurs well above the area that the precocious males would occupy after release. The release occurs at the very end of the native spawning period and the number of males is small compared to the natural spawning population.

Spawn timing differences are significant between adult hatchery steelhead and wild steelhead. However, there is evidence that hatchery steelhead are reproducing naturally. Competition among wild and hatchery smolts appears to be minimal however. Large numbers of both steelhead and salmon smolts present in the river during the spring may attract avian predators and cause additional mortality to wild smolts. However, wild smolt outmigration appears to be slightly later than hatchery smolt outmigration and slightly behind the major abundance of avian predators, so this risk may not be great.

(3) positively impact program:

None

(4) be positively impacted by program

Releases of large masses of hatchery reared fish may overwhelm established predators providing a beneficial, protective effect to co-occurring wild fish. Hatchery fish spawning naturally could provide additional nutrients upon dying (indication is that most don't die upon spawning) that would benefit the productivity of the other salmonid species.

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.

Water rights total 11,670 gpm from two sources: West Fork Washougal River and Vogel Creek. The Washougal River provides most water used. Actual water use averages 9,800 gpm and ranges from 6,650 to 11,460 gpm. Vogel Creek water is used for incubation and early rearing while Washougal River water is used thereafter until spring release.

Environmental monitoring is conducted at WDFW facilities to ensure that these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. Discharges from the cleaning treatment system are monitored as follows:

-*Total Suspended Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples.
-*Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples.
-*In-hatchery Water Temperatures*—daily maximum and minimum readings.

This facility is not in compliance with the current WDFW screening criteria. Measures are under way to develop a proposal for changing the screening system to a modern system that will meet the current agency criteria for in-stream withdrawal permits.

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.

Capitol requests are in place for screen replacements that will comply with current standards. Vogal creek has in place up-stream control devices that prevent adult fish passage to prevent IHN shedding into incubation waters and causing IHN epizoodic's. Environmental monitoring is conducted at WDFW facilities to ensure that these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. Discharges from the cleaning treatment system are monitored as follows:

-*Total Suspended Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples.
-*Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples.
-*In-hatchery Water Temperatures*—daily maximum and minimum readings.

SECTION 5. FACILITIES

Appendix B

5.1) Broodstock collection facilities (or methods).

A fish ladder approximately 80' long leads from the North Fork Washougal River to a 20' X 20' trap area where returning fish are routed to one of the three holding ponds. All flow for these ponds and the fish ladder is re-use water from the raceways. The Skamania facility does not have a barrier at the entrance to the fish ladder and a portion of the hatchery fish pass up-stream during the winter and spring migration periods.

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.

Three concrete raceways 12' X 135' X 3.5' (5606 cubic foot) each are used for holding brood fish. These holding ponds have a cover building over the center portion for sorting and spawning adult fish. These ponds are very effective at holding summer steelhead with annual mortality at less than 1%. All flow for these ponds and the fish ladder is re-use water from the raceways.

5.4) Incubation facilities.

The incubation facilities consists of 64 shallow troughs and 6-8 tray vertical stack incubators. All steelhead eggs are incubated in shallow trough baskets. A portion of the building is isolated with plastic curtains for eyeing eggs by take.

5.5) Rearing facilities.

The rearing facilities consists of 64 shallow troughs, six indoor 135 cubic foot fiberglass tanks, thirty-two 1,913 cubic foot concrete raceways and ten 216 cubic foot concrete raceways.

5.6) Acclimation/release facilities.

Fish released at Skamania are acclimated throughout the incubation and rearing time at the hatchery. Direct releases occurr at the Klickitat, Drano Lake and E.F. Lewis River sites. Fish released on the Kalama River are acclimated at the Fallert Creek site as well as at the Green and S.F. Toutle River sites.

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

Disaster can strike with winter ice or spring virus; two problems that could be disastrous to fish populations. We have gravity flow water and back-up power with 24 hour personnel available to handle these problems.

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.

As stated above we have 24 hour personnel ready to react to system failure and we have emergency procedures and plans in place. All systems are alarmed to alert us of failure. As for the threat of a virus outbreak, we have very strict disinfection procedures and compre-
hensive lab analysis of all egg takes for culling, if needed. And we follow a strict disease policy regulating fish health monitoring.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

The Skamania Hatchery Summer Steelhead stock was derived from wild fish taken from the Washougal and Klickitat rivers. For decades the Skamania Hatchery Summer Steelhead broodstock has been obtained directly from adults returning to the hatchery. The Skamania stock is the source of nearly all the hatchery summer steelhead smolts that WDFW releases in the Lower Columbia River region with the exception of Cowlitz and Lewis rivers (BO for CRFD funded facilities, March 1999).

6.2) Supporting information.

6.2.1) History.

The first fish captured at the Skamania Hatchery for broodstock occurred in 1956. The first returns of wild fish reared at the hatchery returned in 1959. Lavier (1973) described the Washougal River as originally being a summer steelhead stream. Cowlitz and Skamania Hatchery stocks were introduced into the system in the late 1950s and are assumed to have interbred with the wild stock (Salmon and Steelhead Production Plan Washougal River Subbasin, 1990).

6.2.2) Annual size.

Because hatchery fish have been fin marked at Skamania for over ten years the brood stock selection is considered all from hatchery fish. Broodstock needs have been consistent at approximately 600 to 800 adult fish returning to the hatchery. The average hatchery return over the past 9 years has been 1653 fish with the highest year in 1992

(5173 fish) and the lowest year being 1999 with an estimated 600 fish. The sex ratio for Skamania Summer Steelhead is typically 45% males and 55% females. A comprehensive view of adult fish returns is found in the " *Preliminary Stock Status For Steelhead in the Lower Columbia River, Washington, November 1997, WDFW".*

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

At present no natural or unmarked fish are used for broodstock.

6.2.4) Genetic or ecological differences.

Skamania Summer Steelhead pool with wild summer steelhead from the Lower Columbia River (Phelps et. al. 1994, Leider et al. 1996 and Busby et al. 1997). The difference in spawn timing (3 months earlier for Skamania hatchery fish), poor reproductive success for these fish in the wild (Hulett et al. 1998) and spatial separation at spawning have helped to maintain genetic differences between hatchery and wild fish. Fish are released as age-1+ smolts whereas wild steelhead are predominantly age-2+ smolts. Outmigration timing for both life history types is similar but is slightly earlier for hatchery component (Fuss et. al. 1999).

6.2.5) Reasons for choosing.

Since steelhead spawn from January to June, hatchery personnel selected the earliest returning and spawning steelhead to develop this steelhead stock in the 1950's. Hatchery steelhead spawning time is approximately three months earlier than wild steelhead. WDFW views these as management opportunities that reduce mixed stocked fishery impacts and genetic risks to wild fish.

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.

No listed natural fish are used in broodstock selection.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adults

7.2) Collection or sampling design.

The intent of the adult collection procedures at Skamania Hatchery is to collect enough adults to maintain the hatchery production program. Hatchery fish enter the sub-basin from April through September with a peak in June/July. Adults captured are spawned at the hatchery while some portion of the run may pass the fishway and escape to the upper portion of the North Fork Washougal River where a considerable sport harvest occurs.

Wild fish (with adipose fin) that become trapped are transported up-stream or directly released for up-stream passage. The Skamania Hatchery has no weir for trapping.

7.3) Identity.

All hatchery-origin Skamania summer steelhead are adipose-fin clipped. Only adipose fin-clipped adults are used for broodstock..

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

600 males and 600 females

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995	285	293		855,000	
1996	430	387		1,375,600	
1997	461	461		1,844,000	
1998	258	263		875,000	
1999	167	167		617,000	

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

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

All fish in surplus of broodstock needs are either recycled (if in robust condition), planted into lakes (sport harvest), or used for food banks. Also, they may be used for watershed nutrient enhancement.

7.6) Fish transportation and holding methods.

The first adult summer steelhead begin arriving at Skamania Hatchery in May and are held until December before spawning begins. Pre-spawning mortality is typically 1 to 2 %.

7.7) Describe fish health maintenance and sanitation procedures applied.

The brood holding area is separated from all other hatchery operations by a fence and all equipment and personnel use a chlorine disinfection procedure upon entering or exiting the area. The fish treatments are rare and only for fungus control using formalin bath treatments.

7.8) Disposition of carcasses.

Carcasses fit for human consumption are donated to local food banks. Treated carcasses are taken to a local rendering plant. Recycling of early returning adults for additional sport harvest opportunity is an option if returns to the hatchery are great enough.

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.

No listed natural fish are used for broodstock collection. The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines. The trap area is monitored daily for enumeration and wild fish release.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Spawning occurs (95%) in December and January. Each weeks egg take will be represented in the production. 5 fish pools for gametes and sperm are used as isolation units.

8.2) Males.

Spawning protocol as described in the IHOT 1995 Volume III. The intent is to utilize a spawning population of at least 200 adults and spawn fish at a 1:1 male-to-female ratio. However, difficulty in obtaining sperm may sometimes result in using two males per female.

8.3) Fertilization.

Fertilization occurs using a 5 fish pool method and tracking pools with viral sampling during incubation

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.

No listed natural fish are used in the mating scheme. All hatchery-origin fish are marked.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

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

The program goal for green egg-to-fry survival is 90%. The past 5 brood years are shown below.

	Eggs taken:	Eggs lost:	Eggs destroyed:	Viable eggs:
Brood 96	1,870,311	157,718	574,718	1,137,651
Brood 97	1,928,449	122,449	121,000	1,685,000
Brood 98	1,034,175	85,875	0	948,3000
Brood 99	829,279	99,329	63,785	666,255
Brood 00	652,837	106,480	176,947	369,410
Averages	1,262,610	9%	14.8%	91.%

9.1.2) Cause for, and disposition of surplus egg takes.

Due to IHN possibilities excess eggs are taken to safeguard against potential incubation/rearing losses. And, historically, we have shipped a lot of summer steellhead eggs throughout the Lower Columbia region. These requests are again the logic behind the greater than needed egg takes indicated above.

9.1.3) Loading densities applied during incubation.

Summer steelhead eggs range in size from 2800 eggs/lb to 3000 eggs/lb. The standard loading is 20,000 eyed eggs per shallow trough basket. Trough flow varies from 8 to12 gpm depending on the stage of the egg or fry.

9.1.4) Incubation conditions.

All of the flow to the incubation room is from Vogle Creek. This water is saturated with oxygen at 12 ppm. Silt in this water source is a common occurrence during rain events and is handled by standard daily trough cleaning techniques. The water temperature is monitored continuously with a thermograph during all phases of incubation.

9.1.5) Ponding.

Ponding / feeding begins on a volitional basis when the fry are 100% at the swim-up stage. At this point very little, if any, yolk sack will be present. All feed start and early rearing occurs in the incubation troughs.

9.1.6) Fish health maintenance and monitoring.

Formalin (37% formaldehyde) is dispensed into water for control of ecto-parasites on juvenile fish and for fungus control on eggs. Egg mortality ranges from 6 to 16 % and all eggs are processed through an automated egg picking machine and to some degree by hand.

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.

All phases of incubation are monitored by alarm systems for flow interruptions. Daily trough inspections and maintenance procedures are performed. Silt in the water system is very manageable. All eggs incubated are from hatchery-origin marked adults.

9.2) <u>Rearing</u>:

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 (1988-99), or for years dependable data are available..

Green egg to fry survival average 90%, fry to smolt survival 95%. This is typical of survival rates for Skamania Hatchery Summer Steelhead for the past five years.

9.2.2) Density and loading criteria (goals and actual levels).
Include density targets (lbs fish/gpm, lbs fish/ft3 rearing volume, etc).

In all facilities our goal is to keep densities at or below 3.3 lbs /gpm and 0.5 lbs /cu ft. before the last loading reduction in the fall of the year. Trough maximum loading is 40 lbs at 12 gpm (3.33 lbs/gpm). Tank and raceway maximum loading for early rearing is 132 lbs for the tanks at 40 gpm (3.3 lbs/gpm) and 800 lbs per raceway at 300 gpm.(2.66 lbs/gpm). The final loading per raceway is approximately 3200 lbs. at 300 gpm (10.6 lbs/gpm).

9.2.3) Fish rearing conditions

Environmental monitoring is conducted at WDFW facilities to ensure that these facilities meet the requirements of the National Pollution Discharge Elimination Permit administered by the Washington Department of Ecology. Discharges from the cleaning treatment system are monitored as follows:

-*Total Suspended Solids (TSS)*—1 to 2 times per month on composite effluent, maximum effluent and influent samples.

-*Settleable Solids (SS)*—1 to 2 times per week on effluent and influent samples.

-*In-hatchery Water Temperatures*—daily maximum and minimum readings.

All ponds are broom cleaned every other day and pressure washed between broods. The raceways are not covered to protect the fish from birds and we see the effects in fish loss. We use demand feeders on all raceways throughout the fall and winter months.

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.

Monthly fish growth rates are as follows:

Month:	Fish per pound:	month growth rate / % gain
March 1	2,200	feed start
April 1	1,000	54%
May 1	400	60%
June 1	175	56%
July 1	90	48%
August 1	45	50%
September 1	17	62%
October 1	13	23%
November 1	10	23%
December 1	9	10%
January 1	8	11%
February	7	12%
March 1	6	14%
April 1	5	8%

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

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*).

Growth rates are driven by water temperatures and fish size. The fish food of choice is Moore Clark with a small amount of Bio starter diet used each year. Over all conversion of food to fish is approximately 1.4/ 1. Average feed ration per period is listed below.

Period:	Average % body weight feed per day:
March thru May:	2 to 6 %
June thru September:	2 to 2.5 %
October thru January:	1.5 to 1.8 %
February thru April:	1 to .5 %

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

Health Monitoring -Necropsies of diseased and dead fish are conducted by Area Fish Health Specialist to diagnose the cause of loss. Appropriate treatments are prescribed.

-The Co-Managers Fish Disease Control Policy is used to determine how specific disease problems will be addressed and what restrictions may be placed on movements of diseased stocks.

Sanitation

-All eggs brought to the facility are surface-disinfected with iodophor (as per disease policy).

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

-Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water.

-Tank trucks are disinfected between the hauling of adult and juvenile fish.

-Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

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

Gill ATPase activity is not routinely checked on smolts.

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

None at this time.

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.

No listed fish are under propogation.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels. *(Use standardized life stage definitions by species presented in **Attachment 2**. "Location" is watershed planted (e.g. "Elwha River").)*

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Smolt	60,000	5	April	Washougal River
	20,000	5	April	Drano Lake
	12,000	5	April	Green River
	12,000	5	April	S.F. Toutle River
	50,000	5	April	N.F. Lewis River
	25,000	5	April	E.F. Lewis River
	100,000	5	April	Klickitat River

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

Stream, river, or watercourse: See Below
Release point: See Below
Major watershed: See Below
Basin or Region: Columbia River

WRIA 26	Cowlitz River (26.0002)	Toutle River SF (26.0248)	RM 6
WRIA 26	Cowlitz River (26.0002)	Toutle River NF (26.0314)	RM 23
		Green River (26.0323)	RM 7
WRIA 27	Kalama River (27.0002)	Gobar Creek (27.0073)	RM 6
		Kalama River (27.0002)	RM 3
WRIA 27	Lewis River (27.0168)	East Fork (27.0173)	RM 14
		North Fork (27.0168)	RM 10

WRIA 28	Washougal River (28.0159)	North Fork (28.0159)	RM 1.5
		Washougal (28.0159)	RM 8
WRIA 29	White Salmon (29.0160)	Big White (29.0160)	RM 4
	Drano Lake	Little White (29.0131)	RM 0
WRIA 30	Klickitat River (30.0001)	Klickitat River (30.0001)	RM 27, 22, 20, 18, 10

10.3) Actual numbers and sizes of fish released by age class through the program.
*For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in **Attachment 2**. Cite the data source for this information.*

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Yearling	Avg size	Smolt	Avg size
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995					74,567	11.3	142,443	6.3
1996							277,925	5.96
1997							182,518	5.95
1998							321,125	5.68
1999							333,370	5.55
Average					74,567	11.3	251,476	5.88

Data source: (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

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 or forced from rearing ponds and raceways. All smolt releases begin on or after April 15.

10.5) Fish transportation procedures, if applicable.

Fish are loaded with 6" fish pumps and oxygen is supplied through diffuser stones in the tanks. Densities are always less than one pound per gallon. Time of transport can vary from two hours to twenty minutes (avg. time is one hour). Primary truck is insulated

while the other transport trucks are not. No problems with elevated temperatures during hauling.

10.6) Acclimation procedures.

On-station releases are acclimated the entire time. Off-station releases are trucked to a release site for direct release.

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

All Skamania Hatchery Summer Steelhead are adipose fin clipped.

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

Resident lakes where a clear expectation of sport harvest can occur.

10.9) Fish health certification procedures applied pre-release.

Prior to release, fish are given a fish health exam. Whenever abnormal behavior or mortality is observed, the Area Fish Health Specialist examines the affected fish, makes a diagnosis and recommends the appropriate treatment. Reporting and control of selected fish pathogens are done in accordance with the Co-managers Fish Disease Control Policy.

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

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.

All summer steelhead will be released as smolts after April 15. Any additional smolts or sub-smolts will be lake planted for resident fish harvest.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

This section describes how "Performance Indicators" listed in Section 1.10 will be monitored. Results of "Performance Indicator" monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet "Performance Standards".

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

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

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

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.

SECTION 12. RESEARCH

Provide the following information for any research programs conducted in ***direct association with the hatchery program described in this HGMP. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish****. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in* ***Table 1****.*

12.1) Objective or purpose.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

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

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

12.6) Dates or time period in which research activity occurs.

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

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

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

12.10) Alternative methods to achieve project objectives.

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

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.

SECTION 13. ATTACHMENTS AND CITATIONS

Fuss, H. J. and J. Byrne, 1998. Stock Characteristics of Hatchery Reared Salmonids at Washington Department of Fish and Wildlife Columbia River Hatcheries. Washington Department of Fish and Wildlife Annual Report H98-03. 65 pp.

Salmon and Steelhead Production Plan, 1990 (Washougal River Subbasin)

Biological Opinion On Artificial Propagation in the Columbia River Basin,1999 (Section 7 Consultation).

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.

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.

Semi-Annual Operations Reports for Lower Columbia Fisheries Development Program Mitchell Act Hatcheries (Washington State). 1987 thru 1999.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information 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:_____

Appendix B

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Steelhead_____ ESU/Population:Lower Columbia Steelhead_____ Activity:Hatchery Operations				
Location of hatchery activity:Skamania/Washougal hatcheries Dates of activity:January-September Hatchery program operator:WDFW_____				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			100	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown	10	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.

Appendix B

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chinook ESU/Population: lower Columbia Chinook Activity:Hatchery Operations				
Location of hatchery activity:Skamania/Washougal hatcheries Dates of activity:January-September Hatchery program operator:WDFW____				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			Unknown	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown	Unknown	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Chum ESU/Population: lower Columbia Chum Activity:Hatchery Operations				
Location of hatchery activity:Skamania/Washougal hatcheries Dates of activity:January-September Hatchery program operator:WDFW____				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			Unknown	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown	Unknown	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.

Appendix C. Hatchery and Genetic Management Plan, Washougal River "Type N" Coho Program

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Washougal River "Type N" Coho Program
Species or Hatchery Stock:	"Type N" Coho (Onchorynchus kisutch) Washougal River
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Washougal River, tributary to Columbia River Washington state
Date Submitted:	, 2001
Date Last Updated:	May 29, 2001

Appendix C

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Washougal River "Type N" Coho Program

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

Washougal River "Type N" Coho Salmon (Onchorynchus kisutch)

1.3) Responsible organization and individuals

Name (and title):	Chuck Johnson, Region 5 Operations Manager Dick Johnson, Complex Manager
Agency or Tribe:	Washington Department of Fish and Wildlife
Address:	600 Capitol Way North, Olympia, Wa. 98501-1091
Telephone:	(360) 902-2653 (360) 837-1020
Fax:	(360) 902-2943 (360) 837-3201
Email:	**johnsdhj@dfw.wa.gov** **johnsrejdfw.wa.gov**

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

The coho production program is funded through the Mitchell Act via National Marine Fisheries Service (NMFS) for the purpose of mitigation for lost fish production due to hydroelectric 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 are, therefore, involved in short and long-term production planning. Operated and managed by the Washington State Department of Fish and Wildlife.

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

The coho production program is funded through the Mitchell Act via National Marine Fisheries Service (NMFS).

1.5) Location(s) of hatchery and associated facilities.

Include name of stream, river kilometer location, basin name, and state. Also include watershed code (e.g. WRIA number), regional mark processing center code, or other sufficient information for GIS entry. See "Instruction E" for guidance in responding.

Washougal River Hatchery (Washington state) is located on the Washougal River (28.0159) at approximately RM 20. GIS coordinates for Washougal Hatchery X=122.168, Y=45.653. All supporting facilities are at same coordinates.

1.6) Type of program.

Integrated harvest

1.7) Purpose (Goal) of program.

The Washougal "Type N" coho program is a mitigation program as described in the "Artificial Production Review" Sept. 15, 1999 draft. The production is to mitigate for activities within the Columbia River Basin that have decreased salmonid populations.

1.8) Justification for the program.

Indicate how the hatchery program will enhance or benefit the survival of the listed natural population (integrated or isolated recovery programs), or how the program will be operated to provide fish for harvest while minimizing adverse effects on listed fish (integrated or isolated harvest programs).

This program will be operated to provide fish for harvest while minimizing adverse effects on listed fish. This will be accomplished in the following manner:

1. Release coho as smolts with expected brief freshwater residence.

2. Time of release not to coincide with out-migration of listed fish.

3. Mark all reared fish.

4. Consistent with Fish Health Policy, Genetic guidelines and NPDES criteria.

1.9) List of program "Performance Standards".

"Performance Standards" are designed to achieve the program goal/purpose, and are generally measurable, realistic, and time specific. The NPPC "Artificial Production Review" document attached with the instructions for completing the HGMP presents a list of draft "Performance Standards" as examples of standards that could be applied for a hatchery program. If an ESU-wide hatchery plan including your hatchery program is available, use the performance standard list already compiled.

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

"Performance Indicators" determine the degree that program standards have been achieved, and indicate the specific parameters to be monitored and evaluated. Adequate monitoring and evaluation must exist to detect and evaluate the success of the hatchery program and any risks to or impairment of recovery of affected, listed fish populations.

The NPPC "Artificial Production Review" document referenced above presents a list of draft "Performance Indicators" that, when linked with the appropriate performance standard, stand as examples of indicators that could be applied for the hatchery program. If an ESU-wide hatchery plan is available, use the performance indicator list already compiled. Essential 'Performance Indicators" that should be included are monitoring and evaluation of overall fishery contribution and survival rates, stray rates, and divergence of hatchery fish morphological and behavioral characteristics from natural populations.

The list of "Performance Indicators" should be separated into two categories: "benefits" that the hatchery program will provide to the listed species, or in meeting harvest objectives while protecting listed species; and "risks" to listed fish that may be posed by the hatchery program, including indicators that respond to uncertainties regarding program effects associated with a lack of data.

1.11) Expected size of program.
In responding to the two elements below, take into account the potential for increased fish production that may result from increased fish survival rates effected by improvements in hatchery rearing methods, or in the productivity of fish habitat.

The coho program for Washougal as described in the Biological Assessment For The Operation Of Hatcheries Funded by The National Marine Fisheries Service (March 99) is to produce 500,000 yearling coho for on-station release, provide 220,000 eggs/fish to co-op programs and to produce 2,500,000 yearling coho for release into the Klickitat River as per U.S.v. Oregon agreement.

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

500 females and 500 males

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Smolts	Washougal River (28.0159), RM 20	500,000 2,500,000

Life Stage	Release Location	Annual Release Level
	Klickitat River (30.0002), RM 18	

Note: If "Type N" coho is not available up to 2,500,000 "Type S" coho will be used for the Klickitat release.???

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.
Provide estimated smolt-to-adult survival rate, total adult production number, and escapement number (to the hatchery and natural areas) data available for the most recent twelve years (roughly three fish generations), or for the number of years of available and dependable information. Indicate program goals for these parameters.

Need Regional (natural escapement levels) and Olympia staff to generate.

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

1958/59.

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.
Include WRIA or similar stream identification number for desired watershed of return.

Washougal River (28.0159).
Klickitat River (30.0002)

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

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

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

None

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

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.
Include information describing: adult age class structure, sex ratio, size range,migrational timing, spawning range, and spawn timing; and juvenile life history

strategy, including smolt emigration timing. Emphasize spatial and temporal distribution relative to hatchery fish release locations and weir sites

Need information from Regional staff, if known.

- Identify the ESA-listed population(s) that will be directly affected by the program.
(Includes listed fish used in supplementation programs or other programs that involve integration of a listed natural population. Identify the natural population targeted for integration).

None.

- Identify the ESA-listed population(s) that may be incidentally affected by the program.
(Includes ESA-listed fish in target hatchery fish release, adult return, and broodstock collection areas).

Lower Columbia Steelhead, Chinook and Chum, Mid Columbia Steelhead, Upper Columbia Steelhead and Spring Chinook, Snake River Sockeye, Chinook and Steelhead, Upper Willamette Steelhead and Chinook and Columbia River Bull Trout.

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 (*see definitions in "Attachment 1").*

Critical and viable population thresholds have not been established for the above ESU's and the populations within them. NMFS has formed a Lower Columbia River/Willamette River Technical Review Team to review population status within these ESU's and develop critical and viable population thresholds.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

Need information from Regional staff, if known.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.
(Include estimates of juvenile habitat seeding relative to capacity or natural fish densities, if available).

Need information from Regional staff, if known.

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Need information from Regional staff, if known.

2.2.3) <u>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</u> *(see "Attachment 1" for definition of "take")***.**

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.
(*e.g. "Broodstock collection directed at sockeye salmon has a "high" potential to take listed spring chinook salmon, through migrational delay, capture, handling, and upstream release, during trap operation at Tumwater Falls Dam between July 1 and October 15. Trapping and handling devices and methods may lead to injury to listed fish through descaling, delayed migration and spawning, or delayed mortality as a result of injury or increased susceptibility to predation*").

When wild fish of any species are trapped they are sorted to a live box for later transport to the up stream site prescribed by fish management. Adult fish mortality can and does occur as a result of water quality. So few wild fish have been encountered that no data on survival exists at the hatchery. Transport of fish up stream is via a live tube to the tanker truck and then to the river from the tube. This is a proven method for wild steelhead

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

Any wild/natural fish that may be encountered are held for transport in live boxes in the holding pond. Need numbers, if known, and if any observed injury or mortality.

- 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).
*Complete the appended "take table" (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.*

Need a "range" of potential take numbers if available in take table.

- 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.

(*e.g. "The number of days that steelhead are trapped at Priest Rapids Dam will be reduced if the total mortality of handled fish is projected inseason to exceed the 1988-99 maximum observed level of 100 fish."*)

Need information/plan if identified.

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.
(e.g. "The hatchery program will be operated consistent with the ESU-wide plan, with the exception of age class at release. Fish will be released as yearlings rather than as sub-yearlings as specified in the ESU-wide plan, to maximize smolt-to-adult survival rates given extremely low run sizes the past four years.").

3.2) 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.

This program operates under the Mitchell Act agreement thru the CRFD. The program also operates under the "Operation Plans for Anadromous Fish Production Facilities in the Columbia River Basin" (IHOT) 1995 Volume III. Constraints to the IHOT are described in the "Hatchery Evaluation Report Washougal Hatchery - "Washougal Coho" 1997. This program is also identified in part of the U.S. v. Oregon settlement.

3.3) Relationship to harvest objectives.
Explain whether artificial production and harvest management have been integrated to provide as many benefits and as few biological risks as possible to the listed species. Reference any harvest plan that describes measures applied to integrate the program with harvest management.

For every 100,000 smolts released, approximately 1,200 adults will be harvested. The Washougal River does not have a fish management goal for adult coho other than the escapement goal for the Hatchery returns needed for broodstock. The current program goal for hatchery escapement is 1,000 fish back to the hatchery. This escapement goal represents only the needs for broodstock for the 500,000 fish release on station. The returning adult fish have ample opportunity to escape over the river rack during November and December high flows. This can make recruitment difficult when returns are low in numbers. The natural spawning estimates will be discussed later in this report.

Adult returns to the hatchery are listed in the following table , (table 1.0) and described in the "Wash. State Fish and Wildlife Semi-Annual Operations Reports" for each year shown with time and spawn data included.

With mass marking the agency staff has taken steps to identify natural coho stocks and handle them in a manner that would provide for their survival and reproduction yet maximizing harvest thus limiting hatchery coho on the spawning grounds. Harvest rates for Columbia River coho have averaged 74.2% in the mid 1980s (1985-89). The harvest rates for the recent two years have averaged 48.8% (1997-98). With strong hatchery returns in the future in conjunction with mass marking, aggressive harvest rates on hatchery coho might be achieved with minimal take on Washougal River natural coho in the future.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available. *Also provide estimated future harvest rates on fish propagated by the program, and on listed fish that may be taken while harvesting program fish .*

Need information if available (Regional staff).

3.4) Relationship to habitat protection and recovery strategies.

Describe the major factors affecting natural production (if known). Describe any habitat protection efforts, and expected natural production benefits over the short- and long-term. For Columbia Basin programs, use NPPC document 99-15, section II.C. as guidance in indicating program linkage with assumptions regarding habitat conditions.

Need information if available (Regional staff).

3.5) Ecological interactions.

Describe salmonid and non-salmonid fishes or other species that could (1) negatively impact program; (2) be negatively impacted by program; (3) positively impact program; and (4) be positively impacted by program. Give most attention to interactions between listed and "candidate" salmonids and program fish.

None in the Washougal River. Smolts are released volitionally and clear the river quickly, with only a small portion remaining as residuals (Fuss et. al 1999). However, avian predation from common merganser, double crested cormorant, and caspian tern, does pose a large threat.

(1) negatively impact program:

None in the Washougal River. Smolts are released volitionally and clear the river quickly, with only as small portion remaining as residuals (Fuss et. al 1999). However, avian predation from common merganser, double crested cormorant, and caspian tern, does pose a large threat.

2) be negatively impacted by program:

Less than 0.002% of the hatchery coho release will residualize thus competition for food resources with natural fish (Fuss et. al. 1999) is minimal. Large scale releases of coho,

steelhead and chinook may attract avian predators which may linger during the period of coho rearing and migration.

(3) positively impact program:

(4) be positively impacted by program.

The Washougal River drainage is thought to be inadequately seeded with anadromous fish carcasses and a program has been initiated with the use of volunteers (Camas Washougal Fish and Habitat League) to distribute coho carcases throughout the basin from hatchery coho returning to the Washougal Salmon Hatchery.

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.

For integrated programs, identify any differences between hatchery water and source, and "natal" water used by the naturally spawning population. Also, describe any methods applied in the hatchery that affect water temperature regimes or quality. Include information on water withdrawal permits, National Pollutant Discharge Elimination System (NPDES) permits, and compliance with NMFS screening criteria.

Need information on water source, pumps, gravity feed, etc.

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.

(e.g. "Hatchery intake screens conform with NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish.").

Hatchery waste discharge conforms to NPDES criteria and guidelines. IS THIS CORRECT? Do hatchery intakes entrain listed fish?

SECTION 5. FACILITIES

Provide descriptions of the hatchery facilities that are to be included in this plan (see "Guidelines for Providing Responses" Item E), including dimensions of trapping, holding incubation, and rearing facilities. Indicate the fish life stage held or reared in each. Also describe any instance where operation of the hatchery facilities, or new construction, results in destruction or adverse modification of critical habitat designated for listed salmonid species.

5.1) Broodstock collection facilities (or methods).

The adult collection occurs during September and October, with most of the collection of coho during October. The collection occurs at the hatchery rack (RM 20) where fish are diverted into a fish ladder and into the adult holding pond. Dimensions of trapping facility?

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

Need description of trucks or containers used in transporting of adults and juveniles.

5.3) Broodstock holding and spawning facilities.

Need information on the above facilities; dimensions, etc.

5.4) Incubation facilities.

Need information on how many Heath trays, shallow troughs, etc are used for incubation.

5.5) Rearing facilities.

Need pertinent information on how many raceways, ponds, etc. are used for rearing. Also need dimensions on the rearing facilities.

5.6) Acclimation/release facilities.

Need information on release facilities (on and off-station), if applicable.

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

Need information if applicable.

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.
(e.g. "The hatchery will be staffed full-time, and equipped with a low-water alarm system to help prevent catastrophic fish loss resulting from water system failure.").

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.
List all historical sources of broodstock for the program. Be specific (e.g., natural spawners from Bear Creek, fish returning to the Loon Creek Hatchery trap, etc.).

The Washougal Hatchery coho "Type N" broodstock for the on-station release of 500,000 smolts came from the Washougal River from 1987 to present with the exception (1993) when Lewis River stock coho "Type N" were used as a supplement to the Washougal

shortfall. Acceptable stocks are any lower river "Type N" coho. The stock used most often for the 2,500,000 smolt program to the Klickitat River for supplementing the Washougal needs is the Lewis River "Type N". These stocks originated from Cowlitz "Late" stock coho and were introduced to the Washougal Hatchery in 1985. Prior to 1985 the Washougal coho program was "Early" stock coho with history from the Washougal River in 1958/59.

6.2) Supporting information.

6.2.1) History.

Provide a brief narrative history of the broodstock sources. For listed natural populations, specify its status relative to critical and viable population thresholds (use section 2.2.2 if appropriate). For existing hatchery stocks, include information on how and when they were founded, sources of broodstock since founding, and any purposeful or inadvertent selection applied that changed characteristics of the founding broodstock.

The brood stock for the Washougal Hatchery is recorded in the Salmon and Steelhead Subbasin Production Plan 1990. “In 1951 the Washington Department of Fisheries estimated the minimum coho escapement to be 3,000 fish. Coho were said to spawn mainly in the tributaries below falls and in the Little Washougal River, Winkler Creek, and the West Fork Washougal. The Hatchery program began with local stocks and some imported Toutle "Early" stock coho in 1958/59. In 1985 "Late" stock coho were introduced from the Cowlitz Salmon Hatchery. Since that time most years production has been a composite of late run Washougal and Lewis River "Type N" Coho.

Stock history described in the "Salmon and Steelhead Production Washougal Subbasin Plan" and in the " Biological Opinion On Artificial Propagation in the Columbia River Basin" (3/29/99).

6.2.2) Annual size.

Provide estimates of the proportion of the natural population that will be collected for broodstock. Specify number of each sex, or total number and sex ratio, if known. For broodstocks originating from natural populations, explain how their use will affect their population status relative to critical and viable thresholds.

Broodstock for hatchery production is collected form adult fish with spawn time represented in egg takes used for production fish. The following table (2.0) gives a view of historical returns to the hatchery that provided broodstock for rearing. We began a mass marking program with the 1996 Brood coho releases and, as a result, future brood stock will be identified as hatchery fish and natural returning fish may be separated for management needs.

Table 2.0) presents the Washougal type N Coho returns to the hatchery by brood year.

	Males	Females	Total	Jacks
1998	521	571	1,092	26
1997	863	861	1,724	0

1996	634	477	1,111	75
1995	303	210	513	62
1994	710	531	1,241	27
1993	350	266	616	13
1992	4,417	1,835	6,252	282
1991	6,275	3,041	9,316	358
1990	1,383	659	2,042	347

A mass marking program began with the 1996 brood "Type N" coho releases. As a result future broodstocks can be identified as hatchery-origin fish and natural spawning fish.

6.2.3) Past and proposed level of natural fish in broodstock.
If using an existing hatchery stock, include specific information on how many natural fish were incorporated into the broodstock annually.

The level of natural fish in the returning broodstock is unknown prior to 1998. Since that time only hatchery origin broodstock identified by their missing adipose fin have been used for propagation purposes. Few, if any, natural fish have been identified within the captured population of broodstock since 1998. A escapement goal for coho has been established at 600 adults based on a production of 30,000 smolts.

Need information, if known (Regional staff).

6.2.4) Genetic or ecological differences.
Describe any known genotypic, phenotypic, or behavioral differences between current or proposed hatchery stocks and natural stocks in the target area.

There are no known genotypic, phenotypic or behavioral differences between the hatchery and natural stocks in the Washougal drainage.

6.2.5) Reasons for choosing.
Describe any special traits or characteristics for which broodstock was selected.

"Type N" coho provide for extended fishing opportunity. The "Type N" stock(s) are the strength of the of the Columbia River contribution to the Washington coastal fisheries especially in zones 1 & 2. Combined with earlier returning stocks they provide a extended period of quality catch in both the fresh water recreational and commercial fisheries. "Type N" provide the fresh water commercial fishers opportunity (timing) outside the peak fall chinook returns in the lower Columbia River.

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.
(e.g. "*The risk of among population genetic diversity loss will be reduced by selecting the indigenous chinook salmon population for use as broodstock in the supplementation program*.").

All hatchery-origin "Type N" coho are being mass marked.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adults.

7.2) Collection or sampling design.

Include information on the location, time, and method of capture (e.g. weir trap, beach seine, etc.) Describe capture efficiency and measures to reduce sources of bias that could lead to a non-representative sample of the desired broodstock source.

The adult collection occurs annually during October, November and December. Most of the collection of coho is during November. Collection occurs at the hatchery rack where fish are diverted into a fish ladder and then into the adult holding pond. The Washougal River can and does flood over the intake and river barrier which will provide fish opportunity to escape above the weir. The total fish that escape are in the 3 to 5% range of the run size.

Any exotic fish that may be encountered are held for transport in live boxes in the holding pond.

Broodstock collection occurs with no upstream escapement goal and as a result the first priority is hatchery egg take goal. The second goal is for any lower Columbia River "Type N" coho program that may request eggs for their programs. The third goal is for all surplus fish to be harvested for nutrient enhancement in the subbasin.

7.3) Identity.

Describe method for identifying (a) target population if more than one population may be present; and (b) hatchery origin fish from naturally spawned fish.

No target fish exist with "Type N" coho and if natural fish show up in the brood we will have the option of sorting them for brood consideration??? or prescribed action. This will be possible because all hatchery returns will be adipose-fin clipped.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

500 females and 500 females

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Appendix C

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1988					
1989					
1990					
1991					
1992					
1993					
1994					
1995					
1996					
1997					
1998					
1999					

Data source: *(Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)*

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.
Describe procedures for remaining within programmed broodstock collection or allowable upstream hatchery fish escapement levels, including culling.

Surplus adults are used for nutrient enhancement within the watershed.

7.6) Fish transportation and holding methods.
Describe procedures for the transportation (if necessary) and holding of fish, especially if captured unripe or as juveniles. Include length of time in transit and care before and during transit and holding, including application of anesthetics, salves, and antibiotics.

The trapping of fish begins in early September and is constant through October.(for type N fish???) Adults swim up the fish ladder and are held for up to 30 days before spawning occurs.

When wild fish of any species are trapped they are sorted to a live box, transported via a live tube to a tanker truck and then transported up-river and released. This is a proven method for handling wild steelhead in the region. (How long are fish in transit? Any anesthetics, antibiotics applied during holding or transit?)

7.7) Describe fish health maintenance and sanitation procedures applied.

Need information if applicable.

7.8) Disposition of carcasses.
Include information for spawned and unspawned carcasses, sale or other disposal methods, and use for stream reseeding.

The coho will be 100% used for nutrient enhancement in the future. While we still have a viable contract (sold to a buyer) for carcasses, the nutrient enhancement option will be the choice for the Washougal Hatchery.

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.
(e.g. "The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines").

All hatchery-origin "Type N" coho are being mass marked for identification upon return as adults.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.
Specify how spawners are chosen (e.g. randomly over whole run, randomly from ripe fish on a certain day, selectively chosen, or prioritized based on hatchery or natural origin).

The adult spawners used for program goals are chosen from each days take and, if possible, used in the aggregate as a percentage of the total eggs taken for the season that they represent. Spawning occurs once per week for 4 to 5 weeks.

8.2) Males.
Specify expected use of backup males, precocious males (jacks), and repeat spawners.

The spawning protocol is described in the IHOT 1995 Volume III as follows; " The intent is to use a spawning population of at least 500 adults. When spawning fewer than 1 million eggs in a day, the male-to-female ratio will be 1:1 for all stocks. When spawning more than one million eggs in a day, the ratio will not be less than 1 male to 3 females."

8.3) Fertilization.
Describe spawning protocols applied, including the fertilization scheme used (such as equal sex ratios and 1:1 individual matings; equal sex ratios and pooled gametes; or factorial matings). Explain any fish health and sanitation procedures used for disease prevention.

One to one (1:1) ratio in no larger than 10 fish pools is the method of choice for fertilization. All eggs are water hardened in an iodine solution before incubation begins.

8.4) Cryopreserved gametes.

If used, describe number of donors, year of collection, number of times donors were used in the past, and expected and observed viability.

None used.

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. (*e.g. "A factorial mating scheme will be applied to reduce the risk of loss of within population genetic diversity for the small chum salmon population that is the subject of this supplementation program".*).

All hatchery-origin "Type N" coho are being mass marked.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

NEED APPROPRIATE INFORMATION FOR ALL QUESTIONS BELOW, IF KNOWN.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.
Provide data for the most recent twelve years (1988-99), or for years dependable data are available.

9.1.2) Cause for, and disposition of surplus egg takes.
Describe circumstances where extra eggs may be taken (e.g. as a safeguard against potential incubation losses), and the disposition of surplus fish safely carried through to the eyed eggs or fry stage to prevent accedence of programmed levels.

9.1.3) Loading densities applied during incubation.
Provide egg size data, standard incubator flows, standard loading per Heath tray (or other incubation density parameters).

9.1.4) Incubation conditions.
Describe monitoring methods, temperature regimes, minimum dissolved oxygen criteria (influent/effluent), and silt management procedures (if applicable), and any other parameters monitored.

9.1.5) Ponding.
Describe degree of button up, cumulative temperature units, and mean length and weight (and distribution around the mean) at ponding. State dates of ponding, and whether swim up and ponding are volitional or forced.

9.1.6) Fish health maintenance and monitoring.
Describe fungus control methods, disease monitoring and treatment procedures, incidence of yolk-sac malformation, and egg mortality removal methods.

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.
(*e.g. "Eggs will be incubated using well water only to minimize the risk of catastrophic loss due to siltation.")*

All hatchery-origin "Type N" coho are being mass marked.

9.2) <u>Rearing</u>:

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 (1988-99), or for years dependable data are available..

9.2.2) Density and loading criteria (goals and actual levels).
Include density targets (lbs fish/gpm, lbs fish/ft3 rearing volume, etc).

9.2.3) Fish rearing conditions
(Describe monitoring methods, temperature regimes, minimum dissolved oxygen, carbon dioxide, total gas pressure criteria (influent/effluent if available), and standard pond management procedures applied to rear fish).

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.

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

Contrast fall and spring growth rates for yearling smolt programs. If available, indicate hepatosomatic index (liver weight/body weight) and body moisture content as an estimate of body fat concentration data collected during rearing.

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*).

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

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

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

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. (*e.g. "Fish will be reared to sub-yearling smolt size to mimic the natural fish emigration strategy and to minimize the risk of domestication effects that may be imparted through rearing to yearling size.")*

All hatchery-origin "Type N" coho are being mass marked.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program. *Specify any management goals (e.g. number, size or age at release, population uniformity, residualization controls) that the hatchery is operating under for the hatchery stock in the appropriate sections below.*

10.1) Proposed fish release levels. *(Use standardized life stage definitions by species presented in **Attachment 2**. "Location" is watershed planted (e.g. "Elwha River").)*

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerlings				
Smolts	500,000 2,500,000	17 20	May April	Washougal River Klickitat River**

Note: If "Type N" coho is not available up to 2,500,000 "Type S" coho will be used for the Klickitat release. **Is this true???**

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

Stream, river, or watercourse: Washougal River (28.0159), Klickitat River (30.0002)
Release point: Washougal River RM 20, Klickitat River RM 18
Major watershed: Washougal and Klickitat Rivers
Basin or Region: Columbia River

10.3) Actual numbers and sizes of fish released by age class through the program.
For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in ***Attachment 2****. Cite the data source for this information.*

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Smolts	Avg size
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995								
1996								
1997								
1998								
1999								
Average								

Data source: *(Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)*

10.4) Actual dates of release and description of release protocols.
Provide the recent five year release date ranges by life stage produced (mo/day/yr).
Also indicate the rationale for choosing release dates, how fish are released (volitionally, forced, volitionally then forced) and any culling procedures applied for non-migrants.

All fish released into the Washougal River are forced from the raceways in May of the year while fish to the Klickitat River are trucked and released at RM 18 in April.

10.5) Fish transportation procedures, if applicable.
Describe fish transportation procedures for off-station release. Include length of time in transit, fish loading densities, and temperature control and oxygenation methods.

Need information on fish transportation procedures for Klickitat releases.

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

All production occurs with a mixture of Boyles Creek, Bob's Creek, and Washougal River water giving the on-station coho release a distinct location indicator. All fish are programmed to be at smolt size before release. All coho for the Klickitat release hauled for direct release with no acclimation. Washougal Hatchery coho are forced released from raceway ponds at release. The Klickitat release site needs an acclimation facilities.

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

All pre-smolts are/will be mass marked to identify hatchery-origin adults.

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

Need information/plans if identified.

10.9) Fish health certification procedures applied pre-release.

Need information on any fish health certification procedures applied pre-release.

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

Need information if available.

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.
(*e.g. "All yearling coho salmon will be released in early June in the lower mainstem of the Green River to minimize the likelihood for interaction, and adverse ecological effects, to listed natural chinook salmon juveniles, which rear in up-river areas and migrate seaward as sub-yearling smolts predominately in May").*

Need information if available.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

This section describes how "Performance Indicators" listed in Section 1.10 will be monitored. Results of "Performance Indicator" monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet "Performance Standards".

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

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

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

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.
(*e.g. "The Wenatchee River smolt trap will be continuously monitored, and checked every eight hours, to minimize the duration of holding and risk of harm to listed spring chinook and steelhead that may be incidentally captured during the sockeye smolt emigration period.)"*

SECTION 12. RESEARCH

Provide the following information for any research programs conducted in ***direct association with the hatchery program described in this HGMP. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish****. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in* ***Table 1****.*

12.1) Objective or purpose.
Indicate why the research is needed, its benefit or effect on listed natural fish populations, and broad significance of the proposed project.

12.2) Cooperating and funding agencies.

12.3) Principle investigator or project supervisor and staff.

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

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

12.6) Dates or time period in which research activity occurs.

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

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

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

12.10) Alternative methods to achieve project objectives.

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

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.
(*e.g. "Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.").*

SECTION 13. ATTACHMENTS AND CITATIONS

Include all references cited in the HGMP. In particular, indicate hatchery databases used to provide data for each section. Include electronic links to the hatchery databases used (if feasible), or to the staff person responsible for maintaining the hatchery database referenced (indicate email address). Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, benefit/risk assessments, or other analysis or plans that provide pertinent background information to facilitate evaluation of the HGMP.

Salmon and Steelhead Production Plan. 1990 (Washougal River Subbasin).

Biological Opinion On Artificial Propagation in the Columbia River Basin.1999 (Section 7 Consultation).

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

Byrne, J. and H.J. Fuss. 1998. Annual coded-wire tag program Washington: Missing Production Groups. Annual Report 1998. Bonneville Power Administration, Portland, Or. Project Number 89-066. 107 pp.

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.

Fuss, H.J. and P. Seidel. 1987. Hatchery incubation techniques at WDF hatcheries. Washington Department of Fisheries, Technical Report 100. 86 p

Marshall, A. R., C. Smith, R. Brix, W. Dammers, J. Hymer, and L. LaVoy *in* Busack, C. and J.B. Shaklee, editors. 1995. Genetic diversity units and major ancestral lineages of salmonid fishes in Washington. Washington Department of Fish and Wildlife, Fish Management Program, Technical Report # RAD 95-02. 62 pp.

IHOT (Integrated Hatchery Operations Team). 1995. Operation plans for anadromous fish production facilities in the Columbia River basin. Volume III-Washington. Annual Report 1995. Bonneville Power Administration, Portland Or. Project Number 92-043. 536 pp.

Operations Plans for Anadromous Fish Production Facilities in the Columbia River Basin.1995 (IHOT) Volume III.

Semi-Annual Operations Reports for Lower Columbia Fisheries Development Program Mitchell Act Hatcheries (Washington State). 1987 through1999.

Washington Department of Fish and Wildlife. 1998. Water resource inventory area river mile indices for the Columbia and Snake river basins. Unpublished document. Habitat Management Division, Washington Department of Fish and Wildlife, Olympia, WA.

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.

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.

Wood, J.W. 1979. Diseases of Pacific Salmon, their prevention and treatment, 3rd edition. Washington Department of Fisheries, Hatchery Division, Olympia, Washington. 82 p.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information 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:_____

Appendix C

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: _____ ESU/Population:_____ Activity:_____				
Location of hatchery activity:_____ Dates of activity:_____ Hatchery program operator:_____				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.

Appendix D. Fisheries Management and Evaluation Plan, Lower Columbia River

FISHERIES MANAGEMENT AND EVALUATION PLAN

Lower Columbia River

Prepared by
Washington Department of Fish and Wildlife

February 21, 2001

Summary of the Estimated Tributary Fisheries exploitation in the Lower Columbia Management Area. Exploitation includes incidental mortality due to other-species targeted fisheries.

Chinook

Lower Columbia Fall Tule Fall	Tributary fishery impacts will not cause total fisheries (ocean, Columbia mainstem, and tributary) exploitation to exceed 65%. Example, if PMFC/North of Falcon and Columbia River Compact fisheries are 45%, Tributary fisheries exploitation will not exceed 20%.		
Spring	Fishery in year	2001	2002 and on.
Cowlitz		≤25%	≤10%
Kalama		≤60%	≤10%
Lewis		≤60%	≤10%

Steelhead

Winter	≤10%
Summer	≤10%
Summer run upstream of Bonneville	≤4%

Chum

Lower Columbia	≤4%

Title.

Fishery Management and Evaluation Plan: Lower Columbia River Region

Responsible Management Agency.

Agency:	Washington Department of Fish and Wildlife
Name of Primary Contact:	Ross Fuller, Chief, Fish Management Division
Address:	600 Capitol Way N.
City, State, Zip Code:	Olympia, WA. 98501
Telephone Number:	360-902-2655
Fax Number:	360-902-2944
Email Address:	fullerkf@dfw.wa.gov

Date Completed.

Include the dates of any previous draft FMEP that were submitted, if applicable.

SECTION FISHERIES MANAGEMENT

1.1) General objectives of the FMEP.

The objectives of the Washington Department of Fish and Wildlife's (WDFW) Fish Management and Evaluation Plans (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 1997a). 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.

The primary focus of anadromous salmonid fisheries in the LCR is to target harvest of known hatchery origin steelhead, spring chinook, coho salmon, sea-run cutthroat, and fall chinook. The primary focus for resident game and non-game fish in the LCR tributaries is to 1) provide recreational opportunities, 2) minimize impacts to juvenile anadromous fish through time and area closures, and 3) minimize impacts to listed species.

1.1.1) List of the "Performance Indicators" for the management objectives.

Performance indicators of fish populations include parameters such as abundance, freshwater carrying capacity, survival through the migration corridor, ocean productivity, intrinsic productivity of the stock, and recruits per spawner. Based on these parameters, fisheries and extinction risks are established to maintain the abundance of the stock above a level that does not compromise the existence of the stock and allows fishery management objectives to be met. To develop fisheries using this approach, precise and accurate estimates of wild run size, escapement, harvest, age structure, fecundity, stray rate, smolt production, and smolt to adult survival are needed. In addition, the number of hatchery spawners and their reproductive successes in the wild are also needed for each stock or population. Due to limited resources, this information is rarely collected with enough accuracy and precision for every stock to develop individual fisheries or extinction risks as described above. Therefore, WDFW has used an approach in this FMEP using index streams to estimate these parameters and applying these results to other basins. However, WDFW recognizes the potential that index streams may not adequately reflect populations in non-index streams. In the Monitoring and Evaluation section of this FMEP, we have outlined an approach to expand data collection to other populations so we are not dependent on a few index streams in the future.

The following monitoring 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.

Performance indicators for fisheries include estimates for the catch, catch rates, harvest, harvest rates, hooking mortality for fish caught and released, effort of the fishery, and catch per unit effort (CPUE) for the fishery. Creel surveys are conducted in a few basins for steelhead and salmon to determine the CPUE and ratio of hatchery fish caught to wild fish released. WDFW typically makes statistically based estimates of steelhead and salmon catch from the WDFW catch record card (CRC) and follow-up phone surveys. To calculate the wild steelhead and freshwater salmon sport fishing mortality rate, the indirect mortality that can occur from wild fish release, biologists determine the wild interception rate by expanding the number of wild fish released from the creel surveys by the ratio of total catch from the CRC divided by the number of fish sampled during the creel surveys. Creel surveys are conducted on the Cowlitz and NF Lewis rivers to collect fisheries data for steelhead and salmon. Creel surveys are also conducted during chinook and coho fisheries on the Grays, Elochoman, Cowlitz, Toutle, Kalama, Lewis, Washougal, Wind, and Little White Salmon rivers to evaluation these fisheries.

1.1.2) Description of the relationship and consistency of harvest management with artificial propagation programs.

Harvest of salmon and steelhead in the LCMA is managed to meet wild salmon and steelhead escapement objectives and to meet the objectives of artificial propagation programs. To manage harvest to meet these goals, WDFW has developed escapement objectives for all hatchery populations, and some wild populations; interim maximum harvest rates have been established for the remaining wild stocks. Fishing seasons are then established based on a forecast of salmon and steelhead returning to the LCMA. In years where run size to the tributaries is forecast to be below escapement requirements, harvest in tributaries is eliminated, or reduced to limited mortality from wild salmon or steelhead release. Harvest reductions are accomplished by time and area closures, gear restrictions, or changes in the daily catch limits. When forecasts are not made, conservative harvest rates are established. These rates are less than the estimated maximum sustainable yield (MSY) harvest rates under low ocean productivity or Recovery Exploitation Rates established by the National Marine Fisheries Service (NMFS) (NMFS 2000a).

To the extent possible, WDFW uses selective fisheries to maximize harvest rates on hatchery stocks while setting wild stock harvest rates consistent with wild stock protection and/or rebuilding. Artificial propagation programs within the LCMA have three purposes: 1) rebuild wild populations that are at risk and/or re-establish wild populations that have been extirpated, 2) determine the benefits and risks of artificial propagation programs have on wild populations through research and develop strategies that maximize benefits and minimize risks, and 3) provide for harvest opportunity.

Restoration Programs
Hatcheries have and will continue to play an important role in recovering wild populations. WDFW has used hatcheries to successfully boost wild steelhead populations in the Toutle River after the eruption of Mt. St. Helens. Currently, WDFW is engaged in reintroduction programs in the Cowlitz basin for spring chinook, coho, and steelhead. Fry, smolts, and adults from hatcheries in the lower river are released above Cowlitz Falls to establish naturally spawning populations. For at-risk chum populations in the Grays River, WDFW is developing a broodstock from wild spawners to reintroduce chum salmon into the Chinook River and to maintain the Grays River population, which is at considerable risk due to degraded habitat. In addition, WDFW is exploring the potential of establishing a wild spring chinook population in the upper Kalama River using hatchery fish as a donor stock.

Fish released from hatchery programs with a recovery emphasis usually consist of unclipped fish releases. By not externally marking these fish, the direct harvest in selective fisheries is eliminated, which increases the number of recovery fish that will spawn naturally. Where possible, these recovery fish are marked for evaluation purposes. In some cases, fish above recovery needs are differentially marked and released along with recovery fish to provide fishery opportunity.

Research Programs
To better understand the risks and benefits to wild populations from hatchery programs, gene flow, reproductive success, and ecological interactions between hatchery and wild fish are studied. Research projects are developed that address specific needs, and go through a peer review process including assessment of experimental design to accomplish the objectives and a risk analysis. Only after this rigorous review process are projects approved. A variety of internal and external marks are used to evaluate different test groups and replicates. Harvest of these experimental fish may be controlled to meet study design goals through selective fisheries.

Harvest Programs
The purpose of the majority of hatchery programs in the LCMA is to provide harvest opportunity. Hatchery coho, steelhead, and sea-run cutthroat are adipose-fin marked to allow quick identification of these hatchery fish intended for harvest. The presence of the adipose fin also allows for quick identification of wild stocks, so anglers can limit the handling of these fish. The spring chinook marking program was initiated to provide a selective fishery while protecting the weak spring runs. All hatchery-released spring chinook in the LCMA, downstream of Bonneville Dam, have been externally marked since 1998. It is anticipated that by fishing season 2002, a selective fishery for hatchery only spring chinook can be implemented.

For programs designed for steelhead harvest, WDFW tries to minimize natural escapement of hatchery fish to protect the genetic diversity of wild stocks. 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. When hatchery fish do spawn, their reproductive success in the wild is "very" low and few offspring are produced (Chilcote et al. 1986 and Leider et al. 1990). 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.

An alternate strategy has been used for most salmon stocks and some steelhead stocks, in which every effort is made to maintain similarities in between hatchery and wild fish. Guidelines for this type of program generally include the following: 1) incorporate wild fish annually into the broodstock; 2) maintain similar genetic and biological characteristics between hatchery and wild populations including size, age, size and age at maturity, age at ocean entry, fecundity, sex ratio, run timing, and spawning time; 3) limiting the proportion of hatchery spawners by managing for intense selective fisheries, and maintaining high trapping efficiencies at hatcheries and adult traps that remove hatchery fish prior to spawning; 4) use hatchery management practices, acclimation, timing, and lower river releases to limit competition and predation that can occur from hatchery releases; and 5) follow (IHOT 1995) guidelines to limit disease risks from hatchery salmon and steelhead.

Hatchery Genetic Management Plans are being developed for artificial propagation programs for facilities located on Lower Columbia River tributaries.

1.1.3) General description of the relationship between the FMEP objectives and Federal tribal trust obligations.

Tribal fisheries below Bonneville Dam do not currently exist. The extent of treaty tribal fishing rights below Bonneville Dan has not been adjudicated. In the event that tribes are found to have treaty rights below Bonneville Dam, WDFW will work with the tribes to develop LCMA tributary fisheries consistent with the protection of ESA listed stocks and harvest sharing. Treaty Indian fisheries promulgated by the member Tribes of the Columbia River Inter-Tribal Fish Commission are conducted in the tributaries above Bonneville Dam. The Yakama Nation (YN) currently has fisheries in the Wind River watershed. This fishery is not regulated by WDFW. Each tribe has retained their authority to regulate their fisheries and issues fishery regulations through their respective governing bodies. The tribes are represented by their staff on the

Technical Advisory Committee and participate in monitoring activities and data sharing with other parties. The tribes have policy representation in the U.S. v. Oregon harvest management processes.

1.2) Fishery management areas

1.2.1) Description of the geographic boundaries of the management area of this FMEP.

Since the LCR ESU is not consistent between species, we have defined the LCMA for Washington, as the area from the mouth of the Columbia River upstream and including the Wind River Watershed. This FMEP covers all of Washington's freshwater fisheries in the LCR excluding those conducted in the mainstem of the Columbia River, which are covered in a Section 7 and/or 10 consultation under US v Oregon. This plan includes recreational fisheries in the anadromous portions of independent tributaries entering into the LCR from the mouth of the Columbia River up to and including the Wind River. These include the Grays, Skamokawa, Elochoman, Cowlitz, Kalama, Lewis, Salmon, Washougal, and Wind watersheds, as well as independent lower Columbia River tributary creeks in Wahkiakum, Cowlitz, Clark, and Skamania counties that are accessible to LCMA salmonids.

1.2.2) Description of the time periods in which fisheries occur within the management area.

Fisheries in LCMA tributaries occur year-round. Recreational fisheries include targeted spring chinook, fall chinook, summer steelhead, winter steelhead, coho, trout, sturgeon, smelt, crayfish, shad, and fisheries directed at other native and non-native species. Most harvest impacts to listed species occur in the targeted fishery and few impacts occur in non-targeted fisheries. Chinook fisheries are closed year-round unless specifically listed as open. Spring chinook fisheries commence as fish begin entering the tributaries in February and March and typically close in August to protect spawners. Tributary fall chinook fisheries occur from August through January. Tule stocks are present in most LCMA tributaries and fisheries peak in September. The Lewis River fall chinook stock is a later timed stock with peak fishing in October. Chum salmon are present in tributaries from October through January. The Washington tributaries have been closed to chum salmon fishing since 1995. Fisheries targeting winter steelhead are concentrated from December through February and close by March 15. In the Cowlitz, Kalama, Lewis, and Washougal basins winter steelhead fisheries extend through May 31. Summer steelhead enter fisheries from March through October and most of the catch occurs from late May through August.

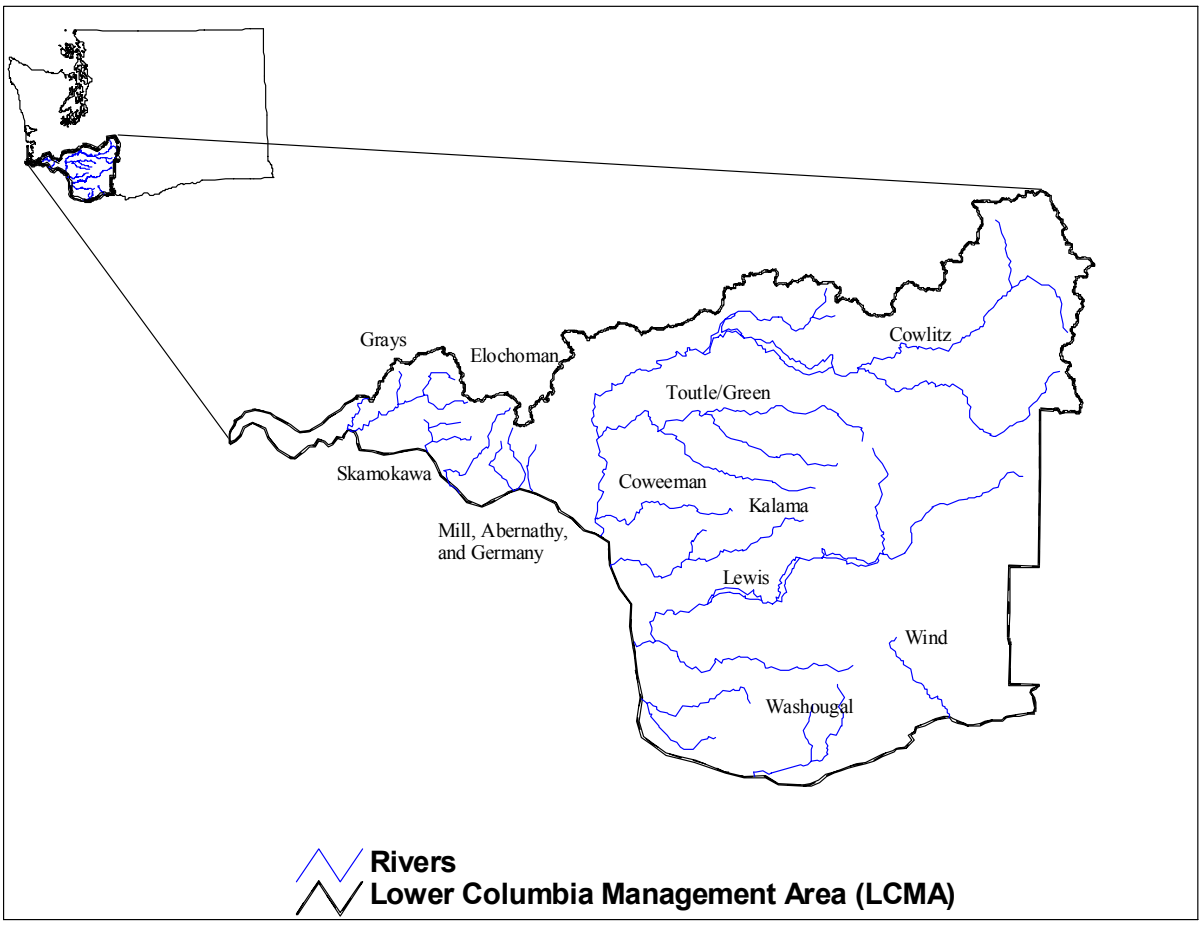

Figure 1. The Lower Columbia River Management Area**.**

Fisheries in the LCMA occur for non-listed fish including coho, trout, sturgeon, shad, smelt, warmwater fish, and crayfish. Fisheries for adipose fin-clipped hatchery coho salmon destined for Grays, Elochoman, Cowlitz, Toutle, Kalama, Lewis, and Washougal rivers occur from August through January in most years. Shad and sturgeon fisheries are opened in LCMA tributaries but the fishery effort is concentrated in the mainstem Columbia River and is very low in the LCMA tributaries. Shad and sturgeon fishing is open year-round, however shad fishing is concentrated from May through July. Non-hook and line fisheries occur for smelt and crawfish in LCMA tributaries. Participants in the smelt fishery use dip nets, while crawfish anglers primarily use pot or traps. Fishing for smelt occurs primarily from January to April and fishing for crawfish primarily occurs in the late spring and summer. The game fish fishing season is open from June 1 to October 31 in LCMA tributaries.

Appendix A contains the statewide general freshwater rules for Washington state and the 2000-01 Sport fisheries timing for LCMA tributaries. The fisheries and attributes of the fisheries (gear restrictions, timing, areas open, etc.) within this appendix may change at any time and should not be considered as a management guideline.

1.3) Listed salmon and steelhead affected within the Fishery Management Area specified

in section 1.2.

Listed salmon and steelhead present in LCR include lower Columbia River chinook salmon ESU (threatened effective May 24, 1999), lower Columbia River chum salmon ESU (threatened effective May 24, 1999), and lower Columbia River steelhead ESU (threatened effective May 18, 1998). The salmon and steelhead natural populations in Table 1 are from the 1992 Salmon and Steelhead Stock Inventory (SASSI) (WDF et al. 1993). The stock definition in SASSI is "The fish spawning in a particular lake or stream(s) at a particular season, which to a substantial degree do not interbreed with any group spawning in a different place, or in the same place at a different season." Steelhead stocks were updated in a 1997 preliminary SASSI (WDFW 1997b). Washougal and Wind River summer and winter populations were used in this update and they are retained here as well. All tributary fisheries for anadromous salmonids after 2001 will be selective fisheries (all returning hatchery adults will have external marking) except for spring chinook fisheries above Bonneville Dam and the fall chinook fisheries. Mass marking programs have been established for hatchery spring chinook downstream of Bonneville Dam. Selective fisheries allow for "weak stock" protection by only allowing harvest of healthy hatchery stocks.

Spring chinook are native to the Cowlitz and Lewis rivers. It is unclear if spring chinook were historically present in the Kalama River. Native populations are believed to have been extirpated from the Lewis River. The current status of wild spring chinook populations in the Cowlitz and Kalama rivers is unknown. Spring chinook were not native to the Deep/Grays, Toutle, Wind, or Little White Salmon rivers and hatchery releases into these basins are strictly for harvest. WDFW has ongoing research/recovery programs for spring chinook in the Kalama and Cowlitz rivers.

All medium to large tributaries in the LCMA had native populations of fall chinook salmon. Tule fall chinook salmon are present in almost all basins. These fish enter earlier and are more mature than other LCMA fall chinook stocks. Tule fall chinook are produced from Elochoman, Cowlitz, Toutle, Kalama, and Washougal hatcheries. The tule fall chinook program has been significantly reduced due to Mitchell Act funding reductions in the mid-1990s. Bright chinook are found primarily in the Lewis River. These fish are later timed and less mature on entry. Genetic analysis supports differences between tule and bright races of fall chinook.

WDFW has identified two population centers for chum salmon near the Grays River and below Bonneville Dam. The Grays River population consists of fish spawning in the mainstem Grays, WF Grays, Crazy Johnson, and Gorley subbasins. The below Bonneville Dam population consists of fish spawning in the mainstem Columbia, Hardy Creek, and Hamilton Creek. Other basins where chum salmon have been observed include: Skamokawa, Elochoman, Mill, Abernathy, Germany, Cowlitz, Lewis, Washougal, small independent Columbia Gorge tributaries, mainstem Columbia River near I-205, and the Columbia River above Bonneville Dam. It is unclear if the spawners in these other basins are a separate population, due to the lack of genetic and population data. Hatchery chum salmon are currently being raised at Grays River Hatchery as part of a recovery plan for tributaries in the LCMA.

Table 1. List of the natural fish populations and associated hatchery stocks included in this FMEP.

Appendix D

Natural Populations (or Management Units)	Associated hatchery stock(s)	Recovery Categories	Hatchery stock essential for Recovery? (Y or N)
Coweeman River Winter Steelhead	Beaver Creek	1	N
Toutle River Winter Steelhead	None	1	N
SF Toutle Winter Steelhead	Skamania Summers	1	N
Green River Winter Steelhead	Skamania Summers	1	N
Cowlitz River Winter Steelhead	Cowlitz Early, Cowlitz Late, Cowlitz Summers	2	N
Kalama River Winter Steelhead	Beaver Creek & Kalama Winters	1	N
Kalama River Summer Steelhead	Skamania Summers & Kalama Summers	1	N
Lewis River Winter Steelhead	Merwin Winters	2	N
NF Lewis River Summer Steelhead	Merwin Summers	2	N
EF Lewis Winter Steelhead	Skamania Winter	1	N
EF Lewis Summer Steelhead	Skamania Summers	1	N
Washougal River Winter Steelhead	Skamania Winters	1	N
Washougal River Summer Steelhead	Skamania Summers	1	N
Hamilton Creek Winter Steelhead	None	1	N
Wind River Winter Steelhead	None	1	N
Wind River Summer Steelhead	None	1	N
Grays River Fall Chinook	None	2	N
Skamokawa Creek Fall Chinook	None	2	N
Elochoman Fall Chinook	Elochoman	2	N
Mill Creek Fall Chinook	None	2	N
Abernathy Creek Fall Chinook	None	2	N
Germany Creek Fall Chinook	None	2	N
Coweeman Fall Chinook	None	1	N
SF Toutle Fall Chinook	None	2	N
Green River Fall Chinook	Toutle	2	N
Cowlitz Fall Chinook	Cowlitz	2	N
Cowlitz Spring Chinook	Cowlitz	3w/o Cowlitz Falls 2 w Cowlitz Falls	N
Kalama Fall Chinook	Kalama	2	N
Kalama Spring Chinook	Kalama	2	N

EF Lewis Fall Chinook	None	1	N
Lewis Fall Chinook	None	1	N
Lewis Spring Chinook	Lewis	3	N
Washougal Fall Chinook	Washougal	2	N
Wind River Tule Fall Chinook	None	1	N
Wind River Bright Fall Chinook	None	2	N
Wind River Spring Chinook	Carson	3	N
Grays River Fall Chum	Grays	1	N
Hardy Creek Fall Chum	None	1	N
Hamilton Creek Fall Chum	None	1	N

Winter steelhead are native to all major and most minor basins to the LCMA. Hatchery steelhead are produced in the Cowlitz, Coweeman, Kalama, Lewis, Salmon, and Washougal basins. Self-sustaining populations exist in all tributaries with the possible exception of parts of the Cowlitz and Lewis rivers. Large hatchery programs in these basins were developed to mitigate the loss of access to the most productive steelhead habitat due to the construction of dams. Due to the magnitude of hatchery spawners and the duration of the program, wild steelhead population abundance and wild steelhead genetic composition is unknown in these basins. Steelhead in tributaries below the mouth of the Cowlitz River are in the SW Washington ESU and are not listed under the ESA.

Summer steelhead are native to the Kalama, Lewis, Washougal, and Wind basins. Wild summer steelhead populations are still present in these basins. Hatchery summer steelhead are planted into the Cowlitz, Toutle, Green, Kalama, Lewis, Washougal, and Little White Salmon Rivers. Summer steelhead are reproductively isolated from winter steelhead by differences in spatial and temporal distribution.

1.3.1) Description of "critical" and "viable" thresholds for each population (or management unit) consistent with the concepts in the document "Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units."

NMFS defines population performance in terms of abundance, productivity, spatial structure, and diversity and provides guidelines for each (McElhany et al. 2000). NMFS identifies abundance guidelines for critical and viable population thresholds. Critical thresholds are those below which populations are at relatively high risk of extinction. Critical population size guidelines are reached if a population is low enough to be subject to risks from: 1) depensatory processes, 2) genetic effects of inbreeding depression or fixation of deleterious mutations, 3) demographic stochasticity, or 4) uncertainty in status evaluations. If a population meets one critical threshold, it would be considered to be at a critically low level. Viability thresholds are those above which populations have negligible risk of extinction due to local factors. Viable population size guidelines are reached when a population is large enough to: 1) survive normal environmental variation, 2) allow compensatory processes to provide resilience to perturbation, 3) maintain genetic diversity, 4) provide important ecological functions, and 5) not risk effects of uncertainty in status evaluations. A population must meet all viability population guidelines to be considered viable.

Productivity or population growth rate guidelines are reached when a population's productivity is such that: 1) abundance can be maintained above the viable level, 2) viability is independent of hatchery subsidy, 3) viability is maintained even during poor ocean conditions, 4) declines in abundance are not sustained, 5) life history traits are not in flux, and 6) conclusions are independent of uncertainty in parameter estimates. Spatial structure guidelines are reached when: 1) number of habitat patches is stable or increasing, 2) stray rates are stable, 3) marginally suitable habitat patches are preserved, 4) refuge source populations are preserved, and 5) uncertainty is taken into account. Diversity guidelines are reached when: 1) variation in life history, morphological, and genetic traits is maintained, 2) natural dispersal processes are maintained, 3) ecological variation is maintained, and 4) effects of uncertainty are considered.

This fishery management plan focuses primarily on maintaining harvest rates that are consistent with recovery. Spatial structure is generally a function of habitat size and distribution. Recreational fisheries discussed in this management plan do not affect habitat. The small fishery impact rates estimated also will not reduce population sizes to levels where spatial effects are exacerbated. The estimated small fishery impact rates on wild fish are not expected to exert sufficient selection pressure on any single characteristic to affect diversity. Periodic poor cohorts are inevitable but an extended sequence of poor survival should trigger consideration of more conservative management strategies and this consideration should be tied to fish numbers. Lower cohort survivals are expected at very large escapements because the available habitat can be overseeded. Poor replacement rates under these conditions should not trigger a conservative management response. Fishery closures after critical low escapement levels are reached provide limited benefits because too few fish are affected at low run sizes to substantially increase escapement. To reduce the likelihood of this happening, WDFW is implementing harvest regimes that were developed under the lowest survivals to ensure adequate levels of escapement are available even during the least productive years.

Definition of an appropriate viability threshold depends largely on the capacity and productivity of the available habitat and the corresponding population size where compensatory population processes begin to provide resilience. Habitat capacity and productivity are available for Lewis River fall chinook and Kalama River steelhead populations. These parameters have been estimated from time series data of spawners and recruits but in other basins we lack either suitable population data or knowledge of hatchery effects in other basins. Changes in hatchery practices and the institution of appropriate monitoring programs will provide the necessary information in the future but preliminary estimates of productivity and capacity will require a minimum of ten years of age-specific escapement data in addition to the data already collected.

The NMFS provides limited guidance on fish numbers corresponding to critical and viability thresholds. They discuss hypothetical risks related to genetic processes effective at annual spawning population ranging from 50 to several thousand individuals. The NMFS' Viable Salmonid Populations guidelines include multiple cautions about the effects of uncertainty in population assessments and also recommend an adaptive management approach for reducing uncertainty (McElhany et al. 2000). At this time, WDFW is not developing viable or critical population thresholds as they will be developed by the Technical Recovery Team (TRT).

Description of the current status of each population (or management unit) relative to its "Viable Salmonid Population thresholds" described above. Include abundance and/or escapement estimates for as many years as possible.

WDFW did not establish "Viable Population Thresholds" for the listed stocks. However, WDFW is a member of NMFS' TRT for the Lower Columbia River/Willamette River ESU. It is the responsibility of this team to develop "Viable Salmonid Population Thresholds." WDFW has proposed interim harvest rates as NMFS has done for listed steelhead and salmon populations that are caught in the Pacific Salmon Treaty and the Pacific Management Fisheries Council areas. The escapement or abundance estimates of chum salmon, steelhead, and chinook salmon populations are presented in Tables 2, 3, 4, 5, and 6. WDFW considers most populations to be depressed compared to historical levels due to habitat degradation and the recent low productivity in the ocean.

Chum salmon abundance data is calculated in peak counts of fish per mile in three index basins, which are the Grays River, Hamilton Creek and Hardy Creek. Population estimates have not been calculated for these populations but should be available by 2001. Chum salmon have been observed in most major LCMA tributaries but abundance data is lacking for these other basins. The aggregate average abundance for these fish has declined since the 1940s and reached its lowest level in the late 1970s and early 1980s. Since that time, these populations have remained stable or improved. No or very few hatchery chum salmon are present in these counts because few attempts have been made to successfully culture chum salmon in these basins

WDFW began collecting wild winter and summer steelhead abundance data in 1976 on the Kalama River at the Kalama Falls trap. By the 1980s, abundance was estimated for other wild winter steelhead populations by redd surveys (Table 3). In the 1980s, WDFW also incorporated snorkel surveys to estimate wild summer steelhead abundance (Table 4). Wild steelhead abundance peaked in the mid 1980s and has declined to lower levels by the early to mid 1990s. This decline coincided with a sharp reduction in the hatchery smolt to adult survival and recent low abundance of wild steelhead is believed to be related to ocean conditions. Stock status for these populations are generally believed to be depressed compared to historic levels. However, smolt production monitoring on the Wind, Kalama, EF Lewis, and Cedar Creek indicates that smolt production is stable and near expected levels given the quality of habitat despite the declining adult escapement.

Fall chinook escapement estimates are listed in Table 5. Unlike the chum and steelhead estimates, which are estimates of wild escapement, chinook salmon escapements are composed of hatchery and wild spawners. Extensive hatchery programs have operated in the LCR and partitioning of a fall chinook hatchery escapement was not possible until return year 1996, when all LCMA hatcheries coded-wire-tagged a portion of their production. Less than 10% of the spawning populations in Mill, Germany, Coweeman, SF Toutle, EF Lewis, NF Lewis, and Wind basins are hatchery spawners. WDFW considers the wild NF Lewis River fall chinook population to be healthy. Because we have not been able to determine wild spawning escapements until recently, the status of most other populations of fall chinook is unknown but generally believed to be depressed from historical conditions based on degraded habitat.

The wild spring chinook salmon population in the NF Lewis River is extirpated due to lack of access to historical habitat and the inability for enough juveniles to survive through the dams. For the same reasons, wild Cowlitz River spring chinook may also be extirpated. However, with the completion of fish collection facilities at Cowlitz Falls Dam and the settlement agreement for relicensing of Mayfield and Mossyrock dams, WDFW is engaged in a spring chinook reintroduction program on the Cispus and upper Cowlitz Rivers using hatchery fish. Table 6 illustrates the most recent 20 years of abundance estimates for LCMA spring chinook.

Table 2. Peak chum salmon fish per mile counts for LCMA chum salmon populations.

Fall Chum Return Year	Grays Fish/mile	Hamilton Fish/mile	Hardy Fish/mile	Average Fish/mile
1944	453	500		476
1945	333	2,090		1,212
1946	295			295
1947	170	1,660		915
1948				
1949				
1950		950		950
1951	2,027	1,316		1,671
1952	1,624	1,512		1,568
1953	656	410		533
1954		1,166		1,166
1955	52	100		76
1956		222		222
1957	319	460	40	273
1958	6		119	62
1959	521	754	205	493
1960	323	374	83	260
1961	217	612	154	328
1962	51	391	327	257
1963	127	892	73	364
1964	24	606	179	270
1965	43	574	22	213
1966	206	374	217	266
1967	138	496	91	242
1968	98	90	24	71
1969	95	298	74	156
1970	40	316	123	160
1971	81	213	88	127
1972	156	563	42	254
1973	56	106	130	97
1974	14	167	86	89
1975	43	117	14	58
1976	60	68	6	45
1977	105	80	137	107
1978	77	127	42	82
1979	33	4	1	13
1980	29	67	131	76
1981	9	50	7	22
1982	184	230	210	208
1983	31	66	112	69
1984	86	67	76	76
1985	89	119	67	91
1986	180	274	58	171
1987	149	100	193	147
1988	269	189	436	298
1989	65	36	9	37

1990	132	73	116	107
1991	104	27	125	85
1992	461	213	635	436
1993	199	29	324	184
1994	42	99	264	135
1995	140	29	130	100
1996	242	123	125	163
1997	146	207	105	153
1998	171	400	443	338
1999	316	260	157	244

Table 3. Wild winter steelhead abundance estimates in the LCMA.

Brood Year	Index Redd Surveys					Pop. Est. Trap Counts		Index Trap/redd
	Coweeman	SF Toutle	Green	EF Lewis	Washougal	NF Toutle	Kalama	Cedar
1977							774	
1978							694	
1979							371	
1980							1,025	
1981							2,150	
1982							869	
1983							532	
1984		836					943	
1985		1,807	775				632	
1986		1,595		282			919	
1987	889	1,650	402	192			982	
1988	1,088	2,222	310	258			1,078	
1989	392	1,371	128	140		18	494	
1990	522	752	86	102		36	355	
1991		904	108	72	114	108	959	
1992		1,290	44	88	142	322	1,973	
1993	438	1,242	84	90	118	165	842	
1994	362	632	128	78	158	90	725	
1995	252	396	174	53	206	175	1,030	
1996						251	725	70
1997		388		192	92	183	456	78
1998	314	374	118	250	195	149	372	38
1999		562	72	276	294	133	478	52

Table 4. Wild summer steelhead abundance estimates in the LCMA.

Brood Year	Pop Est Trap	Index Snorkel			Index Redds
	Kalama	EF Lewis	Washougal	Wind	Wind

1977	400				
1978	1,015				
1979	484				
1980	718				
1981	2,926				
1982	1,385				
1983	869				
1984	247				
1985	461				434
1986	473		54		428
1987	445		169		608
1988	848		197		826
1989	492		140	274	464
1990	731		156	116	228
1991	704		31	123	294
1992	1,075		77	129	287
1993	2,283		71	161	
1994	1,041		49	104	
1995	1,302		70	136	84
1996	614	93	44	96	
1997	598	85	57	106	106
1998	205	61	70	44	
1999	237	60	70	43	96
2000	219	99		26	

Table 5. Fall chinook salmon abundance estimates in the LCMA

Year	Elocho-man River	Ger-many Creek	Aber-nathy Creek	Cowee-man River	Cowltiz River	Drano Bright	Drano Tule	Grays River	Green River	Skam-okawa Creek	Toutle River	Kalama River	EF Lewis River	NF Lewis River	Mill Creek	Wash-ougal River	Wind River Bright	Wind River Tule
1964	95			364	3,312			92	2,287	2,925	207	4,695	632	16,857		152		774
1965	191			75	5,707			136	1,290	2,348	175	5,509	891	7,927		198		83
1966	155			108	4,782			127	1,148	2,829	200	2,684	583	11,627		249		862
1967	347			100	5,487			137	1,446	2,835	116	3,305	411	9,711		158		228
1968	756			132	2,303			338	2,476	2,838	39	2,806	249	7,160		144		254
1969	301			86	4,260			129	2,221	2,672	327	2,191	329	4,986		62		29
1970	455			72	9,706			359	3,904	2,731	266	2,738	657	4,130		72		51
1971	367			290	22,758			622	5,163	2,910	566	3,102	2142	19,926		1,666		1,801
1972	108			174	21,027			674	6,188	2,761	409	3,222	534	18,488		1,287		1,190
1973	500			42	8,390			503	872	2,850	171	6,199	210	9,120		189		472
1974	245			41	7,566			624	1,253	2,880	263	12,449	420	7,549		2,769		481
1975	220			91	4,766			706	596	5,228	107	17,761	581	13,859		923		556
1976	1,682			68	3,726			1,144	1,406	701	288	7,517	325	3,371		2,824		549
1977	568			81	5,837			1,495	920	2,462	134	6,484	568	6,930		1,553		922
1978	1,846			58	3,192			2,685	6,443	3,214	300	3,637	687	5,363		593		1,322
1979	1,478			80	8,253			1,206	4,400	724	157	2,704	716	8,023		2,388		884
1980	64			50	2,418			185		183		5,675	311	13,839		3,152		355
1981	138	80	816	35	3,991			246		376		1,840	397	19,297		1,789		197
1982	317	257	1,568	63	3,024			422		1,035		4,570	240	8,370		301		361
1983	1,016	548	2,999	40	3,654			927		1,611		2,681	305	13,540		2,677		442
1984	292	93	436	136	2,577			242		1,744		2,955	192	7,132	3	1,195		126
1985	407	347	1,247	158	4,300			812		5,512		1,055	540	7,491	2	1,723		168
1986	558	15	517	97	3,388			901		506		2,227	389	11,983	7	1,274		403
1987	2,392	351	3,807	62	5,930			1,093		349		9,632	135	12,935	1,867	3,578		776
1988	1,356	1,113	929	1,027	7,700			1,003		1,055		24,279	427	12,052	808	3,135	664	1,206
1989	120	357	861	770	7,220			805		973		20,413	591	21,199	1,490	4,408	806	112
1990	136	106	237	241	2,698			287	123	451		20,54	342	17,506	150	2,062	177	11

1991	178	109	1,758	174	2,567			188	123	267	33	5,085	230	9,066	22	3,494	296	52
1992	190	33	736	424	2,489			4	150	202		3,593	202	6,307	27	2,164	51	54
1993	274	266	398	327	2,218			40	281	134	3	1,941	156	7,025	274	3,836	686	0
1994	688	706	2,648	525	2,512			47	516	316	0	2,020	395	9,939	218	3,625	1,101	11
1995	144	230	689	774	2,231			29	375	172	30	3,044	200	9,718	402	2,969	278	4
1996	508	59	368	2,148	1,602			351	667	39	351	10,630	167	14,166	67	2,821	58	166
1997	1,875	103	484	1,328	2,710	282	1,125	12	560	262		3,539	307	8,670	8	4,529	220	148
1998	220	29	274	144	2,108		784	93	1,287	138	66	4,318	104	5,929	50	2,971	953	202
1999	706	75	376	93	997	118	633	303	678	251	42	2,617	217	3,184	124	3,105	46	126

Table 6. Spring chinook salmon abundance estimates in the LCR (included hatchery and wild fish).

Year	Cowlitz	Kalama	Lewis	Wind	Drano
1980	166	298	992	91	0
1981	959	721	324	155	0
1982	209	2,712	986	79	0
1983	70	1,009	732	266	0
1984	147	133	1,565	213	0
1985	156	0	512	191	0
1986	467	165	1,875	111	0
1987	71	471	6,850	87	0
1988	172	475	5,267	164	0
1989	563	572	3,483	148	0
1990	278	34	1,345	172	0
1991	149	32	1,607	140	0
1992	266	168	1,254	248	0
1993	214	98	1,412	657	0
1994	159	407	475	50	0
1995	282	376	270	26	0
1996	34	254	493	423	0
1997	437	39	410	227	0
1998	262	42	211	59	0
1999	235	215	240	79	0

1.4) Harvest Regime

Harvest of listed salmon and steelhead in the LCMA is both direct and indirect. Direct harvest occurs when legally caught fish are retained as part of the daily limit. At this time direct harvest will only occur on returning adult Lewis River fall chinook above the 5,700 escapement goal and tule fall chinook stocks at levels less than the Recovery Exploitation Rate, which includes the impacts of all fisheries including those in tributaries. The 2001 spring chinook fishery will be constrained to meet hatchery escapement objectives and would include wild spring chinook take. After 2001, spring chinook fishery impacts below Bonneville Dam will be limited to indirect mortalities occurring in a selective fishery. Tributary fisheries in 2002 will be managed for wild spring chinook release. All steelhead fisheries will be limited to selective fisheries, where only hatchery fish may be retained. All sport tributary fisheries for chum remain closed, the release of all chum is required. Indirect harvest can occur when listed fish are caught and released. The sport fishing mortality is a function of the number of fish caught and released and the mortality of those released fish. The sport fishing mortality rate is the interception rate multiplied by the hooking mortality rate, where the interception rate is the total number of salmon or steelhead caught and released divided by the run size and the hooking mortality rate is the percentage of release fish that do not survive after being caught and released.

Hooking Mortality

WDFW has proposed selective fisheries to reduce the impacts to listed spring chinook, chum salmon, and steelhead. The US v Oregon TAC has used estimates of salmon and steelhead hooking mortality of 10%. In an effort to better estimate hooking mortality for steelhead, we will use the hooking mortality rates for steelhead based on the data presented in Rawding (1998). The winter steelhead hooking mortality ranged from 1% to a maximum of 5% based on two British Columbia studies summarized by Hooton (1987) and WDFW unpublished data. The summer steelhead hooking mortality rate ranged from 8% to 9% for two summer steelhead broodstock collections in British Columbia (Lirette, 1989). For chinook salmon in freshwater, a literature search indicated hooking mortality of 7.6% for chinook salmon in the Kenai River (Bendock and Alexandersdottir 1993) and 8.6% for Willamette River spring chinook (Schroeder et al. 1999). Since we could find no data for chum salmon, we used the 8.6% chinook salmon hooking mortality rate.

Schill et al. (1986) and Schill (1996) estimated hooking mortality for fly- and bait-caught wild trout in streams at 1% and 16%, respectively. These are lower than other published reports possibly due to differences in experimental design. In previous studies, wild trout were released into small pens to evaluate mortality from catch and release. They had higher mortality possibly due to stress associated with additional handling and confinement of wild fish. It should be noted that in many of the steelhead hooking mortality studies, hooking mortality includes both hooking mortality and mortality associated with holding these fish to determine their mortality. In these studies, the reported "hooking mortality" may be substantially less if fish had been released immediately into the river rather than transported to a hatchery or placed in a trap.

WDFW is also concerned with the spawning success of salmon and steelhead that survive from catch and release. Pettit (1977) studied the reproductive success of female hatchery steelhead caught and released on the Clearwater River in Idaho. The results of this study indicate the reproductive success of female steelhead caught and released, that were spawned in the hatchery was the same as uncaught female steelhead.

Interception Rates

Rawding (1998) found that interception rates from wild winter steelhead release fisheries were similar to the harvest rates that occurred when anglers retained wild steelhead. Therefore, WDFW uses either interception rates from wild steelhead release fisheries or historical harvest rates to determine interception rates in wild salmon and steelhead release fisheries when the fishery targets hatchery fish of the same species.

The harvest rates for wild Kalama winter steelhead between 1977 and 1991 ranged from 18% to 70%, mean 50%. These compare favorably with the interception rates determined from creel surveys on the Toutle (38%) and the Kalama (73%). It is possible that the Kalama interception rate of 73% is slightly higher than the 70% harvest rate because released steelhead may be caught more than once. It is also possible that in 1995/96 we overestimated the interception rate because, 1) angling effort is reduced after February 15 when the hatchery winter steelhead fishery effort declines and we were not able to sample effectively later in the season, 2) late arriving winter steelhead may be less available to be caught because they are more mature and may move quickly through the fishery to sanctuary waters, and 3) some of the wild fish caught and released may be summer steelhead and not winter steelhead.

The winter steelhead interception rate is estimated to be 70% for Cowlitz, Kalama, NF Lewis, EF Lewis, Washougal and Wind River. These are usually open in the spring for hatchery steelhead or spring chinook fisheries. The winter steelhead fishery closes on March 15 in all other basins except the SF Toutle River, which closes on March 31. By March 15, 30% of the wild winter steelhead run is available to the fishery. Therefore, the seasonal interception rate (70%) is multiplied by the proportion of the run available to the fishery (30%). This equals 21% and is used for all winter steelhead fisheries except for the SF Toutle River, which is open to March 31, where we will use the 38% based on the creel survey.

Interception rates for wild summer steelhead in the Kalama River reached a maximum of 75%. Recently, WDFW has implemented management strategies that have reduced this rate. First hatchery fish are being released at Fallert Creek, which concentrates the fishery away from the upriver summer steelhead holding pools. Hatchery summer steelhead trapped at Kalama Falls are recycled to river mile 2 rather than being passed above the falls. This recycling reduces genetic risk and further concentrates the hatchery fishery in the lower river. This has concentrated steelhead effort below the wild steelhead holding areas. We believe this has reduced the interception rate from a maximum of 75% to 60%. Due to the extensive angling closures to protect summer steelhead holding areas on the EF Lewis River near Lucia Falls and the entire river above Horseshoe Falls, and the entire Washougal River above Salmon Falls, the interception rate is believed to be near 40% in these basins. Prior to 2000, the Wind River was open from the mouth upstream, but the fishery was concentrated in the lower 20 miles. Before the closure above Shipherd Falls, the interception rate for steelhead was estimated to be near the Kalama maximum of 75%. Since the closure, only 2 of 20 miles are open to angling equating to 10% of the area opened. The current estimated interception rate is at 7.5%.

Targeted salmon fisheries in the Grays River were estimated to harvest about 5% to 10% of the wild chum salmon run prior to 1995. WDFW has prohibited retention of chum salmon in tributary fisheries since that time. Therefore, the interception rate for most basins currently open to steelhead or salmon fishing would be less than 5%. To further protect the largest wild chum salmon run in the LCMA, time and area closures from October 15 to December 15 have eliminated almost all sport fishing impact to wild chum salmon on the Grays River. Another major tributary population in Hardy Creek is closed to fishing from November 1 through May 31 eliminating all interception of chum salmon.

The maximum harvest rates for spring chinook in the Cowlitz, Lewis, Kalama, Wind, and Little White Salmon rivers from 1980 to 1999 were 34%, 72%, 77%, 45%, and 40%, respectively. These rates will be used as maximum interception rates once selective fisheries begin in 2002. However, due to recent poor hatchery returns these interception rates are much less. Since selective fisheries are not possible for fall chinook, due to lack of external marking programs for fall chinook, the harvest rates used were determined from the fishery. The harvest rate is calculated by dividing the harvest by the run size. Harvest is calculated from statistical creel surveys or from CRC returns.

The above interception rates apply to targeted fisheries for the same species, such as wild steelhead impacts from a hatchery steelhead fishery. However, in tributaries, non-targeted

impacts can occur when a sport fishery targeting a healthy stock catches and releases another species. This may occur during a sport fishery for a healthy run of hatchery coho salmon, where fall chinook salmon are caught and released. These impacts are generally low because anglers usually target different areas and use different gear for different species. For example, in 1996 the NF Lewis River was closed to fall chinook salmon to meet escapement objectives. However, the coho and steelhead fisheries were open. We estimated the interception rate of fall chinook by expanding the ratio of coho caught to fall chinook handled from creel surveys and multiplied this number by the CRC estimate of coho divided by the number of creel-checked coho. The interception rate of fall chinook was less than 1% of escapement in this fishery. We will use 1% as the standard interception rate for all species in non-targeted fisheries.

WDFW has not estimated the number of wild steelhead parr that are caught during resident fisheries. It is likely that most interception occurs during trout fisheries. WDFW has limited hatchery trout plants to resident production areas above natural barriers or above dams. Since most trout anglers focus on these areas or lakes, the level of trout fishing that occurs in the anadromous sections of LCMA tributaries is low. Based on professional judgment, we estimate a maximum of 15% of the age 1 or older steelhead parr would be intercepted in trout fisheries. This estimate is used for all populations of winter steelhead.

All summer steelhead streams have substantial sanctuary water, which is closed to fishing. These areas are located in the upper watersheds where most wild summer steelhead parr reside. Based on smolt trapping and professional judgment we estimated that more than 90% of the summer steelhead production in the Kalama, EF Lewis, Washougal and Wind Rivers is likely to occur from sanctuary areas. Therefore, we estimate that less than 1% of the wild summer steelhead parr are caught and released in trout fisheries.

Other sport fish seasons are set to maximize catch of bass, walleye, catfish, crappie, yellow perch, sunfish, whitefish, and northern pikeminnow, sturgeon, and carp. The steelhead and salmon handled in these fisheries are believed to be minor but no specific data exists for Lower Columbia River tributary catch. Data from creel surveys conducted from 1993-1996 in the area between Bonneville and McNary dams, and in 1994 between McNary and Priest Rapids dams show only 1% of steelhead were caught by non-salmonid anglers (James 1997). Based on creel surveys conducted in 1994 (James 1997), only 72 smolts (all species combined) were handled during April and May in the McNary Pool area. All other LCMA tributary fisheries are assumed to have less than 1% interception rate on listed stocks.

1.4.1) Provide escapement objectives and/or maximum exploitation rates for each population (or management unit) based on its status.

Until VSP levels are established for each population, WDFW has proposed interim maximum exploitation rates for tributary fisheries. The exception is the NF Lewis River fall chinook population, where fisheries will be managed to meet the 5,700-adult escapement goal. Due to concerns about low spawner abundance, WDFW has eliminated the direct harvest of adult steelhead and chum salmon in these fisheries through the use of selective fisheries that require all anglers to release all wild steelhead and chum salmon. In addition, WDFW has used time and area closures to establish sanctuaries, which are closed to fishing for these species. WDFW has

proposed the same selective fishery rules for spring chinook salmon below Bonneville, beginning with the 2002 return when all hatchery spring chinook stocks in the LCMA will be marked. In addition, WDFW is supportive of developing selective fisheries for tributary fall chinook fisheries, is working to help develop technology for mass marking of hatchery fish, and to secure funding for mass marking when technologies can be implemented.

Steelhead escapement goals were established in the mid-1980's during moderate to high ocean productivity and based on a habitat model developed for the Boldt Case area. Wild steelhead stock escapements have not been monitored for sufficient years in most basins to determine scientific-based escapement goals. As more data become available, basin specific goals will be established. Rawding (2001) has calculated extinction harvest rates for summer and winter steelhead in the Kalama River during low ocean productivity using a stock-recruitment analysis (Figure 2). Extinction harvest rates in this context are defined as harvest from all sources including fisheries, research, and habitat degradation, that if continued will eventually lead to extinction. For extinction to occur, harvest rates above the threshold must occur for 10 generations or 50 years. These rates were 37% for Kalama summer steelhead and 56% for Kalama winter steelhead, respectively. If harvest rates exceed these during low ocean productivity for more than a generation, the survival and recovery of the species is in jeopardy. Therefore, harvest rates should be set below this level.

MSY harvest rates were also calculated during low ocean productivity and they were 22% and 37% for summer and winter steelhead, respectively. Although the data set did not include a measurement of observational error, we thought that it was low since most fish are trapped at Kalama Falls and others are accounted for by statistical snorkel surveys or jumper counts.

NMFS explicitly recognizes the MSY concept in the McElhany et al. (2000) and states "Assuming MSY is actually being achieved, a wild population harvested at MSY is, by definition, sustainable (VSP) –provided that the time horizon of MSY is the same as VSP and the MSY estimate takes into account all the factors affecting viability, such as genetic diversity and spatial structure."

For winter and summer steelhead populations below Bonneville, we are estimating a maximum10 percent mortality in WDFW steelhead selective fisheries. We are also estimating this level of mortality for winter steelhead populations above Bonneville Dam. However, this level of mortality in the tributary fishery may jeopardize recovery of summer steelhead populations above Bonneville Dam given the impacts from the operation of Bonneville Dam, fisheries research, and mainstem harvest. Due to these impacts, WDFW has closed the Wind River above Shipherd Falls since 1996, and believes harvest impacts on Wind River summer steelhead should be less than 4%.

There is limited data to determine appropriate harvest rates for chum salmon in the LCR. In a meta-population analysis, Myers et al. (1999) indicated Ricker ln(α) values were around 1.3, which is similar to those observed for Kalama winter steelhead. Since sustainable exploitation rates are only dependent on the Ricker α parameter, the proposed winter steelhead harvest rates applied to chum salmon would be consistent with recovery. However, to be more conservative we followed and used the 8.3% harvest rate NMFS suggested was appropriate for listed Puget

Sound summer chum salmon in the PST analysis (NMFS 2000a). We estimate a maximum 4% harvest rate on chum salmon during tributary fisheries.

WDFW had to rely on other analysis and data to develop appropriate harvest rates for spring chinook salmon. NMFS' review of the PST discussed appropriate harvest rates for LCMA spring chinook stocks (NMFS 2000a). "The three remaining spring chinook stocks within the LCR include those on the Cowlitz, Kalama, and Lewis rivers. Although some spring chinook spawn naturally in each of these rivers, the historic habitat for spring chinook is now largely inaccessible. The remaining spring chinook stocks are therefore dependent, for the time being, on the associated hatchery programs. The hatcheries have met their escapement objective in recent years, assuring what remains of the genetic legacy is preserved. Harvest constraints for other stock, including those provided specifically as a result of the agreement, will provide additional protection for the hatchery programs until such time that a more comprehensive recovery plan is implemented." During the 2001 season, WDFW estimates the maximum harvest rate for Lewis and Kalama spring chinook stocks of 60% and up to a 25% harvest rate for Cowlitz stock during tributary fisheries. Beginning in 2001, WDFW will implement a selective harvest in the tributary fisheries for spring chinook and we expect the harvest rate to be reduced to less than10% for these spring chinook stocks. This is consistent with the average annual freshwater harvest rate of Willamette River spring chinook stocks based on viability analysis and ocean fisheries (ODFW 2000).

LCMA fall chinook salmon are differentiated into tule and bright stocks. The only bright stock identified in the Washington portion of the LCR is the Lewis River stock. All other stocks are considered tule stocks. The escapement goal for the Lewis River fall chinook was established at 5,700 based on spawner recruit analysis (McIssac 1990). Subsequent analysis by Peters et al. (1999), which incorporated additional brood years, indicated a similar goal of 5,800. The 5,700-fish goal has been met every year since 1980, except in 1999. There was severe flooding in the winters of 1995 and 1996 that limited egg to fry survival for these brood years. The combination of back to back brood years with low incubation survival is believed to be the primary factor in not meeting the escapement goal in 1999. This tributary fishery will be constrained in all years to meet the 5,700-adult escapement goal.

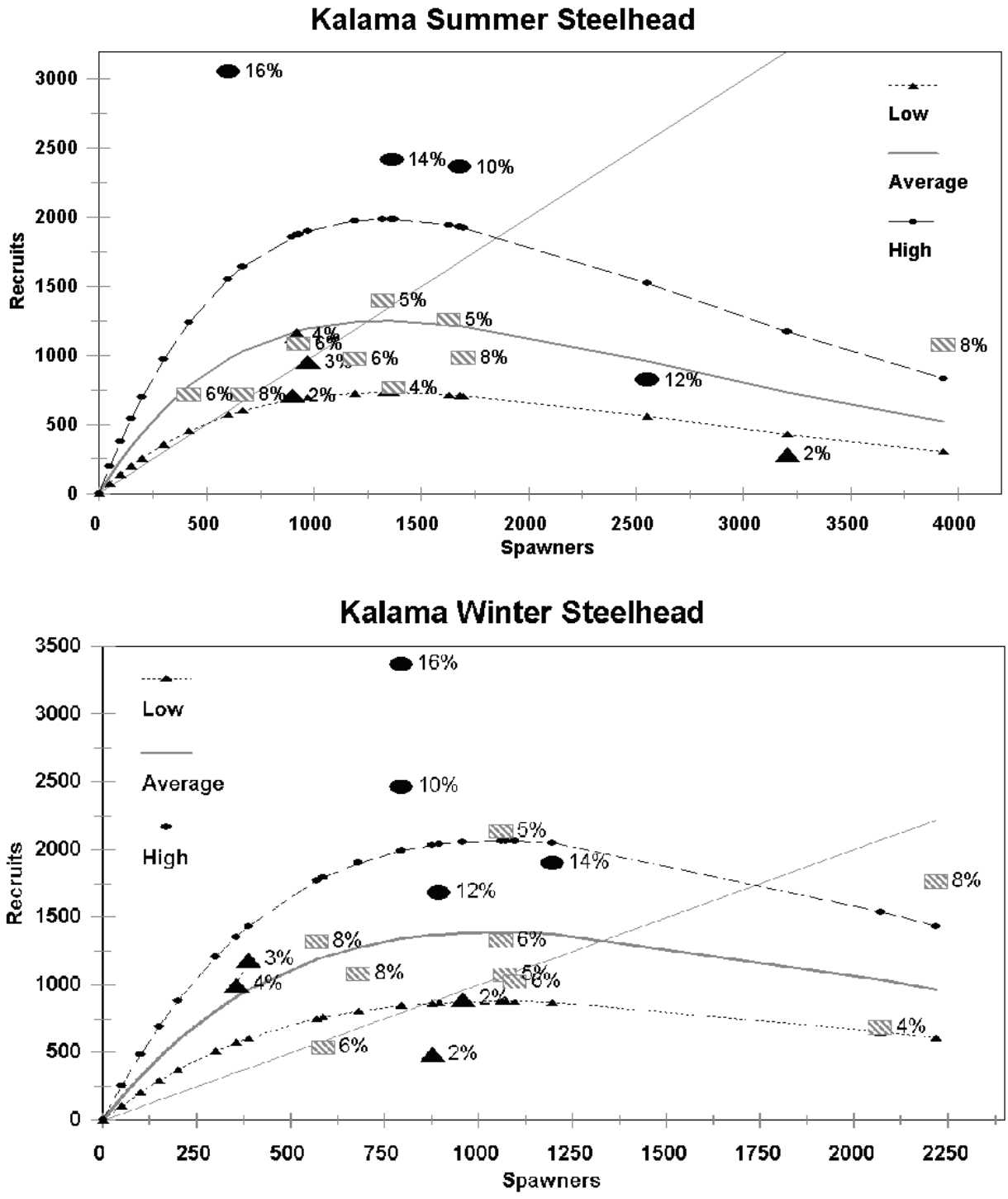

Figure 2. Spawner recruit model for wild winter and summer steelhead under low, average, and high ocean productivity, brood years 1977-93.

NMFS developed criteria for the Recovery Exploitation Rate that "will not appreciably increase the number of times a population will fall below the critical threshold and also not appreciably reduce the prospects of achieving recovery." The Recovery Exploitation Rate for naturally producing tule fall chinook is 65% (NMFS 2000a). This includes the impact from all fisheries. Since a substantial amount of fall chinook harvest occurs in the ocean and the mainstem Columbia River, tributary harvest rates are incorporated into the North of Falcon and Columbia Compact processes.

Steelhead escapement goals were established in the 1980's during moderate to high ocean productivity. The ocean's productivity has progressed through less productive cycles and seems to be moving back into higher productivity. Steelhead escapement goals are outdated and set with limited data sets. Most steelhead stocks have not been sufficiently studied to have necessary data to establish escapement goals. Goals will be updated as data become available.

1.4.2) Description of how the fisheries will be managed to conserve the weakest population or management unit.

All LCMA tributary fisheries for adult chum salmon, coho salmon, sea-run cutthroat, and steelhead are selective. The adult spring chinook fishery will change to a selective fishery beginning in 2002. Resident fisheries are also selective with regard to their impacts to listed steelhead and salmon. These fisheries are closed during the migration of smolts from tributaries and require the release of all salmonids 8 inches or smaller, and 12 inches or smaller in mainstem tributaries. The implementation of selective fisheries allows for WDFW to manage fisheries to protect the weakest stock. The harvest rates in selective fisheries are consistent with weak stock management. The harvest rates proposed for 2001 spring chinook are consistent with providing natural and hatchery escapements for rebuilding and restoration programs. Since selective fisheries are currently not possible for fall chinook, WDFW has proposed harvest rates are consistent with Recovery Exploitation Rates for tule fall chinook, meeting the Lewis River fall chinook escapement goal, and meeting hatchery escapement objectives.

1.4.3) Demonstrate that the harvest regime is consistent with the conservation and recovery of co-mingled natural-origin populations in areas where artificially propagated fish predominate.

WDFW has closed all tributaries to the harvest of wild chum, coho, and steelhead adults. We have proposed a fishery regime in 2001 consistent with maintaining and rebuilding spring chinook stocks. Beginning in 2002, the spring chinook fishery will change to a selective fishery below Bonneville Dam including the tributaries. WDFW is moving toward selective fisheries for fall chinook but issues associated with technology, funding, and negotiations with co-mangers still remain. The interim fall chinook harvest regime is consistent with maintaining and rebuilding populations by regulating tributary fisheries to meet escapement goals in the Lewis River and Recovery Exploitation Rates for the remaining tule chinook stocks. Juvenile fall chinook and chum salmon are not intercepted in fisheries because their small size does not allow them to recruit to resident fisheries. Age 1+ juvenile steelhead can recruit to the trout fishery. In recognition of this, WDFW delays the opening of the trout season to June 1, until 95% of the

steelhead migrants emigrated from the tributaries. In addition, the 8-inch minimum size in tributaries protects 99% of the juvenile steelhead in these tributaries. It is also unlikely that juvenile spring chinook recruit to the fishery, since they are smaller than steelhead juveniles. It is illegal to harvest juvenile salmon in resident fisheries but if anglers do misidentify them as trout, the size minimum limits for trout protects more than 99% of the juvenile salmon from harvest.

1.5) Annual Implementation of the Fisheries

WDFW Major year regulation cycle
Implementation of recreational fisheries outside the PFMC/North-of-Falcon and the Columbia River Compact processes is administered through the Washington Fish and Wildlife Commission. The sport rule adoption process is conducted on an annual basis. The 'major year' regulation cycle begins in the spring of the year, and involves solicitation from the public of recommendations for regulation changes. Public meetings are held, and further public review and comments are solicited. The public proposals are evaluated by department managers and technical staff, and recommended for action if appropriate. At the end of the year, the Commission closes the public comment period and takes oral testimony from the public in an open meeting. In February of the following year, the Commission meets to adopt rules, and the public is notified. Changes are effective May 1st annually, and notification to the public is incorporated into the State fishing pamphlet.

WDFW Minor year regulation cycle
The 'minor year' cycle regulations are amended through a separate, abbreviated process. Public proposals are not solicited, although WDFW staff may include recommendations from the public along with staff-generated proposals, commencing in early summer. Staff proposals are reviewed by the Fish Program, and the Director's office approves those proposals to be sent to the Commission. The Commission reviews the proposals, solicits public comments, takes written comment and holds a public hearing on the proposals in December. The Commission meets in February to adopt rules, the public is notified, and changes are incorporated into the State fishing pamphlet, effective May 1.

WDFW In-season regulation changes
In-season changes to the adopted rules may be made, depending on changes in run sizes or other information, to further restrict the fishery for conservation needs or to expand a fishery when population status of the target species warrants, and when impacts to weak stocks can be minimized. The in-season modifications to the planned fisheries are promulgated by emergency rule changes under the State Administrative Procedures Act.

U.S. v. Oregon/Columbia River Compact
U.S. v. Oregon/Columbia River Compact fisheries are not discussed in this FMEP, but the Technical Advisory Committee impact assessments are evaluated through Section 7/10 consultation process. Commercial fishery seasons on the portion of the mainstem Columbia River where the states of Oregon and Washington share a common boundary are regulated by a joint Oregon and Washington regulatory body (the Columbia River Compact). The ODFW and WDFW directors or their delegates comprise the Compact and act consistent with delegated

authority by the respective state commissions. Columbia River seasons are also regulated by the U. S. v. Oregon process which dictates sharing of Columbia River fish runs between treaty Indian and non-Indian fisheries. The Compact receives input from the tribes, states, the federal government, and the fishing industry through a series of meetings held throughout the year. These meetings assist the Compact in developing harvest allocations and decisions related to monitoring harvest quotas. Meetings are held in late January of each year to establish the harvest guidelines for the spring and summer fisheries and in late July to establish guidelines for fall fisheries.

PFMC/North-of-Falcon

PFMC/North-of-Falcon fisheries are not discussed in this FMEP, but are evaluated during the annual pre-season planning process for ocean fisheries and authorized through Section 7 consultation. Except where specifically authorized, according to the management framework developed within the annual Pacific Fishery Management Council/North of Falcon (PFMC/North-of-Falcon) agreements, salmon fisheries are closed. The PFMC/North-of-Falcon process includes the analysis of impacts to salmon stocks of concern, including those listed under ESA. Preseason planning for Columbia River fisheries occurs during the North-of-Falcon process. Ocean sport, commercial, and tribal fisheries are heavily influenced by the abundance of Columbia River salmon stocks, and season structures in ocean fisheries must take into account the needs of the fisheries in the mainstem Columbia River and it's tributaries.

SECTION 2 EFFECTS ON ESA-LISTED SALMONIDS

2.1) Description of the biologically-based rationale demonstrating that the fisheries management strategies will not appreciably reduce the likelihood of survival and recovery of the affected ESU(s) in the wild.

Fishing rates identified in this plan do not appreciably reduce the likelihood of survival and recovery of wild chum salmon, chinook salmon, and steelhead. WDFW adopted the exploitation rates established by NMFS for LCMA spring chinook and tule fall chinook fishery impacts that occur in fisheries regulated by the Pacific Salmon Treaty (NMFS 2000a). By definition, these rates do not appreciably reduce the likelihood of survival and recovery of these fish. We are estimating a maximum 65% harvest rate for tule chinook stocks in all fisheries. WDFW fall chinook tributary harvest rates are usually less than 10%. The tributary impacts from selective tributary spring chinook fisheries are also expected to be less than 10%. The escapement objective for Lewis River fall chinook has been established at 5,700 adults. This stock is a PST indicator stock and is carefully monitored to ensure an adequate escapement. This is a healthy fall chinook stock with an intrinsic productivity near 11, an escapement goal of 5,700 wild fish that is met in almost all years, and this stock has a low number of hatchery spawners. Given these data, it is very likely that this stock would exceed Viable Salmon Population thresholds. Total escapement and harvest estimates are not available for LCR chum and without these it was not possible to establish a Recovery Exploitation Rate. Although no Recovery Exploitation Rate was identified for LCR chum, we used the rate derived for Hood Canal summer chum salmon. This rate is well below the harvest rates that would be derived if we used data from a meta-population analysis, which included chum salmon by Myers et al. (1999).

For steelhead, we used a stock-recruitment analysis to define the relationship between spawners and recruits. We used the most conservative assumption in this spawner recruit model including: 1) using a model with a lowest rate of intrinsic productivity, 2) estimated extinction and MSY harvest rates under the low range of smolt to adult survival within the data set, and 3) set harvest rates below MSY, which by definition meets sustainability. In addition, the harvest rates for LCR steelhead are less than those adopted by NMFS for endangered Upper Columbia River steelhead in the Columbia River mainstem fisheries.

The objective of the harvest regime is to ensure that harvest is consistent with the recovery of listed populations. To prevent extinction caused by overexploitation, we examined the stock-recruitment analysis for Kalama winter and summer steelhead stocks, which were the only stocks with sufficient data points for the analysis. Walter and Ludwig (1981) demonstrated that measurement error can introduce severe bias into the spawner-recruit relationship. The measurement error associated with the estimates of spawners and recruits is believed to be very low because more than 95% of the winter steelhead escapement estimates are derived from direct trap counts and more than 50% of the summer steelhead escapement estimates are based on trap counts. The remaining escapement estimates, (5% for winter and 50% for summer steelhead) are based on snorkel surveys or jumper counts at the falls (Bradford et al. 1996). Reisenbichler (1986) demonstrated that in Monte Carlo simulations, estimates of stock recruitment parameters may be imprecise or biased if age data is unknown. Steelhead do not die after spawning, and scales for age analysis must be collected during their spawning migration at traps or in fisheries. Since wild steelhead harvest fisheries have been reduced since the mid-1980s, the Kalama River is one of the few areas where age data is available. A detailed section of the methods for this analysis may be found in Rawding (2001).

The data was fit with Ricker and Beverton-Holt stock recruitment curves and the results showed a similar goodness of fit. The Beverton-Holt form is sometimes cited (Gibbons et. al. 1985, Ward 1996, and McGie 1994) as most consistent with the life history of this species, i.e., its extended juvenile residence time in freshwater suggests that density-dependent spawning effects will be of lesser importance than the limiting nature of the freshwater environment. Hence, an empirical relationship between recruits and spawners would be expected to show some asymptotic, maximum recruitment. Barrowman and Myers (2000) found that the Beverton-Holt model generally produced a maximum productivity at low spawning densities that is higher than the Ricker model. If the Beverton-Holt model does overestimate the slope at origin, this may leave managers with a dangerously high impression of resiliency. The Kalama steelhead data sets, like many other salmon and steelhead data sets, have few data points at a low escapement that are critical in defining the slope at origin in either the Beverton-Holt or Ricker model. Since wild steelhead stocks in this FMEP are listed under ESA, it is critical that we not overestimate the intrinsic productivity of the stocks. Therefore, given the similar goodness of fit, we chose the Ricker model because it provided a more conservative estimate of resiliency.

The initial Ricker model fit for summer and winter steelhead was average to good, with R^2 of 0.43 for winter steelhead and 0.65 for summer steelhead. However, we noticed the Pearsons Product Moment Correlation between smolt to adult survival and the number of maiden steelhead recruits produced was 0.83 and 0.66 for summer and winter steelhead. Based on this,

we added a marine survival parameter to the Ricker model and the improved the R^2 to 0.66 for winter steelhead and 0.83 for summer steelhead. Next, spawner recruit relationship was examined under the low, average, and high levels of smolt to adult return in the data set. These are surrogates for the different levels of ocean productivity. Based on this analysis, Ricker α and β parameters were calculated for the different ocean conditions. Next, extinction and MSY fishery harvest rates were estimated under various ocean conditions.

Recent research has indicated that changes in climate are cyclical, affect ocean productivity, and cause fluctuations in the salmon populations. Andersen (1998) indicated that the five-year average Pacific Northwest Index (PNI), a North Washington coastal climate index, correlated well with the five-year average catch of Columbia River chinook salmon. He indicated that the PNI showed regime shifts in ocean productivity occurred in 1925, 1947, and 1977. This data indicates that cycles of poor ocean productivity lasted about twenty years and are generally followed by a twenty-year period of high ocean productivity. Hare and Francis (1995) demonstrated that changes in Bristol Bay sockeye salmon abundance were correlated with another climate index called the Pacific Decadal Oscillation (PDO) that showed a similar time for changes in ocean productivity. If these two patterns persist for Columbia River steelhead stocks, we would expect that stocks have below average productivity for up to 25 years or 4 to 5 steelhead generations followed by 25 years of good productivity. Age structure data indicate the average age at maturity for Kalama River steelhead is 5 to 6 years. Oregon steelhead populations seem to cycle over an 18-year period with nine years of above average productivity and nine years of below average productivity (Mark Chilcote, personal communication). Under these conditions, steelhead populations may only be at greater risk from low ocean productivity for up to 2 generations.

WDFW desires to establish harvest rates on Kalama wild steelhead that promote recovery. Since μ_{ext} is defined as the harvest rate that will lead to extinction, harvest rates for recovery must be set above this level. Any harvest rate less than $_{ext}$ is sustainable. The exploitation rate that maximizes the long-term yield is defined as μ_{msy}. NMFS explicitly recognizes the MSY concept in the McElhany et al. (2000) and states "Assuming MSY is actually being achieved, a wild population harvested at MSY is, by definition, sustainable (VSP) –provided that the time horizon of MSY is the same as VSP and the MSY estimate takes into account all the factors affecting viability, such as genetic diversity and spatial structure."

This analysis indicates that the Kalama summer steelhead stock is less productive than the winter steelhead stock. This may be due to different ocean residency and migration patterns, higher pre-spawning mortality for summer steelhead due to their extended freshwater residence prior to spawning, the differential use of freshwater habitats by these different races, and/or the greater influence of hatchery spawners on wild summer steelhead as compared to winter steelhead. This analysis suggests that Kalama summer steelhead are at a greater risk of extinction due to their lower intrinsic productivity as compared to winter steelhead.

Since WDFW does not currently forecast wild steelhead runs, we have chosen to use a maximum exploitation rate set that does not jeopardize survival or recovery of steelhead under the lowest ocean conditions observed in the data set. This is a very conservative estimate. For summer and winter steelhead below Bonneville Dam and for winter steelhead stocks above Bonneville Dam,

we estimate a maximum harvest rate of 10%. However, this level of take in the tributary fishery may jeopardize recovery of summer steelhead populations above Bonneville Dam given the impacts from the operation of Bonneville Dam, fisheries research, and mainstem harvest. Therefore, we estimate 4% impact for summer steelhead in the Wind River during tributary fisheries. For winter steelhead stocks above Bonneville Dam, tributary fisheries impacts are estimated to be less than 10%.

2.1.1) Description of which fisheries affect each population (or management unit).

There is potential that any fishery may affect any of the listed populations within the ESU. However, due to fishery management regulations including time, area, and gear restrictions, WDFW has largely been able to restrict harvest impacts to the target species. We have identified three fisheries in which the target fishery has potential to affect non-targeted listed stocks: 1) targeted chinook fisheries may have some impacts on chum and steelhead, 2) targeted steelhead fisheries may impact chinook and chum stocks, and 3) targeted trout fisheries may impact juvenile steelhead stocks Tables 7, 8, 9, 10, and 11.

Table 7. Fisheries likely to affect wild summer steelhead stocks in the LCMA.

Summer Steelhead Stock	Trib Winter Steelhead	Trib Summer Steelhead	Trib Spring Chinook	Trib Fall Chinook	Trib Coho	Trib Resident Fish
Kalama	X	X	X	X	X	X
EF Lewis	X	X		X	X	X
Washougal	X	X		X	X	X
Wind	X	X	X	X		X

Table 8. Fisheries likely to affect wild winter steelhead stocks in the LCMA.

Winter Steelhead Stock	Trib Winter Steelhead	Trib Summer Steelhead	Trib Spring Chinook	Trib Fall Chinook	Trib Coho	Trib Resident Fish
Cowlitz	X	X	X	X	X	X
Coweeman	X			X	X	X
NF/Main Toutle		X	X	X	X	X
SF Toutle	X	X		X	X	X
Green		X	X	X	X	X
Kalama	X	X	X	X	X	X
NF Lewis	X	X	X	X	X	X
EF Lewis	X	X		X	X	X
Salmon	X				X	X
Washougal	X	X		X	X	X
Wind	X	X	X	X	X	X
Gorge Tribs	X					X

Table 9. Fisheries likely to affect wild fall chinook stocks in the LCMA.

Fall Chinook Stock	Trib Winter Steelhead	Trib Summer Steelhead	Trib Spring Chinook	Trib Fall Chinook	Trib Coho	Trib Res. Fish
Grays	X			X	X	
Skamokawa						
Elochoman	X	X		X	X	
Mill						
Abernathy	X					
Germany	X					
Cowlitz	X	X		X	X	
Coweeman	X			X	X	
NF/Main Toutle		X		X	X	
SF Toutle	X	X		X	X	
Green		X		X	X	
Kalama	X	X		X	X	
NF Lewis	X	X		X	X	
EF Lewis	X	X		X	X	
Washougal	X	X		X	X	
Wind Tule		X		X	X	
Wind Bright	X	X		X	X	

Table 10. Fisheries likely to affect spring chinook stocks in the LCMA.

Spring Chinook Stock	Trib Winter Steelhead	Trib Summer Steelhead	Trib Spring Chinook	Trib Fall Chinook	Trib Coho	Trib Res. Fish
Cowlitz	X	X	X			
Kalama	X	X	X			
Lewis	X	X	X			

Table 11. Fisheries likely to affect wild chum salmon stocks in the LCMA.

Chum Stock	Trib Winter Steelhead	Trib Summer Steelhead	Trib Spring Chinook	Trib Fall Chinook	Trib Coho	Trib Res. Fish
Grays	X			X	X	
Hardy						
Hamilton	X					
Others	X			X	X	

Steelhead fisheries -
Statewide rules for steelhead fisheries have been developed to protect wild salmon and steelhead populations while providing recreational angling. Only wild steelhead release fisheries are permitted in the LCMA and all anglers are required to release all non-adipose clipped steelhead. To protect juvenile steelhead, a minimum size restriction is imposed. Steelhead less than 20 inches must be released. There is a two-fish daily limit for retaining hatchery steelhead and an annual limit of 30 fish.

Winter steelhead are native to all major and most minor basins to the LCMA. However, steelhead in tributaries below the mouth of the Cowlitz River are in the SW Washington ESU and are not listed under the ESA. Fisheries for winter steelhead occur in the LCR from November through May. Retention is restricted to adipose fin-clipped hatchery steelhead and fisheries occur primarily in the Grays, Skamokawa, Elochoman, Abernathy, Germany, Cowlitz, Toutle, Coweeman, Kalama, Lewis, Salmon, Washougal, Hamilton, Rock, and Wind watersheds. Fisheries targeting winter steelhead are concentrated from December through February and close by March 15. In the Cowlitz, Kalama, Lewis, and Washougal basins, winter steelhead fisheries extend through May 31. Winter steelhead are taken incidentally to spring chinook from February through May. Winter steelhead fisheries may be modified by time or area closures to reduce incidental spring chinook, fall chinook, summer steelhead, and chum catch.

Summer steelhead are native to the Kalama, Lewis, Washougal, and Wind basin but hatchery fish are released in the Elochoman, Cowlitz Toutle, Kalama, NF and EF Lewis, Washougal, and Little White Salmon rivers. Summer steelhead enter fisheries from March through October and most of the catch occurs from late May through August. Fisheries for summer steelhead occur in these rivers and retention is limited to hatchery steelhead under wild steelhead release regulations. Spring chinook adults may be encountered by summer steelhead anglers as both are present at the same time. Beginning in 2002, wild spring chinook will be protected in these fisheries under wild fish release regulations.

As steelhead populations change, WDFW fishery management strategies will change with them. Limits and regulations may change from year to year and from stream to stream. In the middle of the season, wild steelhead run strength is assessed based on snorkel surveys or adult trap counts. In-season adaptive fishery openings and emergency closures are based primarily on these data and may occur throughout a fishery season.

Salmon fisheries -
WDFW statewide rules declare that salmon fisheries are closed unless otherwise specified in Special Rules. Depending on adult salmon return strength, WDFW promulgates regulations allowing spring chinook, fall chinook, and coho salmon fisheries in lower Columbia River tributaries. Recreational salmon fisheries are typically open January through July in streams containing spring chinook runs. Streams with fall-run chinook are typically open from August through December. Coho fisheries typically overlap fall-run chinook fisheries in the LCMA. Salmon-directed fisheries will vary from year to year and from stream to stream depending on the health status of salmonid populations and run-size forecasts for each particular stream.

The WDFW defines adult chinook salmon as 24 inches in length or longer and coho as 20 inches in length or longer. Pink, chum, or sockeye are considered adults at 12 inches or longer. Daily limits may vary from stream to stream. Once the daily bag limit has been retained, it is illegal to continue to fish for salmon. As populations change, WDFW management strategies will change with them. Limits and regulations may change from year to year or stream to stream. In-season adaptive fishery openings and emergency closures may occur throughout a season. Decisions for fishery rule changes are based on run-size forecasts for a particular year. Fishery openings or closures may be proposed at any time during a fishery season, based upon harvest opportunities and conservation needs.

Spring chinook fisheries target hatchery populations occurring in the Grays/Deep terminal area, Cowlitz, Kalama, Lewis, Wind, and Little White Salmon basins. Fisheries will be selective below Bonneville in 2002, when all returns from hatchery releases are adipose fin clipped. Spring chinook fisheries commence as fish begin entering the tributaries below Bonneville Dam in February and March and peak from mid-April through mid-June. Fisheries above Bonneville Dam are typically open in April and peak between late April and late May. Due to recent low run sizes, tributary spring chinook fisheries have been reduced to ensure hatchery spring chinook escapement goals are met. These management actions ensure a level of escapement in each basin. Steelhead impacts during targeted spring chinook fisheries are believed to be low. Wild winter and summer steelhead are protected in these fisheries by wild steelhead release regulations.

Tributary fall chinook fisheries occur from August through January. Tule chinook stocks are present in most LCMA tributaries with fisheries peaking in September. The Lewis River fall chinook are a later-timed stock, with peak fishing occurring in October. Due to recent low run sizes, tributary fall chinook fisheries have been reduced to ensure hatchery and wild fall chinook escapement goals are met. Steelhead impacts during targeted fall chinook fisheries are believed to be low because most wild summer steelhead have passed into the upper watershed sanctuary areas where it is closed to chinook fishing and significant numbers of wild winter steelhead have

yet to arrive. Wild winter and summer steelhead and chum salmon are protected in these fisheries by wild steelhead and chum salmon release regulations.

Fishing in tributaries is closed to chum salmon. Chum salmon are present in tributaries from October through January. Peak abundance in the Grays River takes place from late October through late November and from late November through late December in the area below Bonneville Dam. Winter steelhead and fall chinook fisheries have been modified to reduce incidental hooking mortality on chum salmon in key production and migration areas.

Fisheries for adipose fin-clipped hatchery coho salmon destined for Grays, Elochoman, Cowlitz, Toutle, Kalama, Lewis, Washougal, and Little White Salmon Rivers occur from August through January in most years. These coho fisheries do not encounter adult spring chinook which have all passed into upstream spawning areas or have died by this time. Wild steelhead and chum salmon are protected in these fisheries by wild steelhead and salmon release regulations.

Resident Trout -
The WDFW has established statewide rules for trout fisheries designed to provide recreational angling while at the same time protecting wild salmon and steelhead populations. Trout fisheries are generally scheduled from June through October in rivers, streams, and beaver ponds, and year-round in lakes, ponds, and reservoirs, unless otherwise specified in Special Rules. Trout fisheries incorporate minimum size restrictions designed to protect juvenile salmonids. There is a two-fish daily limit and an eight-inch minimum size restriction in tributary areas. Mainstem rivers open for trout fishing are regulated to afford additional protection with 12-inch or 14-inch minimum retention sizes applied to the two-fish daily bag limit. All wild steelhead and bull trout/Dolly Varden must be released year-round, except as specifically exempted in Special Rules.

Selective gear restrictions are imposed in areas to promote catch and release opportunities or where fish populations are depressed. Where these restrictions are imposed will vary from year to year, depending on the current status of fish populations. These restrictions allow only the use of unscented artificial flies or lures with one barbless single hook, prohibit the use of bait, and fish may be released until the daily limit is retained. Selective gear restrictions also prohibit anyone from fishing from any floating device equipped with a motor, except where specifically allowed under Special Rules for individual waters. Non-buoyant lure and night fishing restrictions are imposed in specific waters to prevent illegal snagging.

Fisheries for resident trout take place in tributaries and standing waters throughout the LCMA. Plants of hatchery-reared trout for put-and-take fisheries have been restricted to standing waters, streams above the anadromous zone, and streams above dams on the Lewis and Cowlitz rivers to minimize impacts on steelhead and salmon smolts. These plants and fisheries now occur above or in the same reservoirs whose dams block historic salmon migrations. In addition, hatchery-reared sea-run cutthroat trout are released in the Cowlitz River to mitigate for the construction of Mayfield and Mossyrock dams.

Trout fisheries have the potential to impact most listed juvenile salmonids. However, WDFW has implemented time and area restrictions, which greatly reduce potential impacts. The general

statewide trout season is open from June 1 to October 31. Trout fishing is closed in the lower Columbia tributaries during the smolt outmigration. WDFW and other agencies operated juvenile outmigrant traps in LCMA tributaries to determine the timing of the wild steelhead and salmon smolt outmigration. In all years, wild migration increased in April, peaked from late April to mid-May, and is concluded in early June. More than 95% of the wild steelhead and coho smolts had completed their migration by June 1. Although no LCR data is available for spring chinook, the literature would suggest similar or earlier timing. WDFW has five basins open during the spring smolt outmigration, and these included the Cowlitz, Kalama, Lewis, Washougal, and Wind watersheds. In all basins, a significant hatchery spring chinook or hatchery summer steelhead fishery is present. All are closed to trout fishing and have a 20-inch minimum size limit to eliminate trout fishing during this period.

In addition to the spring closure to protect smolts, WDFW has an eight-inch minimum size and a daily two-fish limit in all streams, with at least a 12-inch minimum and a two-fish limit in larger mainstems. For example, during the 1997 smolt outmigration on the Wind River, 346 of 347 (99.7%) wild steelhead smolts handled in Trout Creek were less than the eight-inch minimum size. In addition, all 736 smolts handled in the mainstem Wind River smolt trap were less than the 12-inch minimum and 730 of 736 (99.2%) of the wild steelhead smolts were less than eight inches. Wild steelhead outmigration size and timing are believed to be similar in the remainder of the LCR and current fishing regulations eliminate the direct harvest of wild steelhead juveniles.

The direct harvest of juvenile salmon is prohibited in freshwater. However, WDFW recognizes that juvenile salmon caught by anglers may be misidentified as trout. As long as anglers follow the eight-inch minimum size for trout, all wild salmon juveniles will be protected from direct harvest. Wild coho and spring chinook smolts remain in freshwater for only one year compared to steelhead that rear for two or three years in the freshwater. Due to this reduced freshwater residency, spring chinook and coho smolts are smaller than the steelhead smolts, and greater than 99% would be less than the eight-inch minimum size used for trout and steelhead protection for trout.

Chum salmon migrate to the ocean shortly after emergence. Peak migration takes place in April when fish are less than 80mm. Fall chinook also migrate to the ocean at age zero but outmigration from tributaries occurs throughout the spring and early summer. The gear that is used by most trout anglers is large enough that only juvenile salmonids greater than (120mm) are recruited into the fishery. This eliminates the likelihood that chum or fall chinook would be caught in the fishery.

Other Resident Fish Species -
Fisheries for other species may occur year-round within the LCMA or concurrent with salmon and steelhead seasons. Many of these fisheries, however, are concentrated after the spring runoff when flows and warm water temperatures permit successful angling. Targeted species includes whitefish, walleye, and other warm water species, such as largemouth and smallmouth bass. Selective gear requirements are imposed on some tributaries within the LCR, while angling for any fish species.

Fisheries occur in the lower sections of some LCR tributaries for warm water game species including largemouth bass, smallmouth bass, channel catfish, crappie, bluegill, carp, and northern pikeminnow. The whitefish fishery is not significant in the LCR and no specific regulations or special seasons are implemented. Warmwater fisheries also occur in standing waters throughout the basin. Chinook, chum, and steelhead impacts in warm water fisheries are nil. In the LCR tributaries, warm water fisheries are concentrated in backwaters and sloughs, which are not hospitable rearing areas for juvenile salmonids. Chinook, chum, and steelhead are not present in standing waters where warm water fisheries occur. Fisheries are also most active during warm summer months after spring migrant juvenile chinook and chum have left the system and before fall migrant juvenile chinook disperse downstream from rearing areas. Since warm water species potentially prey on and compete with juvenile salmonids, warm water fisheries could actually provide some marginal benefit for listed salmon and steelhead if the warmwater catch were significant.

Other anadromous species -
Shad fisheries are opened in the LCMA tributaries and the fishery effort is believed to be low. Shad fishing occurs from May through July. The onset of the shad run coincides with the tail end of the spring chinook fishery and the summer steelhead fishery. The impacts are considered with the spring chinook and summer steelhead fishery impacts. The recreational shad fishery is open year-round with no bag limits. Small sturgeon fisheries occur in the LCR tributaries. However, most of the effort is concentrated in the Cowlitz River. The fishery is generally open year-round and legal sturgeon retention sizes are 42 to 60 inches. Sturgeon anglers fish with bait on the bottom and use very large hooks to catch these large fish. Salmon and steelhead impacts in sturgeon fisheries are believed to be zero.

A smelt fishery occurs in the lower mainstem Columbia River and Washington tributaries. Under permanent regulations, the commercial smelt fishery operates seven days per week from December 1 through March 31 in the Columbia River. However, the season has been reduced or replaced with a test fishery since 1995 because of recent poor returns. Gear includes small otter trawls, gill nets with a maximum of two-inch mesh size, and hand dip nets. This fishery does not affect salmon or steelhead adults or juveniles. Tributary smelt fisheries are limited to dip nets and the most significant fishery occurs in the Cowlitz River. The few adults present during this time easily avoid the gear. Juvenile salmon and steelhead are not migrating at the times and places smelt fisheries occur.

In the absence of an actual interception rate, WDFW used harvest rates calculated in fisheries when wild steelhead harvest was allowed or where WDFW measured interception rates in wild steelhead release fisheries (Rawding 1998, and WDFW unpublished data). In non-target fisheries where fall chinook are caught and released in a hatchery coho fishery, our preliminary estimate is that the interception rate is less than 1% due to area closures and preference of anglers to target different water types for different species (WDFW, unpublished data).

2.1.2) Assessment of how the harvest regime will not likely result in changes to the biological characteristics of the affected ESUs.

Low harvest impact rates which will result from implementation of selective fisheries for adipose

fin-clipped salmonids will minimize the potential for fishing-related changes in biological characteristics of salmon and steelhead populations. Fishing impacts on chum salmon, summer steelhead, and spring chinook are small and spread over the breadth of the run so that no subcomponent of the wild stock will be selectively harvested at a rate substantially larger than any other portion of the run. No significant harvest differential will occur for different size, age, or timed portion of the run. The winter steelhead harvest is concentrated on the front 30% of the run and coincides with the highest hatchery abundance. However, the low hooking mortality for winter steelhead (<5%) indicates that the sport fish mortality rate would be less than 3.5% for the early part of the run. Since all fish are required to be released, there is no selection in the fishery for size, sex, or age. In addition, low harvest rates for wild fish will maintain or increase the number of wild spawners even in periods of poor freshwater migration and ocean survival conditions. Larger populations will be less subject to genetic risks and loss of diversity associated with small population sizes. Finally, increased harvest rates of hatchery fish in selective fisheries should benefit wild stock integrity and diversity by removing a greater fraction of the hatchery fish which could potentially stray into wild production areas.

2.1.3) Comparison of harvest impacts in previous years and the harvest impacts anticipated to occur under the harvest regime in this FMEP.

WDFW's salmon catch record card system was originally designed to monitor chinook and coho catch, since these were the target of recreational fisheries. Pink, sockeye, and chum salmon were combined into a category called "other." Therefore, direct catch estimates are not available for chum salmon. During this time, WDFW staff conducted creel surveys in major tributaries during the chinook and coho fishery and in most years there was no observed catch of chum salmon except in the Grays River. Since 1995, WDFW has closed all key chum salmon spawning areas to fishing during migration and spawning time. In addition, other basins are open to fishing use selective fishery regulations which require all anglers to release all chum salmon caught. Current chum salmon interception rates are believed to be less than 5% with hooking mortality of 8.6%. This yields a tributary sport fishing mortality rate of less than 1% from 1995 to the present.

Summer steelhead harvest fisheries have been restricted to wild steelhead release fisheries since 1986. Some winter steelhead fisheries went to wild steelhead release in 1986 as well. The remaining fisheries went to wild steelhead release in 1992, with the exception of the SF Toutle, which went to wild steelhead release in 1994. It was not possible to estimate wild steelhead harvest rates for most streams in the basin because wild steelhead escapement and harvest estimates were not available for most basins when steelhead harvest fisheries were permitted. The exception is the Kalama River, where an ongoing research program collected these data. The Kalama River is representative of the changes in wild steelhead harvest rates. Harvest rates for winter and summer steelhead declined from more than 50% under harvest fisheries to less than 6% in wild steelhead release fisheries (Figure 3).

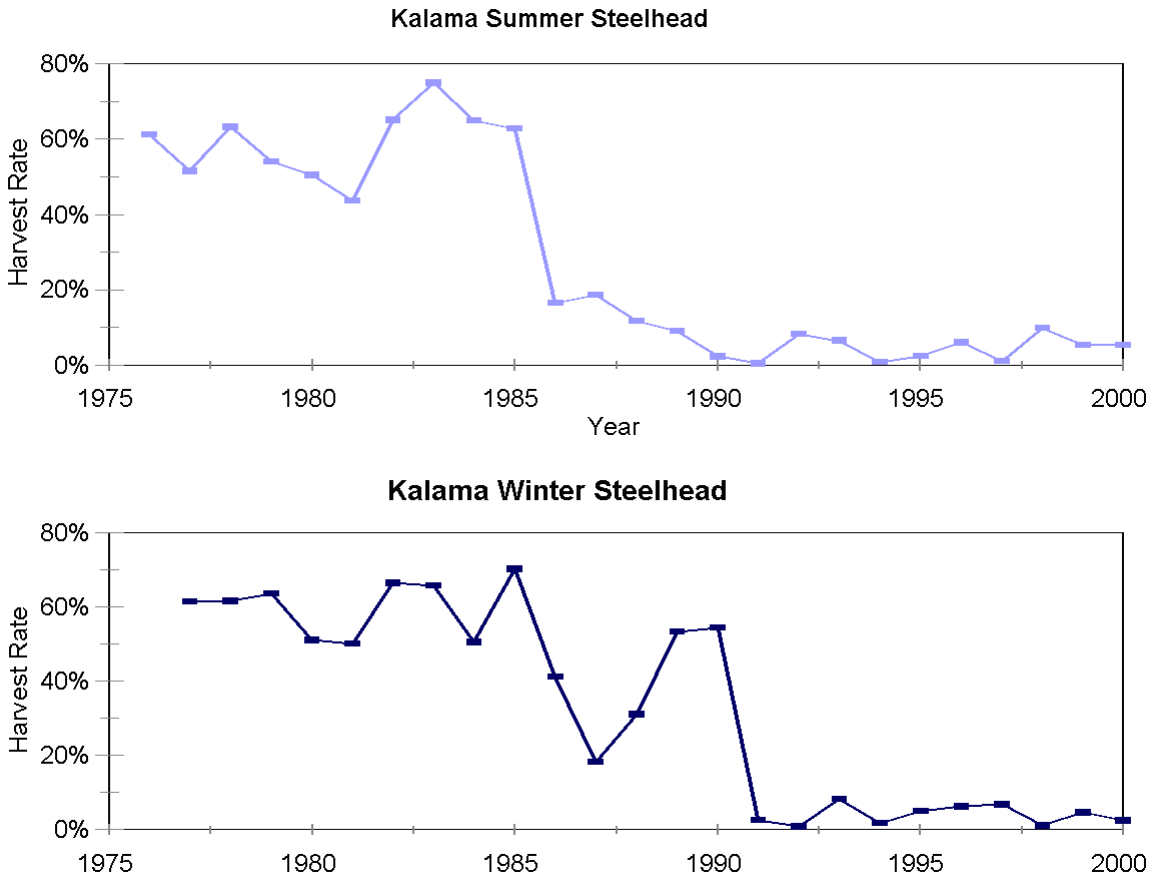

Figure 3. Wild steelhead harvest rates for winter and summer steelhead, 1976-1999. Harvest for winter steelhead after 1991 and summer steelhead after 1985 is adult morality due to hooking mortality in the wild steelhead release fisheries.

Sring chinook harvest rates averaged 67%, 42%, and 30% in the Lewis, Kalama, and Cowlitz spring chinook fisheries, when hatchery stocks were abundant. As these stocks declined, fishery restrictions reduced harvest. The proposed harvest regime after 2002 will reduce wild spring chinook harvest rates to less than 10%, generally averaging closer to 5% (Figure 4).
Tributary fall chinook adult harvest rates have varied from 1988 to the present. If run sizes were predicted to meet hatchery escapement objectives, fisheries were open. In productive ocean cycles, the tributary harvest rate has exceeded 20%, but during less productive cycles, sport fisheries in the tributaries have been closed or severely restricted. Figure 5 illustrates the tributary harvest rate of tule fall chinook stocks including hatchery fish. The adult harvest rate in Abernathy Creek, Coweeman River, and EF Lewis River has been near zero during this period because these streams were closed to salmon fishing. We define the tributary harvest rate as the tributary sport fish harvest divided by the run size. Harvest occurring in other fisheries (ocean, Columbia River mainstem) prior to the tributary fishery, will result in the tributary harvest rate adjusted downward.

Lewis River fall chinook are managed for an MSY escapement goal of 5,700 adult spawners. In years where tributary run size is expected to exceed the escapement goal, a sport fishery is open.

When run size was predicted to be less than the escapement goal (years 1996 to 2000), the fishery was closed. Lewis River fall chinook harvest rates are shown in Figure 5.

The expected take of listed stocks in the LCMA during tributary fisheries is illustrated in Table 12.

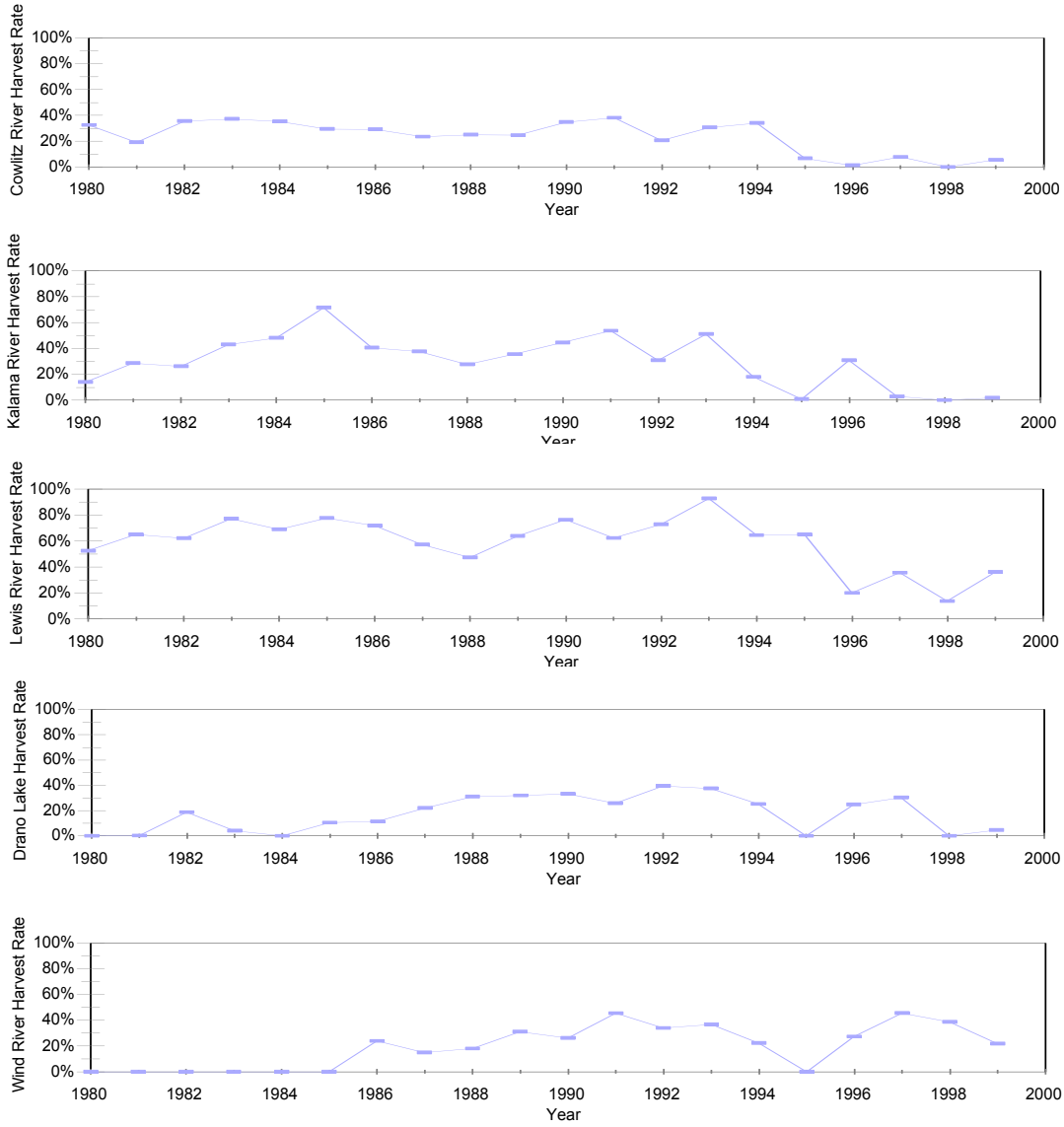

Figure 4. Spring chinook tributary harvest rate 1980-99. Harvest rate equals sport catch divided by run size at tributary mouth.

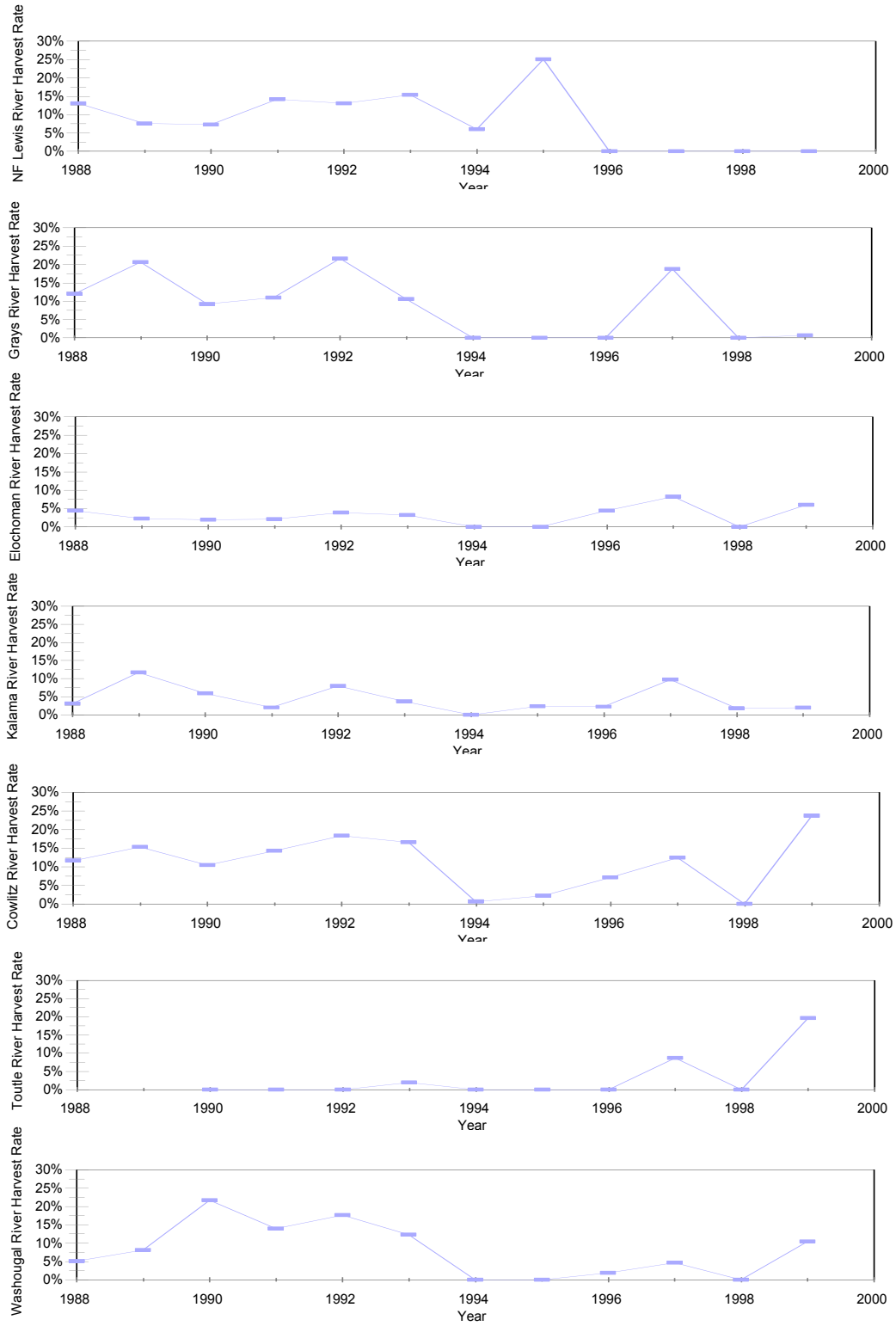

Figure 5. Fall chinook tributary harvest rate, 1988-99. Harvest rate equals sport catch divided by size at tributary mouth.

Table 12. Estimated take of listed fish in various fisheries. Note the spring chinook take in 2001 will be higher because hatchery fish are not marked.

Affected stock	Fisheries									
	Steelhead		Salmon		Res. Trout		Others (eg. Whitefish, warmwater)			
	AE[1]	EM[2]	AE	EM	AE	EM	AE	EM	Harvest[3]	Total take[4]
Grays River										
Fall chinook	0	0	0	0	0	0	0	0	19%	19%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Elochoman River										
Fall chinook	0	0	0	0	0	0	0	0	8%	8%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Coweeman River										
Winter steelhead	30%	1%	0	0	15%	2%	0	0	0	4%
Fall chinook	0	0	0	0	0	0	0	0	10%	10%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Toutle River										
Winter steelhead Mainstem/NF	0	0	0	0	0	0	0	0	0	0%
Winter steelhead SF	38%	2%	0	0	15%	2%	0	0	0	4%
Winter steelhead Green River	0	0	0	0	15%	2%	0	0	0	1%
Fall chinook SF	0	0	0	0	0	0	0	0	NA%	NA%
Fall chinook Green River	0	0	0	0	0	0	0	0	20%	20%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Columbia River chinook	NA									
Cowlitz River										
Winter steelhead	70%	4%	0	0	17%	3%	0	0	0	6%
Fall chinook	0	0	0	0	0	0	0	0	24%	24%
Spring chinook	0	0	77%	7%	0	0	0	0	0	7%

[1]Anticipated Encounters (AE) are catch and released fish. These numbers represent the number of fish from a stock anticipated to be incidentally encountered by anglers of a particular fishery.

[2]Expected Mortality (EM) is the hooking mortality of incidentally caught fish, based on (WDFW 2000). Expected mortalities are included in Anticipated Encounters in terms of take.

[3]Harvest is the expected recreational harvest based on historic recreational catch and future run size projections.

[4]Total take encompasses Anticipated Encounters and expected recreational harvest. This can be construed as the **exploitation rate**.

Affected stock	Fisheries									
	Steelhead		Salmon		Res. Trout		Others (eg. Whitefish, warmwater)		Harvest [3]	Total take [4]
	AE [1]	EM [2]	AE	EM	AE	EM	AE	EM		
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Kalama River										
Winter steelhead	70%	4%	0	0	17%	3%	0	0	0	6%
Summer Steelhead	60%	5%	0	0	<3%	<1%	0	0	0	6%
Fall chinook	0	0	0	0	0	0	0	0	12%	12%
Spring chinook	0	0	77%	7%	0	0	0	0	0	7%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Lewis River										
Winter steelhead Mainstem/NF	70%	4%	0	0	17%	3%	0	0	0	6%
Winter steelhead EF	40%	2%	0	0	17%	3%	0	0	0	5%
Summer steelhead NF	NA									
Summer steelhead EF	40%	3%	0	0	<3%	<1%	0	0	0	4%
Fall chinook EF	0	0	0	0	0	0	0	0	10%	10%
Fall chinook	0	0	0	0	0	0	0	0	25%	25%
Spring chinook	0	0	77%	7%	0	0	0	0	0	7%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Washougal River										
Winter steelhead	40%	2%	0	0	17%	3%	0	0	0	5%
Summer steelhead Mainstem	40%	3%	0	0	<3%	<1%	0	0	0	4%
Fall chinook	0	0	0	0	0	0	0	0	22%	22%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Wind River										
Winter steelhead	30%	1%	40%	3%	17%	2%	0	0	0	6%
Summer steelhead	<10%	1%	<10%	1%	<3%	<1%	0	0	0	3%
Fall tule chinook	0	0	0	0	0	0	0	0	NA%	NA%
Fall bright chinook	0	0	0	0	0	0	0	0	NA%	NA%
Spring chinook	0	0	0	0	0	0	0	0	46%	46%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Little White Salmon River										
Winter steelhead	NA									
Summer steelhead	NA									
Fall tule chinook	0	0	0	0	0	0	0	0	NA%	NA%
Fall bright chinook	0	0	0	0	0	0	0	0	NA%	NA%
Spring chinook	0	0	0	0	0	0	0	0	40%	40%
Columbia River chum	NA									
Other Tributaries										

Affected stock	Fisheries									
	Steelhead		Salmon		Res. Trout		Others (eg. Whitefish, warmwater)		Harvest [3]	Total take[4]
	AE[1]	EM[2]	AE	EM	AE	EM	AE	EM		
Winter steelhead	30%	1%	0	0	15%	2%	0	0	0	4%
Summer steelhead	0	0	0	0	0	0	0	0	0	0
Fall tule chinook	0	0	0	0	0	0	0	0	0	0
Fall bright chinook	0	0	0	0	0	0	0	0	0	0
Spring chinook	0	0	0	0	0	0	0	0	0	0
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Salmon Creek										
Winter steelhead	30%	1%	0	0	15%	2%	0	0	0	4%
Fall tule chinook	0	0	0	0	0	0	0	0	0	0
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%

2.1.4) Description of additional fishery impacts not addressed within this FMEP for the listed ESUs specified in section 1.3. Account for harvest impacts in previous years and the impacts expected in the future.

Columbia River chum salmon are not caught in measurable numbers in ocean salmon fisheries off the Washington, Oregon, and California coast managed by the PFMC (NMFS 2000b). There are fisheries directed at chum in Puget Sound and in Canada and Alaska that generally target maturing fish returning to nearby terminal areas in the fall. There is very little specific information on the ocean distribution of Columbia River chum, but given the timing and distant location of fisheries directed at chum, it is unlikely that Columbia River chum are significantly affected by ocean fisheries (NMFS 2000a).

Columbia River historically contained large runs of chum salmon that supported a substantial commercial fishery during the first half of this century. Commercial landings represented a harvest of a half million chum salmon during some years (Johnson et al. 1997). By 1955, landings had diminished to 10,000 fish. Since 1965, landings have averaged less than 2,000 fish annually. Commercial landings from 1993-1998 averaged 29 fish annually (Figure 6). Presently, no commercial fisheries are directed at Columbia River chum salmon. Chum landings only occur as incidental to targeted coho seasons during the late fall gill net fishery. The biological opinion limited chum salmon harvest rates to less than 5% (NMFS 2000b). However, the projected harvest was estimated to be less than 2%.
Steelhead are rarely caught in ocean fisheries and those fisheries are not considered a significant source of mortality to lower Columbia River steelhead (NMFS 2000c). LCR steelhead may be caught in mainstem Columbia River sport and commercial fisheries as they migrate to their spawning streams. The sport fishery requires wild steelhead release. Non-tribal commercial fisheries directed at steelhead in the Columbia River were prohibited in 1975 and continue to be prohibited. Commercial fisheries are set to optimize chinook or coho catch and minimize steelhead catch through the use of time and area closures and gear restrictions. The expected

incidental harvest rate on lower Columbia River steelhead during non-Indian mainstem commercial fall fisheries is 0.3% (NMFS 2000b). Tribal fisheries for lower Columbia River steelhead in the LCMA occur in the mainstem Columbia River above Bonneville and in the Wind River system only. The expected harvest rate to native-origin lower Columbia River steelhead as a result of the tribal fisheries is estimated at 1.5 percent in the tributaries and less than 10% in the mainstem Columbia River (NMFS 2000b).

Lower Columbia chinook ESU consists of spring, fall tule, and fall bright fish runs. These runs are impacted differently by fisheries outside the LCMA and outside WDFW management. NMFS (2000b) estimates the ocean fisheries' exploitation rate of spring run lower Columbia chinook to be less than 1%. The mainstem Columbia River commercial and recreational fisheries' exploitation rate on lower Columbia River spring-run chinook has been at or below 2% annually since 1995. The commercial fisheries in the Columbia River targeting spring chinook have been restricted since 1975 to the mainstem Columbia from the Willamette River downstream to the mouth. An analysis of CWTs from the 1996 spring chinook fishery estimated that 93 percent of the fish caught were from Willamette stocks. The tribal fishery is not expected to have a measurable impact on the wild spring run chinook in the LCMA, since their fishery occurs on the Columbia River upstream of these stocks (WDFW/ODFW, 2000).

Fall run lower Columbia chinook are more heavily impacted by ocean fisheries. The ocean exploitation rate for tule fall chinook averaged 53% from 1977 to 1990 and was reduced to 25% between 1991 and 1994 (Figure 7). The combined mainstem and tributary fishery impacts for tule chinook are less than 50% of the ocean fishery and have been reduced from 11% to 5% (NMFS 2000b). Lewis River fall chinook are harvested in the ocean fishery at a lower rate than tule chinook but harvested at a higher rate than tule chinook in the Columbia River mainstem and tributary fisheries (Figure 8). The average fisheries exploitation rate on Lewis River fall chinook has been reduced from 49% to 28% from 1977-90 to 1991-94. This is significantly lower than the 65% Recovery Exploitation Rate.

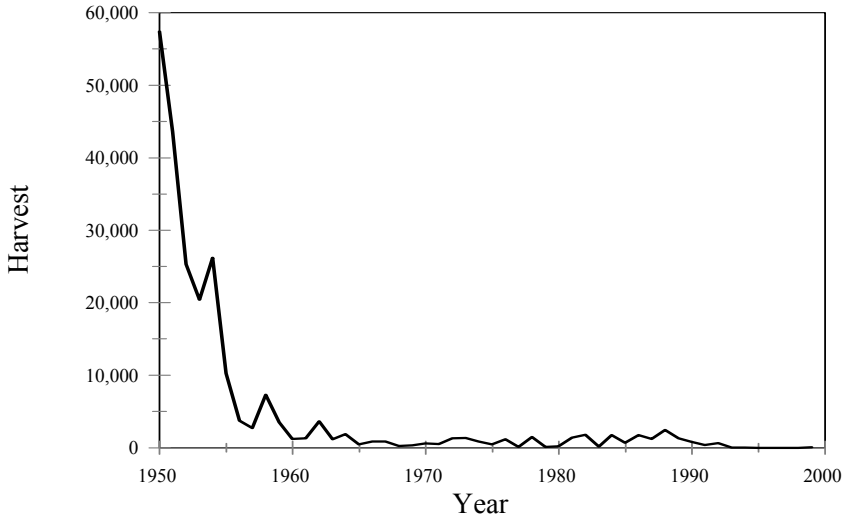

Figure 6. Commercial landings of chum salmon from the Columbia River, 1950-99.

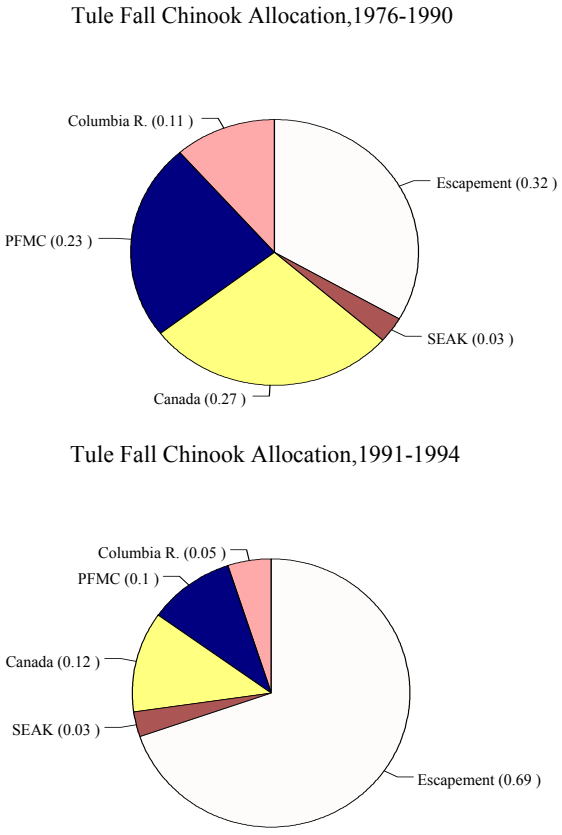

Figure 7. Tule fall chinook allocation pre and post 1991.

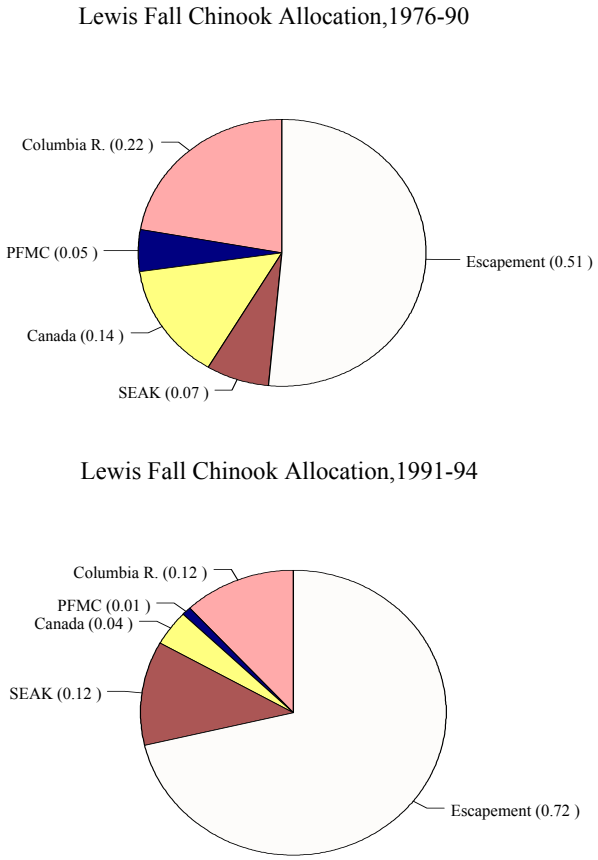

Figure 8. Lewis River chinook allocation pre and post 1991.

SECTION 3 MONITORING AND EVALUATION

3.1) Description of the specific monitoring of the "Performance Indicators" listed in section

Performance indicators for wild LCMA salmon and steelhead include fish population indicators and fishery indicators. Since the objective of this FMEP is to provide fishing opportunity consistent with the recovery of listed species and at rates that do not jeopardize their survival or recovery, the primary indicators for this FMEP are the abundance and productivity of wild salmon and steelhead stocks.

Abundance and productivity

Index streams -

The primary fish population indicators for wild salmon and steelhead are spawning escapement estimates for 3 chum salmon populations, 3 spring chinook populations, 4 summer steelhead populations, 9 winter steelhead populations and 16 fall chinook salmon populations. Our first priority is to choose streams that have a weir and trap so that observation or measurement error can be minimized and/or quantified. Stream indexes include a variety of salmonid populations, are representative of the habitat within the ESU, and dispersed across the ESU. The steelhead

index basins above weirs include the Cowlitz River above Barrier Dam, the North Fork Toutle River above the Sediment Retention Structure, Kalama River above Kalama Falls Hatchery, Cedar Creek tributary of the NF Lewis River above the Grist Mill fish ladder, and the Wind River above Shipherd Falls including the primary tributary of Trout Creek above Hemlock Dam (Table 13). In addition, index snorkel reaches are established for summer steelhead in the EF Lewis and Washougal rivers, and redd survey reaches for winter steelhead have been established in the SF Toutle River, Coweeman River, EF Lewis River, and Washougal River (Tables 14). For chum salmon, index streams include the two population centers for this species in the Grays River, and Hamilton/Hardy creeks and other sites are shown in Table 15. For fall chinook, index streams include, the Grays, Skamokawa, Elochoman, Mill, Abernathy, Germany, Lower Cowlitz, Coweeman, Kalama, NF & EF Lewis, Washougal, Wind River, and Drano Lake (Table 16).

Table 13. Key steelhead & salmon monitoring sites in the Lower Columbia River ESU with current funding.

Basin	Stock	Other Species	Adult Monitoring	Smolt Monitoring	Adult Esc. Method	Comments
Cowlitz above Cowlitz Falls	Winter Steelhead/ Spring Chinook	Cutthroat Coho	Barrier Dam	Cowlitz Falls Dam	Total Fence Count	Population in upper watershed extirpated, reintroduction effort
NF Toutle River	Winter Steelhead	Coho Cutthroat	Fish Collection Facility	intermittent	Total Fence Count	Population recovering after eruption of Mt. St. Helens
Kalama River	Winter/ Summer Steelhead	Cutthroat Chinook	Kalama F. Hatchery	Kalama F. Hatchery	Fence Count with Mark-Recapture	Located in the center of ESU, average habitat, mix of steelhead and spring chinook
Cedar Creek	Winter Steelhead	Chinook Cutthroat Coho	Grist Mill Ladder	Grist Mill Ladder	Fish Ladder Index	Historically, a coho stream with a small fall chinook, steelhead & cutthroat run
Wind River	Summer/ Winter Steelhead	Sp Chinook	Shipherd Falls Ladder	Mouth	Fence Count with Mark-Recapture	Steelhead stream with a hatchery spring chinook run
Trout Creek	Summer Steelhead	none	Hemlock Dam	Hemlock Dam	Total Fence Count	Only streams with no other anadromous salmonids
Grays River	Chum Chinook	Winter Steelhead F.Chinook	Live Counts	None	AUC	

Basin	Stock	Other Species	Adult Monitoring	Smolt Monitoring	Adult Esc. Method	Comments
		Coho				
Hardy Creek	Chum	Coho Winter Steelhead	V-Weir Trap	V-Weir Trap	Mark-Recapture	USFWS providing data
Hamilton Creek	Chum	Coho Winter Steelhead	V-Weir Trap	V-Weir Trap	Mark-Recapture	USFWS providing data
NF Lewis River	Fall Chinook	Coho, Chum Steelhead	Live & Carcass Counts	CWT Seining	Carcass Tagging	

Table 14. Other wild steelhead monitoring sites with current funding.

Basin	Stock	Method	Comments
L. Cowlitz	Winter	Redd	Intermittent tributary surveys for abundance
Coweeman	Winter	Redd	Redd surveys for population estimate
SF Toutle	Winter	Redd	Redd surveys for population estimate
Green	Winter	Redd	Index redd surveys on tributaries for abundance
EF Lewis	Winter	Redd	Index redd surveys for abundance
EF Lewis	Summer	Snorkel	Index abundance snorkel surveys
Washougal	Winter	Redd	Index redd surveys for abundance
Washougal	Summer	Snorkel	Index abundance snorkel surveys
Gorge Tribs	Winter	Redd	Intermittent redd surveys for presence/absence

Table 15. Other chum salmon monitoring sites.

Basin	Method	Comments
Skamokawa	AUC	Intermittent surveys will continue if outside funding secured.
Elochoman	AUC	Intermittent surveys will continue if outside funding secured.
Mill	AUC	Intermittent surveys will continue if outside funding secured.
Abernathy	AUC	Intermittent surveys will continue if outside funding secured.
Germany	AUC	Intermittent surveys will continue if outside funding secured.
Cowlitz	AUC	Intermittent surveys will continue if outside funding secured.
Toutle	AUC	Intermittent surveys will continue if outside funding secured.
Kalama	AUC	Intermittent surveys will continue if outside funding secured.
Lewis	AUC	Intermittent surveys will continue if outside funding secured.
Washougal	AUC	Intermittent surveys will continue if outside funding secured.
Gorge tribs	AUC	Intermittent surveys will continue if outside funding secured.
BON	Count	COE fish counting program

Table 16. Chinook abundance data for streams with PSMFC funding

Basin	Method	Comments
Grays	Carcass Tagging	PSMFC CWT recovery program

Skamokawa	Carcass Tagging	PSMFC CWT recovery program
Elochoman	Carcass Tagging	PSMFC CWT recovery program
Mill	Carcass Tagging	PSMFC CWT recovery program
Abernathy	Carcass Tagging	PSMFC CWT recovery program
Germany	Carcass Tagging	PSMFC CWT recovery program
Cowlitz	Carcass Tagging	PSMFC CWT recovery program
Coweeman	Carcass Tagging	PSMFC CWT recovery program
SF Toutle	Carcass Tagging	PSMFC CWT recovery program
Green	Carcass Tagging	PSMFC CWT recovery program
Toutle	Carcass Tagging	PSMFC CWT recovery program
Kalama	Carcass Tagging	PSMFC CWT recovery program
EF Lewis	Carcass Tagging	PSMFC CWT recovery program
Washougal	Carcass Tagging	PSMFC CWT recovery program
Wind	Carcass Tagging	PSMFC CWT recovery program
Drano	Carcass Tagging	PSMFC CWT recovery program

Currently, a sufficient data set is only available from the Kalama River for steelhead and the NF Lewis for fall chinook salmon to develop a fishery management approach based on measurement of management parameters. Data from other systems (Toutle, Washougal, and Wind rivers for steelhead, and EF Lewis and Coweeman for fall chinook) are currently being prepared for data analysis. We are currently working on an approach to develop the parameters for chum salmon for populations in Grays River, Hamilton/Hardy creeks, and above Bonneville Dam. However, this chum data is not complete for this analysis. Our goal is to develop data sets from all the locations listed above to complete fishery and extinction risks analyses but it may take another decade to collect enough information due to the variation in the data, and the extended and complex life history of anadromous salmonids.

Redd surveys -

Steelhead and salmon escapements are estimated annually using redd surveys, mark recapture studies, carcass tagging, snorkel surveys, Area-Under-the Curve (AUC), and trap counts. WDFW began collecting wild winter and summer steelhead abundance data in 1976 on the Kalama River at the Kalama Falls trap. By the 1980s, abundance was estimated for other wild winter steelhead populations by redd surveys. In the 1980s, WDFW also incorporated snorkel surveys to estimate wild summer steelhead abundance. Estimates from steelhead redd surveys were calculated using the standard WDFW methodology (Freymond and Foley, 1984). Index tributaries were surveyed every two weeks from March 1 to May 31. A peak survey was done outside of index areas and was used to estimate redds in these areas based on the percent of redds visible in index areas at the time of the peak survey. Average redd densities were used to estimate redds in unsurveyed tributaries. The lower mainstems of large tributaries are flown every two weeks and redd life was used to calculate the total number of redds using an AUC methodology. A peak flight is conducted on the upper mainstem to calculate redds. Expansion is similar to that described for tributaries. Escapement estimates based on redd surveys are calculated for winter steelhead in the Coweeman, and SF Toutle rivers. Index redd surveys are not complete escapement estimates and track trends in the LCMA tributaries. Index counts are conducted in the Green, EF Lewis, and Washougal rivers due to limited funding. WDFW uses peak redd count expansion factors for spring and fall chinook estimates in the Cowlitz River.

Mark-recapture -
Summer steelhead escapement estimates in the Wind and Kalama rivers are based on mark recapture estimates. Wild summer steelhead are tagged at the Shipherd Falls and Kalama Falls traps, since summer steelhead can bypass the trap by jumping the falls. Snorkel surveys are conducted in September to count tagged and untagged wild steelhead. A Petersen estimator is used to determine wild steelhead run size. Index snorkel surveys are conducted annually on the EF Lewis and Washougal rivers to track wild summer steelhead abundance. A Petersen estimate is also used to estimate fall chinook populations above the Cedar Creek trap. The only difference between the steelhead and chinook estimates is that tags are recovered by carcass surveys for chinook salmon.

Mark-recapture carcass tagging experiments are used to estimate the abundance of chinook salmon in Grays, Skamokawa, Elochoman, Mill, Abernathy, Germany, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis, Washougal, Wind, and Little White Salmon basins. Population estimates can be determined by a model developed by G. Paulik (prepared by D. Worlund) of the University of Washington. This model is an application of the open model release and recapture techniques presented by Seber (1982). This is the same method used in the previous Lewis River carcass tagging study in 1976 (McIsaac, 1990). Field crews conduct counts of live salmon and carcasses. Crews staple unique shaped and colored plastic carcass tags under the operculum of any chinook. Each week, different colored and shaped carcass tags will be used. After collecting biological and mark sampling data and tagging the carcasses, the fish will be put back as close as possible to their original location. The color and shape of the carcass tags will be noted on all previously tagged carcasses recovered. When previously carcass-tagged fish are recovered, the carcass tags are removed and the tail of the fish is removed to prevent re-sampling. In years when there is no carcass tagging, population estimates are based on the expansion factor that compares the total population estimate divided by the peak live and dead counts.

Barrier trap counts -
For winter steelhead, Kalama and Shipherd falls are total barriers and the trap count is the wild winter steelhead escapement in these basins. Wild winter steelhead counts in the NF Toutle River at the Fish Collection Facility and for the reintroduction effort in the Cowlitz River above the Barrier Dam also equate to the total escapement. An index of wild winter steelhead escapement in Cedar Creek is the trap count. Wild winter steelhead can jump the falls at Cedar Creek but no mark recapture studies have been conducted to estimate the total population.

Coded-Wire-Tags -
All carcasses and trapped salmon and steelhead are examined for fin clips (mark sampling) and snouts taken from fish with missing adipose and ventral fins collected in carcass surveys. Lengths, sex, and scales will be randomly (biological sampling) taken from trapped adults and carcasses with the adipose fin intact and from all adipose-clipped fish recovered. Snouts from the adipose-clipped carcasses will be dissected at the WDFW Olympia office. Scale samples and CWTs will also be read in Olympia. This is standard procedure for all Columbia River samples collected by WDFW. Spring and fall chinook stock composition is determined by removing any

stray hatchery stocks from the natural spawning population based on the expansion of CWTs recovered divided by their respective adult or juvenile tagged to untagged ratios.

Area-Under-the-Curve -
Chum salmon population estimates are made either from the mark recapture described for fall chinook in Cedar Creek, the carcass tagging method used for fall chinook salmon, or the AUC method. The USFWS operates traps in Hamilton Springs and Hardy Creek and will use mark-recapture as the primary method to estimate chum salmon escapements. In Hamilton Creek, Grays River, and the mainstem Columbia River, carcass tagging or AUC will be used. In the AUC, live counts of chum salmon are made every seven days. The escapement of chum salmon is estimated using AUC / RT, where AUC is the area under the observed escapement curve obtained by plotting the number of live fish observed by survey day throughout the spawning season. The total number of spawner days, which is the area under the curve, can be calculated with a polar planimeter, computer software, or using a trapazoidal approximation. The RT, residence time, will be determined from carcass recovery of marked fish or based on the literature.

Outmigration studies -
Juvenile outmigrants are monitored in the Kalama River, NF Lewis River, Cedar Creek, and Wind River. Fall chinook are seined and 100,000 migrants are CWT on the Lewis River. Tag adults are recovered in fisheries and during spawning ground surveys. A Petersen mark recapture estimate is used to estimate the number of fall chinook juveniles based on the recovery of tagged and untagged carcasses. Rotary screw traps are located in the Kalama, Cedar, and Wind basins. Outmigrant estimates are developed using a Petersen estimator based on the trap efficiency method. Wild steelhead are estimated in the Wind River, Kalama River, and Cedar Creek. In addition, spring chinook are estimated in the Kalama and sea-run cutthroat and coho estimates are made for Cedar Creek. Juvenile steelhead, chinook, and cutthroat production is also monitored at Mayfield and Cowlitz Falls dams. Intermittent juvenile production monitoring has been conducted in the NF Toutle and EF Lewis basins. However, annual funding for these is not available.

Fisheries monitoring
Performance indicators for fisheries typically include estimates for the catch, catch rates, harvest, harvest rates, hooking mortality for fish caught and released, effort of the fishery, and catch per unit effort (CPUE) for the fishery. WDFW makes statistically based estimates of hatchery steelhead and salmon catch from the WDFW catch record card (CRC) and follow-up phone surveys. No harvest estimates are made for wild steelhead, since WDFW requires wild steelhead and chum salmon release for all LCR basins. However, WDFW is concerned about the indirect mortality that can occur from wild steelhead and salmon release. Based on a literature search, WDFW estimated the hooking mortality for steelhead (Rawding 1998), and salmon (Bendock and Alexandersdottir 1993, and Schroeder et al. 1999). In the absence of an actual interception rate, WDFW used harvest rates calculated in fisheries when wild steelhead harvested was allowed or where WDFW measured interception rates in wild steelhead or salmon release fisheries. Creel surveys are being conducted on the NF Lewis and Cowlitz rivers for steelhead and salmon to assess hatchery programs. In conjunction with CRC estimates, these can be used to determine the hatchery harvest rate, interception rate for wild fish, and catch per unit effort

(CPUE). Chinook and coho fisheries in major tributaries including the Grays, Elochoman, Cowlitz, Toutle, Kalama, Lewis, Washougal, Wind, and Little White Salmon Rivers are sampled to collect CWT, CPUE, and interception rate for wild fish. Due to lack of funds, these estimates are not available for steelhead fisheries outside of the Lewis and Cowlitz rivers.

Other monitoring programs that occur outside the LCMA will provide information that may be applicable to these fisheries in this ESU. For example, it is not possible to monitor the survival of each released wild salmon and steelhead. The results from studies outside the LCR could be very useful in this area. Other studies on gear selectivity and hooking mortality rates by gear, reproductive success of caught and released steelhead and salmon, effectiveness of sanctuary areas, and others would also have application in the LCMA. WDFW will make an effort to include this new information when the FMEP is updated or before if the information is significant enough to warrant it.

3.2) Description of other monitoring and evaluation not included in the Performance Indicators (section 3.1) which provides additional information useful for fisheries management.

In addition to routine monitoring and evaluation activities described above, WDFW also collects or uses information from other sources related to the status of listed salmon and steelhead and the implementation of fisheries which might affect them. Since freshwater habitats are linked to wild steelhead and salmon production, WDFW monitors habitats through the Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) and through checks on hydraulic permits. These data may be useful in forecasting salmon and steelhead runs, because they may quantify changes in habitat productivity, such as, habitat improvement projects that open historic habitats or document nature depensatory processes. Finally, extensive monitoring and evaluation are conducted for chum salmon, chinook salmon, and steelhead at local hatcheries. This program inventories production and returns, tracks straying, monitors fish health, and relates return rates to hatchery practices.

3.3) Public Outreach

The popularity of the steelhead and salmon fisheries result in intense public interest and participation in the annual management processes for these species. WDFW conducts extensive public involvement and outreach activities related to salmon and steelhead fishery management and recovery. The annual fishery regulation process involving a series of public meetings, information mailouts, press releases, and public hearings was described in detail in section 1.5. Anglers are keenly aware of and accustomed to abrupt inseason management changes including closures and reopenings with short notice. Permanent regulations are detailed in published pamphlets of fishing regulations. Annual regulation and inseason changes are widely publicized with press releases, phone calls or faxes of action notices to key constituents, and signs posted at fishery access points. WDFW also operates an information line, a recorded hotline, and an Internet web page where timely information is available.

In addition to fishery-related outreach efforts, the state of Washington is conducting a broad-based watershed recovery effort coordinated through the Lower Columbia River Fish Recovery

Board (LCRFRB). The LCRFRB is developing a salmon and steelhead recovery plan for the LCR region in conjunction with federal, state, and local governments and concerned citizens.

3.4) Enforcement

Sport fishing regulations in Washington are enforced by the Enforcement Program of the WDFW. The Fish Management and Enforcement programs work together to develop enforceable regulations to achieve fish and wildlife resource management goals. The Region 5 Enforcement program for the LCR includes one captain, three sergeants, and 13 enforcement officers. Although Klickitat County is within Region 5, it is outside the coverage of this plan. Enforcement activities in the LCR are conducted from offices in Vancouver and Cook, and are responsible for enforcement of state fish, wildlife, and habitat regulations in the area covered by this plan. The highest enforcement priority for fish is protection of endangered species, which includes monitoring LCR tributary and mainstem Columbia River fisheries for compliance.

The WDFW Enforcement and Fish programs work together to facilitate enforcement of resource management goals through a monthly cooperative enforcement planning process where local sergeants and officers meet monthly with local biologists at the district to set enforcement priorities by fish species. Sergeants then develop 28-day plans to address priority issues and gain desired compliance levels to protect resources and meet management goals. The results of each 28-day plan are quantified and compared to the compliance level considered necessary to meet management goals. Compliance is typically estimated based on the percentage of angler contacts where no violations are noted. The 28-day plans are adjusted if necessary based on compliance assessments to make the best use of limited resources in manpower and equipment to achieve the goals.

Fisheries are assigned a high priority for enforcement and are intensively monitored. Officers are assigned to work during open fishing days and restrictive seasons, with additional checks during closed periods. Officers conduct bank and boat patrols to check and assist anglers. Covert surveillance is also made in locations where complaints on violators have been received.
The current enforcement database tracks hours worked, angler contacts, warnings, and citations by officer by fishery. The database differentiates fisheries by location (mainstem Columbia versus tributary, or within tributaries Cowlitz versus Lewis), or salmon (chinook versus coho versus chum). Summary compliance reports are available for these fishery activities but have not been compiled except for a draft compliance report to measure how well anglers were complying with Wild steelhead release fisheries.

WDFW enforcement staff conducted a statewide angler compliance survey in 1992 and 1993 in waters that were open to fishing under wild steelhead release or catch and release regulations. A total of 4,879 anglers was contacted. The anglers had retained 351 steelhead. A total of six wild steelhead were retained, providing a compliance estimate of 98.6% (Hahn 1997). To improve compliance monitoring, WDFW is designing a study, which will focus on particular sites over time. This program will include enforcement and non-enforcement components.

3.5) Schedule and process for reviewing and modifying fisheries management.

3.5.1) Description of the process and schedule that will be used on a regular basis (e.g. annually) to evaluate the fisheries, and revise management assumptions and targets if necessary.

Wild population status and fishery performance will be assessed annually by WDFW. The annual fishery review process described in detail in Section 1.5 will continue to be employed to evaluate fisheries and revise management assumptions and targets as needed. To ensure that fish populations and fishery management is meeting the goals described in this plan, annual monitoring will include wild fish escapement numbers and/or indices, cohort replacement rates, projected future wild and hatchery numbers based on age composition of recent returns, fishery harvest of hatchery fish and handle of wild fish, fishery effort, fishery catch per unit effort, mark rates in the fishery and escapement areas, and projected fishery impacts on wild fish.

WDFW used Recovery Exploitation Rates for index populations because sufficient data was not available to estimate Recovery Exploitation Rates for each population. With the monitoring program outlined in this FMEP, WDFW will collect the data required to develop additional population specific Recovery Exploitation Rates. Critical and viable thresholds for each population have not yet been established, and instead WDFW used Recovery Exploitation Rates in this FMEP. Over the next year, WDFW will work with the TRT to develop estimates of critical and viable thresholds and incorporate these thresholds into this fishery analysis. WDFW will produce a report annually on the status of chum, chinook, and steelhead in the LCR.

3.5.2) Description of the process and schedule that will occur every 5 years to evaluate whether the FMEP is accomplishing the stated objectives. The conditions under which revisions to the FMEP will be made and how the revisions will likely be accomplished should be included.

The mean age of maturation for most steelhead and salmon population is five years and it makes little sense to evaluate this FMEP sooner than that period of time. Therefore, comprehensive reviews will be repeated by WDFW at five-year intervals thereafter until such time as the wild stocks are recovered and delisted. Consultations between WDFW and NMFS regarding management of these fisheries will be reinitiated only if there are significant changes in the status of listed chinook, chum or steelhead populations or their habitat.

SECTION 4 CONSISTENCY OF FMEP WITH PLANS AND CONDITIONS SET WITHIN ANY FEDERAL COURT PROCEEDINGS

Tribal fisheries below Bonneville Dam do not currently exist. It is unclear whether any tribes have treaty rights in the LCR tributaries. If the tribes are found to have treaty rights below Bonneville Dam, then WDFW will work with the tribes to develop tributary fisheries consistent with protection of listed species and harvest sharing. Treaty Indian fisheries promulgated by the member Tribes of the Columbia River Inter-Tribal Fish Commission may be conducted in the tributaries above Bonneville Dam. The Yakama Nation currently has fisheries in the Wind River watershed. This fishery is not regulated by WDFW. Each tribe has retained its authority to regulate its fisheries and issues fishery regulations through its respective governing bodies. The tribes are represented by their staff on the Technical Advisory Committee and participate in

monitoring activities and data sharing with other parties. The tribes have policy and technical representation in the U.S. v. Oregon and PFMC/North-of-Falcon harvest management processes, and coordinate fisheries with the State managers and Columbia River Compact as necessary.

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Appendix E. Interim Regional Habitat Strategy

August 3, 2001

SECTION 1. Introduction

This document outlines the goals and strategies the Lower Columbia Fish Recovery Board and its Technical Advisory Committee will use to:

A. Identify and rank habitat restoration and protection needs; and
B. Evaluate and rank habitat project proposals.

It should be noted that this document is an ***interim*** habitat strategy. The adequacy and sophistication of available information on fish stocks, watershed functions, and habitat conditions varies significantly across the lower Columbia region. The strategy will be refined, as better information and analytical tools become available. It is anticipated that this strategy will evolve over the next several years to become an integral element in a comprehensive salmonid recovery plan for the lower Columbia.

In the near-term, this strategy will assist the Board and project sponsors to better target limiting factors and habitat protection needs in a way that will help maximize benefits for fish recovery and ensure the most effective use of limited resources.

The strategy provides fish recovery and habitat recovery goals. It prioritizes fish stocks and habitat recovery and protection needs. And, finally, it sets forth the means the Board and TAC will use to evaluate and rank project proposals.

SECTION 2. Goals

The Lower Columbia Fish Recovery Board (LCFRB) was established by RCW 77.85.200 to coordinate fish recovery activities in the lower Columbia region of Washington State. The Board's key activities include recovery planning, watershed planning and habitat restoration and protection.

It is the overall habitat goal of the Lower Columbia Fish Recovery Board to provide the habitat necessary to support healthy, harvestable populations of ESA listed fish species in the lower Columbia region of Washington. Specific goals for fish recovery and habitat restoration and protection are:

A. **Fish Recovery Goals**

1. **Support Recovery of ESA listed stocks.**

   First priority in achieving this objective will be given to stocks that are listed under the federal Endangered Species Act (ESA). Four of six lower Columbia salmonid species

are currently listed as threatened. These are chinook and chum salmon, steelhead, and bull trout. The ESA defines species as threatened when it is "likely to become endangered within the foreseeable future throughout all or a significant portion of its range." A species is considered endangered when it is "in danger of extinction throughout all or a significant portion of its range."

Second priority will be given to species that are candidates or are proposed for listing under the ESA. Currently coho salmon are a candidate for listing. Sea-run cutthroat are proposed for listing as a threatened species.

2. Support biodiversity through recovery of native wild stocks.

The maintenance of genetic and life-cycle diversity across the region is critical to the recovery of listed fish species. To help preserve this diversity, priority will be given to habitat projects benefiting naturally spawning, locally adapted fish stocks with minimal hatchery influence. The stock origin and production type classifications used for identifying and prioritizing stocks to achieve this objective are those provided in:

a. The 1993 Washington Department of Fish and Wildlife (WDFW) Salmon and Steelhead Stock Inventory (SASSI);
b. The 1998 Salmonid Stock Inventory for bull trout (SaSI);
c. The 2000 Salmonid Stock Inventory for coho (SaSI); and
d. The Lower Columbia Steelhead Conservation Initiative (LCSCI, 1997).

SASSI notes that its stock origin designations should be considered as preliminary until such time as more detailed information confirms or refutes the current origin designations. For this reason, the SASSI data will be augmented by more recent information where and when it becomes available. In developing project proposals, sponsors are encouraged to bring forward any additional information available regarding stock identification, origin, production and status.

Based on the SASSI information, first priority under this objective will be given to stocks that are designated as being of **native** origin and **wild** production. Second priority will be given to stocks of **mixed** or **unknown** origin and **wild** production. Third priority will be given to stocks of **mixed** origin and **cultured** or **composite** production.

SASSI defines a **native** as "an indigenous stock of fish that has not been substantially impacted by genetic interactions with non-native stocks, or by other factors, and is still present in all or part of its original range." **Mixed** stocks are defined as those whose individuals originated from commingled native and non-native parents, and/or by mating between native and non-native fish; or a previously native stock that has undergone substantial genetic alteration." Stocks of **unknown** origin are those "where there is insufficient information to identify stock origin with confidence."

SASSI defines a **wild** production stock as one that "is sustained by natural spawning and rearing in natural habitat, regardless of parentage." A **cultured** stock is defined as one that "depends upon spawning, incubation, hatching, or rearing in a hatchery or other artificial production facility." A **composite** stock is a stock "sustained by both wild and artificial production."

3. Restore or sustain geographic distribution of stocks.

Maintaining multiple stocks across the region is necessary to reduce the risk that changes in environmental conditions, catastrophic events, and disease will result in an unacceptable risk of species extinction. Priority will be given to restore or sustaining the historic geographic distribution of stocks. Noteworthy in this regard are listed chum stocks. Currently only three relatively small stocks of chum exist in the region. They are located in the Grays River, Hardy Creek and Hamilton Creek. Other stocks with limited geographic distribution are summer steelhead and bull trout. Efforts should be made to increase the number and distribution of these stocks throughout their historic range within the region through habitat restoration activities.

4. Maintain healthy stocks of a listed species.

Maintaining healthy stocks of listed salmonid species can substantially reduce the biological risk and costs of species recovery. Rather than allowing habitat conditions to deteriorate to the point that healthy stocks are reduced to depressed or critical levels, priority will be given to projects that protect or restore habitat conditions and habitat – forming processes upon which existing healthy stocks of listed salmonid species depend.

Healthy stocks in the lower Columbia region are identified in Attachment 1. Of the 46 stocks of listed salmonid species in the lower Columbia, 17 are identified as healthy (13 fall chinook, 2 spring chinook, 1 winter steelhead, and 1 chum). The list is based on the WDFW SASSI and SaSI, LCSCI, and Limiting Factor Analysis (LFA, 1999-2001) reports for WRIAs 26 through 29. The information contained in Attachment 1 will be updated and augmented by more recent data when available.

5. Support recovery of critical stocks of listed species

SASSI classifies a stock as "critical" if it is "experiencing production levels that are so low that permanent damage to the stock is likely or has already occurred." SASSI further states that these stocks are "in need of immediate restoration efforts to ensure their continued existence and to return them to a productive state."

The loss of a critical stock can reduce genetic and life-cycle diversity within the region. For this reason habitat restoration and protection actions needed to support the recovery of critical stocks will be given priority. The SASSI report did not identify any critical stocks in the lower Columbia. However, the LCSCI classified Wind River summer steelhead stocks (Mainstem, Panther Creek, Trout Creek) as being in critical condition. (See Attachment 1.) Accordingly, habitat projects benefiting these stocks will be a high priority.

Habitat Protection and Restoration Goals

Recovery of salmonid species requires the restoration and protection of the habitat conditions and processes upon which the fish depend. The following goals are listed in priority order.

Restore access to habitat

Removal of man-made barriers to substantial reaches of good quality habitat provides important benefits to fish in both the near and long term. Actions to improve access can include removal or replacement of blocking culverts and reconnecting isolated habitats, such as side channel areas. Protecting or restoring properly functioning habitat conditions are only beneficial if fish have the necessary access to the habitat. In assessing the need to remove a barrier consideration must be given to the stocks and life-history stages affected and the type, quality and quantity of habitat that would be made accessible. LFA reports, barrier inventories, and other watershed and habitat assessments will be used in assessing the need to remove or correct a barrier.

Protect existing properly functioning habitat conditions.

Existing high quality habitat is critical to sustaining current fish abundance and productivity. Habitat restoration can be expensive and technically difficult, if not impossible. For this reason, protecting properly functioning habitat from degradation and loss is an important priority. LFA reports, other watershed and habitat assessments, and stock priorities will be used to identify and rank habitats for protection.

The quality and quantity habitat, the potentially affected stocks, and the nature and urgency of the threat to habitat values are key considerations in determining habitat protection needs. Priority will be given to protection of high quality habitat facing serious near-term threats.

Restore degraded watershed processes needed to sustain properly functioning habitat conditions.

Habitat projects should focus on the restoration of watershed functions that will sustain habitat conditions upon which salmon stocks depend over the long-term. Projects that address a habitat need on a temporary or near-term basis may be justified as a critical interim step in a comprehensive effort to restore natural habitat forming processes over the long-term.
LFA reports and other technical assessments will be used to help identify and prioritize key watershed functions requiring restoration or protection in each basin.

Support of critical salmonid life-history stages.

Projects may target habitat conditions needed to support critical life-history stage needs. LFA information and other technical assessments should be used to help identify the key habitat needs for each species in a given basin. Sponsors should provide

adequate supporting information linking:

- The habitat requirements of target species and life-history stages.
- The availability of those habitat conditions relative to historic conditions.
- The likelihood that the lack of suitable habitat is restricting population abundance.

Consideration will also be given to a project's contribution to critical life-history stages on a regional level. Some basins, such as the Chinook River, play an important role in the life history of fish stocks from outside the lower Columbia region. (Dewberry, 1997)

Project proposals should clearly identify each species and its life-history stages that will benefit from the proposed action.

Secure near and long-term benefits

Addressing habitat protection and restoration needs that will provide both near-term and sustainable long-term benefits for fish should receive a higher priority than addressing conditions that will provide benefits to fish only in the long-term. Projects that provide only short-term benefits may be justified if they are:

a. Part of a comprehensive effort to restore natural habitat processes over the long-term, and

b. Designed to sustain or protect a stock(s) until natural habitat processes are restored.

SECTION 3. Fish Stock Priorities

Stocks for each salmonid species have been categorized into four tiered priority groupings to assist setting habitat priorities within each watershed and across the lower Columbia region. Stocks for each watershed, except the Chinook River, were identified using SASSI. SASSI defines a stock as "the fish spawning in a particular lake or stream(s) at a particular season, which fish to a substantial degree do not interbreed with any group spawning in a different place, or in the same place at a different season."

Since SASSI stock information is not available for the Chinook River, stocks for this watershed were identified using information from Sea Resources (Dewberry, 1997), WDFW, and the WRIA 24/25 LFA.

The tiered breakdown integrates goals 1 through 5 discussed in Section 2.A above. It uses stock information taken from SASSI, LFA reports, and LCSCI. SASSI definitions of stock origin, production type, and status are outlined in Section 1.A. Attachment 1 provides a list of stocks by watershed or basin. Attachment 2 provides a listing of stocks by tier. The criteria for each of

the four tiers is provided below:

A. Tier 1 (Highest Priority)

This Tier includes stocks that are (1) listed as threatened pursuant to the ESA and are (2) classified by SASSI as native, mixed, or unknown in origin and wild in production. It also includes all chum, summer steelhead, and bull trout stocks due to their limited geographic distribution. It may include stocks designated by SASSI as healthy, depressed, or critical if the stocks satisfy the ESA, origin, and production type designations for this Tier.

B. Tier 2

This Tier includes stocks that are (1) listed as threatened pursuant to the ESA and are (2) classified by SASSI as mixed, non-native, or unknown in origin and composite in production. It includes all stocks designated by SASSI as healthy or critical and not included in Tier 1. It may also include a stock designated as depressed if the stock satisfies the ESA, origin, and production type designations for this Tier.

C. Tier 3

Tier 3 includes all stocks that are proposed or are candidates for listing under the ESA. They may be of any stock origin, production type, or status designation.

D. Tier 4 (Lowest Priority)

Tier 4 includes all stocks that are not listed or proposed for listing under the ESA. They may be of any stock origin, production type, or status designation.

SECTION 4. Habitat Protection and Restoration Priorities

The number of affected stocks and their importance along with the degree to which correction of a limiting factor or protection of habitat would help achieve or sustain properly functioning habitat conditions are key considerations in determining habitat priorities.

As discussed in Section 3, Attachment 1 identifies fish stocks by basin and their priority rating, tiers 1 through 4. It should be noted that not all stocks will be present throughout the basin. Stocks likely to be present in a given river reach can be determined using the LFA fish presence information and maps.

Attachment 3 provides a ranked list of limiting factors. Limiting factors have been identified using LFA reports. The importance of each limiting factor is ranked as high, medium, or low based on the habitat goals set forth in Section 2.B. Attachment 3 presents this ranking information in matrix form. It is organized by basin using the LFA sub-basin designations. In addition to ranking limiting factors within a basin, potential restoration and protection actions have been identified for each limiting factor. Finally, fish stocks and their priorities are also listed for each basin.

In general, limiting factors rated as high and affecting multiple high priority (Tier 1 or 2) stocks are a higher priority than limiting factors rated moderate or low and affecting few or lower priority (Tier 3 or 4) stocks.

This information is provided to assist project sponsors in identifying and developing projects that will address the most important habitat protection and restoration needs. It is intended to serve as guidance. It will be refined as additional information on fish stocks and habitat conditions becomes available. It should be further noted that basing a project on a limiting factor that is rated as high and affects high priority fish stocks substantially enhances the likelihood, but does not ensure, that a project will receive a high priority for funding. As discussed in Section 5 below, a project's priority for funding is based on both its benefit to fish and certainty of success. Certainty of success takes into consideration a project's relationship to other limiting factors and restoration efforts as well as project design, cost, and management elements.

SECTION 5. Evaluation and Ranking of Habitat Projects

The ranking of habitat project proposals will be done using the same basic approach outlined for establishing habitat priorities but also takes into consideration the degree to which a project addresses an identified habitat priority and factors affecting the level of certainty that a project will produce its intended benefits for fish.

A. Evaluation Criteria

Each proposed habitat project will be evaluated using the following criteria:

1. Benefits to Fish

a. The number of stocks that will be affected and their priorities.

The number of stocks that would benefit from a project and their priority will be determined using the tiered stock listing discussed in Section 3 and the fish presence information contained in the applicable LFA report or other comparable source.

b. The nature and significance of the benefit's the project will have for the affected stocks.

While the benefit for all affected stocks will be considered, greatest weight will be given to the project's potential value to ESA listed species or unique stocks essential for recovery.

c. The degree to which the proposed correction of a limiting factor or protection of habitat would help to achieve and sustain properly functioning habitat conditions.

Factors to be considered include the extent to which a project addresses:

(1) An identified habitat priority as discussed in Section 4 or limiting factors identified in an LFA report or other technical assessment.
(2) Section 2.B habitat goals. These include the value of the project in:
  (a) The importance of the project in restoring access to habitat;
  (b) Achieving and sustaining properly functioning habitat conditions; and
  (c) Providing for critical salmonid life history stages in the reach or basin.

2. Certainty of Success

The level of certainty that the project would produce its intended benefit for fish will be assessed based on the extent to which the proposed project:

a. Complements other habitat protection and restoration programs and projects within a basin.

Habitat projects should be designed, coordinated, and sequenced in concert with other salmon recovery activities with a watershed or basin. This can help to achieve the greatest benefit to fish in the shortest possible time and with the most efficient use of resources.

Specific consideration will be given to whether a project is:

(1) An element of a comprehensive watershed or basin restoration and protection strategy;

(2) Well coordinated and logically sequenced with other habitat projects completed, underway, and planned for a watershed or basin; and/or
(3) Complements and supports other local and state salmon recovery regulations and programs, including land use and development regulations, critical area ordinances, storm water management programs, shoreline master plans, forest management regulations, etc.

b. Has a sound technical basis in addressing habitat forming processes and limiting factors.

The success of a project requires a solid understanding of conditions and watershed processes that cause or contribute to the problem or limiting factor being addressed. For some projects, existing LFA information may be sufficient. More complex problems may require a more thorough assessment of conditions and watershed processes. This information may be available through existing studies and evaluations. In some cases, site-specific assessments and design work may be required. In order to assess whether a project has an adequate supporting technical basis, it will be important that the project proposal addresses considerations listed for its project type contained in the Guidance on Watershed Assessment for Salmon, Part 3 (Joint Natural Resources Cabinet, State of Washington, May 2001).

c. Demonstrates that sponsor experience and capabilities are commensurate with project requirements.

The success of a habitat project is dependent on the project sponsor's ability to design, plan, implement and monitor a project. Ideally, project sponsors should have experience in successfully completing project of similar nature, scope, and complexity. At a minimum, sponsors should indicate how they would acquire needed experience and expertise that they do not possess. Options for doing so could include partnerships with other agencies or organizations, or contracting for needed services.

d. Applies proven methods and technologies.

The certainty of a projects success can be enhanced through the use of proven and accepted methods and technologies. Projects should utilize approaches and technologies that are commensurate with the nature, scope, and complexity of the problem being addressed.

Innovative or experimental approaches may be acceptable if no proven method exists or it can be shown that they will reasonably extend knowledge of restoration methodologies.

e. Has community support

The long-term success of habitat restoration and protection efforts depends on the acceptance and support of local communities. Projects should be designed and implemented in a manner that accommodates local values and concerns.

f. Demonstrates that costs are reasonable for the work proposed and the benefit to be derived.

Given that resources for habitat protection and restoration are limited, projects should be designed and implemented in the most efficient and effective manner possible. Project costs should be commensurate with those for projects of similar nature, scope, and complexity. A project's chance of success can also be enhanced through the use of partnerships that can leverage expertise, contributions of materials and labor, and funding.

g. Demonstrates an effective maintenance and monitoring element.

Monitoring the effectiveness of the project is critical to determining the success of the project in meeting its objectives. Maintenance of a completed project may be critical to the project's performance and long-term effectiveness.

B. Scoring and Ranking of Habitat Project Proposals

Habitat projects will be scored by the TAC using a score sheet that is based on the evaluation criteria discussed in section 4.A. above. A sample score sheet is provided as Attachment 4.

Each project will be scored on both its benefits for fish and certainty for success. As discussed above a project's benefit to fish is determined by the affected stocks and their priority and the degree to which the proposed correction of a limiting factor or protection of habitat would help to achieve and sustain properly functioning habitat conditions. Certainty of success is the level confidence that a project will achieve its goals.

The scores for each project will be used to rate its benefit for fish and certainty of success as high, medium, or low. Based on these designations a project will be assigned to a priority using the matrix below. Within each priority category projects will be ranked based on their combined benefit and certainty scores. Projects in categories 1, 2 and 3 will be recommended for funding.

		Benefit To Fish		
		High	**Medium**	**Low**
Certainty Of Success	**High**	**Group 1**	**Group 2**	**Group 4**
	Medium	**Group 2**	**Group 3**	**Group 4**
	Low	**Group 4**	**Group 4**	**Group 4**

Appendix F. Washougal River Sub Basin Stock Summary and Habitat Priorities

Stocks and Priorities

SASSI and LCSCI Stocks	Priority	Other Anadromous Salmonids Present in the Sub-basin (LFA)
Washougal Summer Steelhead (LCSCI)	Tier 1	Chum Salmon
Washougal Winter Steelhead (LCSCI)	Tier 1	
West Fork Washougal Summer Steelhead (LCSCI)	Tier 1	
West Fork Washougal Winter Steelhead (LCSCI)	Tier 1	
Washougal Fall Chinook Salmon (SASSI)	Tier 2	
Washougal Coastal Cutthroat (SaSI)	Tier 3	
Washougal Coho Salmon (SASSI)	Tier 3	

Not all stocks are present in all parts of the subbasin. Use LFA maps or contact Gary Wade at the LCFRB for specific site information.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Fish Passage	**High:** 2.5% of the historic habitat in the subbasin is blocked. Wild Boy Dam removal is a High priority	• Wild Boy Creek Dam blocks 1.7 miles of good quality habitat for winter and summer steelhead, coho, and cutthroat. • Larson Creek culvert blocks approx. 0.4 miles of potential rearing habitat for winter steelhead, coho, and cutthroat trout. • Jones Creek culvert, under	None

		Boulder Creek Road, needs passage assessment and possibly a retrofit. • Numerous smaller tributaries to the Little Washougal have blocking culverts near their mouths and need assessment and repair. • Large cemented log jams on Silver and Bluebird Creeks may block passage for summer steelhead and need assessment. • Hatchery weirs and intake structures block habitat at various times of the year into the upper Washougal, West Fork Washougal, and Vogel Creek.	
Floodplain Conditions	**High:** Very limited floodplain habitat available with numerous modifications.	• Reconnect floodplain habitat in appropriate areas to provide additional rearing and overwintering habitat. Areas to focus include the lower mainstem Washougal, the north shore of the Washougal upstream of the 17th St. Bridge, the Little Washougal system, and Slough and Schoolhouse Creeks. • With restoration, abandoned gravel pits in the lower river might provide good rearing and overwintering habitat. This area needs assessment and if appropriate enhancement.	Preserve off-channel and side channel habitat and associated wetlands wherever they occur. The lower reaches of the mainstem and Little Washougal are priorities.

Sediment	**High:** Sediment fines are significant problems in a number of streams. Lack of spawning gravels also reduces productivity in the Washougal and many of its tributaries.	• ***Identify and repair or decommission roads that are contributing excessive fine sediments to streams in the subbasin, focusing first on the upper Washougal and its tributaries, and the Little Washougal and its tributaries.*** • ***Restrict livestock access to streams and moto-cross activities in critical areas of Winkler and Jones Creek watersheds, and along the power line corridors.*** • ***Reduce development on steep unstable slopes.*** • ***Reduce impacts from stormwater and erosion that occurs in rapidly developing basins like the Little Washougal, Lacamas Creek, and the lower mainstem Washougal.*** • ***Address bank erosion on the Little Washougal near Stauffer Rd, and a major slide on the Washougal near the Vernon Road Bridge.*** • ***Increase LWD and other structural elements that can help capture scarce spawning gravels.***	Protect existing quality riparian corridors from additional development along all anadromous streams within the subbasin. Protect areas with steep unstable slopes, starting with the major slide near the Vernon Road Bridge.
Channel/LWD Conditions	**High:** LWD levels and pool habitat are generally "poor" throughout the subbasin.	• Increase functional LWD structures, or similar natural structures, in appropriate stream reaches through LWD placement projects and/or through recruitment (though recruitment potential is low for most streams). Areas to focus include the Little Washougal, E.F. Little Washougal, middle and upper mainstem Washougal and its tributaries, and in Jones, Boulder, Winkler Creeks. • Encourage beaver activity wherever possible.	Protect existing mature riparian vegetation for LWD recruitment, especially along the upper reaches of the mainstem Washougal and its tributaries, and the Little Washougal. Maintain current appropriate pieces of LWD, and other natural structures, through increased education and enforcement.

Riparian	**Medium:** Riparian conditions are "poor" almost throughout the sub-basin.	• Target riparian restoration efforts along the most productive and/or degraded streams including the lower reaches of the Little Washougal and Winkler Creek. • Reduce, where possible, the impacts to riparian corridors of numerous stream adjacent roads in the upper Washougal and Little Washougal watershed. • Eliminate vehicle access to riparian areas along the lower Washougal, and motorcycle access to Winkler and Jones Creeks.	Preserve healthy riparian corridors in the headwaters of all the sub-basins tributaries, especially in the upper Washougal and its tributaries, and the Little and North Fork Washougal Rivers.
Water Quality	**Medium/High:** High Priority water quality problems in Lacamas Creek, main Washougal, and West Fork. For other areas data is lacking.	• Restore degraded riparian cover for all streams within the subbasin, especially along the lower mainstem Washougal and Little Washougal, and Lacamas Creek. • Fence livestock away from streams and riparian corridors, especially along impacted areas of Winkler Creek. • Protect and restore wetlands, springs, and seeps in the subbasin. • Reduce stormwater impacts on water quality, especially along the Lower Washougal, Little Washougal, and Lacamas Creek.	Protect riparian corridors in all headwaters areas to maintain the supply of cool, clean water to critical downstream spawning and rearing areas. Preserve wetlands, springs, and seeps.
Water Quantity	**Medium/High:** Both elevated peak and low flows present problems in the sub-basin. High Priority to address water withdrawals from Jones and Boulder Creeks	• Reduce stormwater impacts in the Lower Washougal, Little Washougal, and Lacamas Creek watersheds. • Water withdrawals further reduce already low flows on Boulder, Jones, and Lacamas Creeks. Develop alternative water sources that reduce impacts on low summer flows. • Identify unauthorized private diversions within the subbasin and work with	Protect fully forested and unroaded areas in the upper watershed from further development to reduce peak flows to downstream habitats. Preserve floodplain connections and associated wetlands to provide off-channel refuge from

		landowners on alternatives.	high flows and additional flood capacity.
Biological Processes	**Low/Medium:** Escapement is well below historic levels and the lack of nutrients may be limiting (Medium Priority). Invasive species reduce riparian functions and potentially increase predation in the lower river (Low Priority)	• Decrease impacts to summer steelhead holding in pools within the middle and upper Washougal River from recreational activities. • Increase contribution of marine–derived nutrients through increased use of carcasses. • Remove invasive, non-native vegetation and replace it with native species, especially along the lower mainstem and Little Washougal Rivers. • Assess and identify possible remedies to predation in the lower Washougal River and Camas Slough.	Preserve natural vegetation along riparian corridors and within wetlands.

* Restoration and Preservation Actions by Limiting Factor were prioritized based upon the Limiting Factors Report and will be circulated to TAG members for their approval.

"Poor", "Fair" and "Good" comments refer to habitat criteria developed by the Conservation Commission for the Habitat Limiting Factors Analysis Reports.