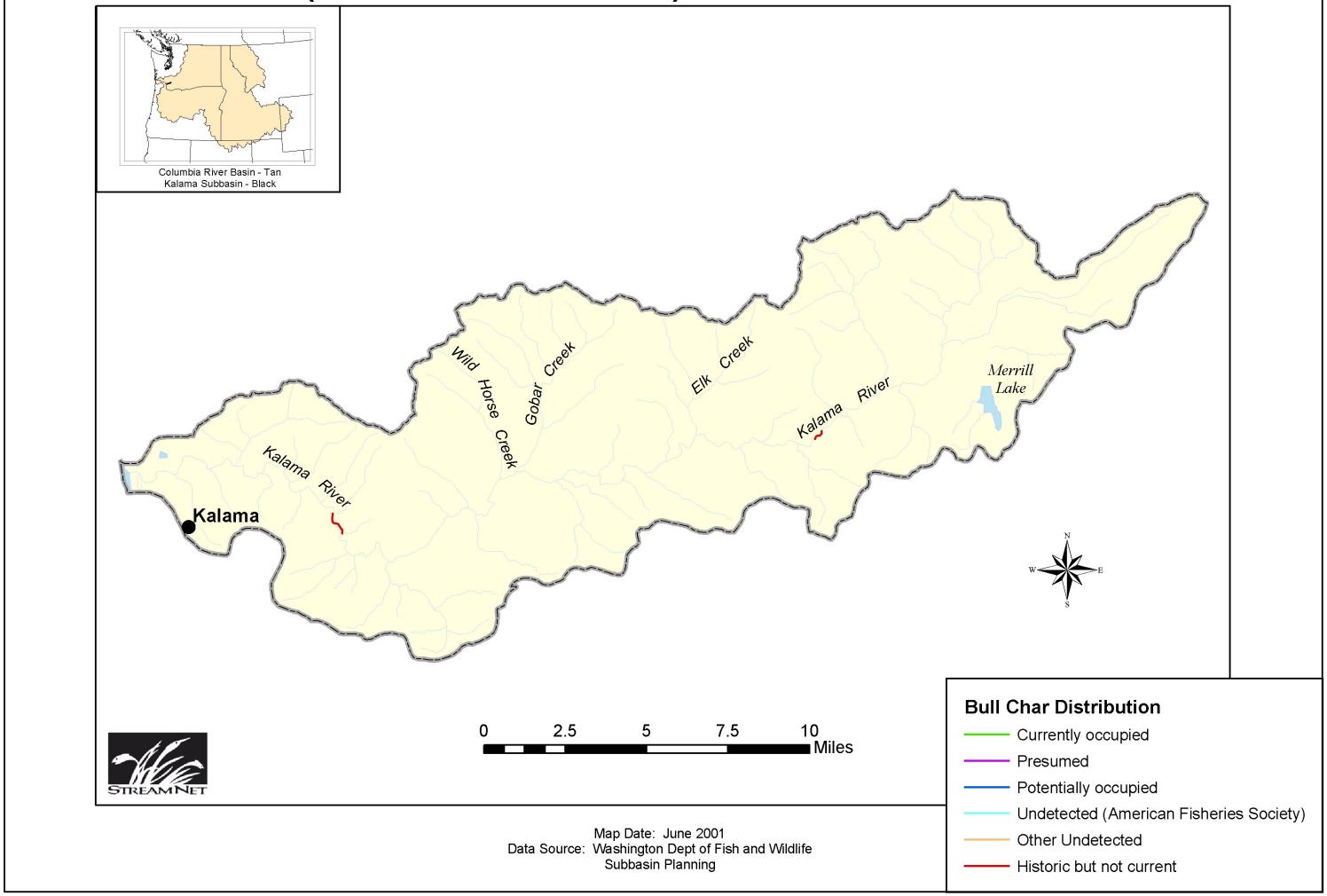
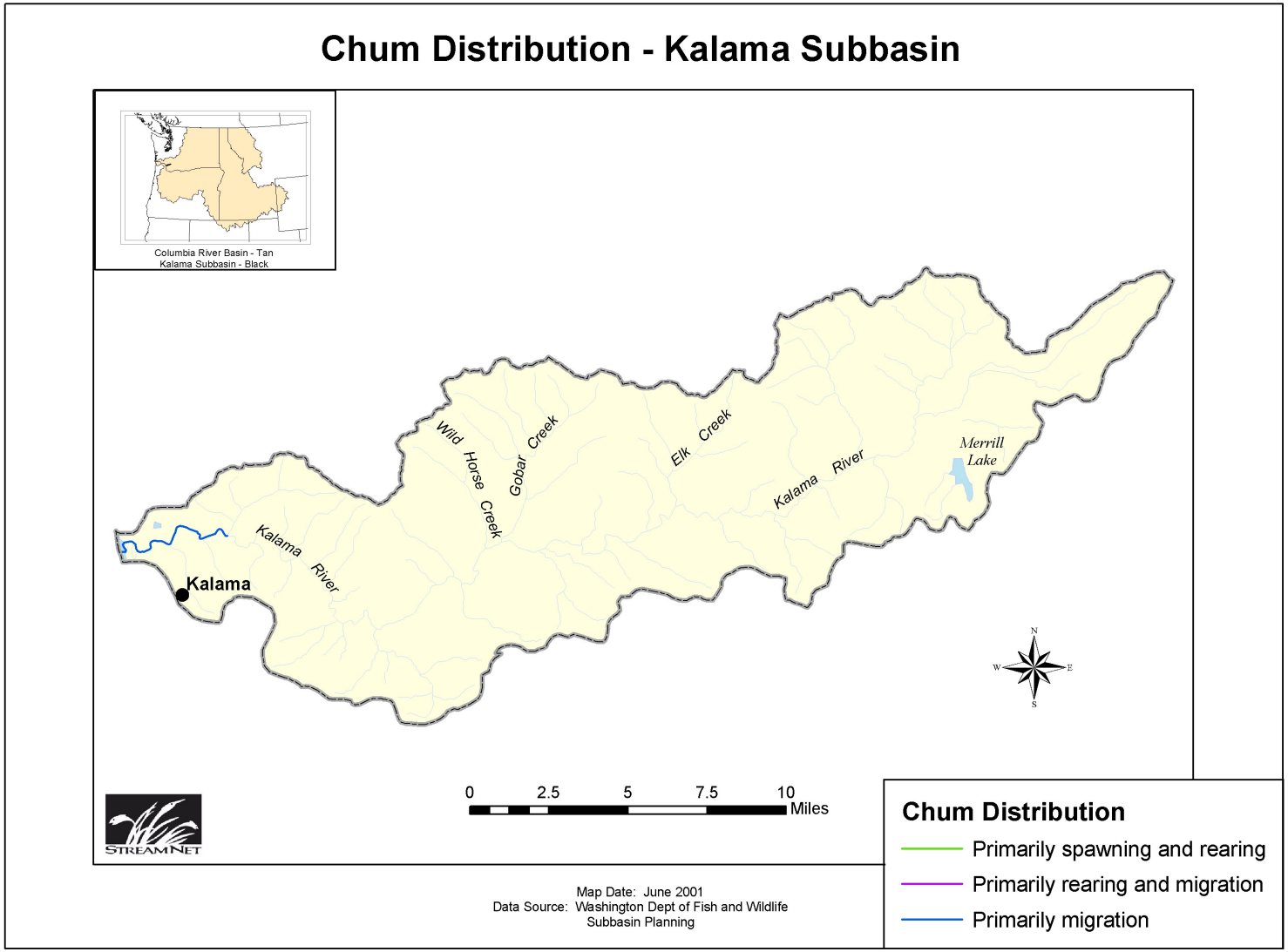
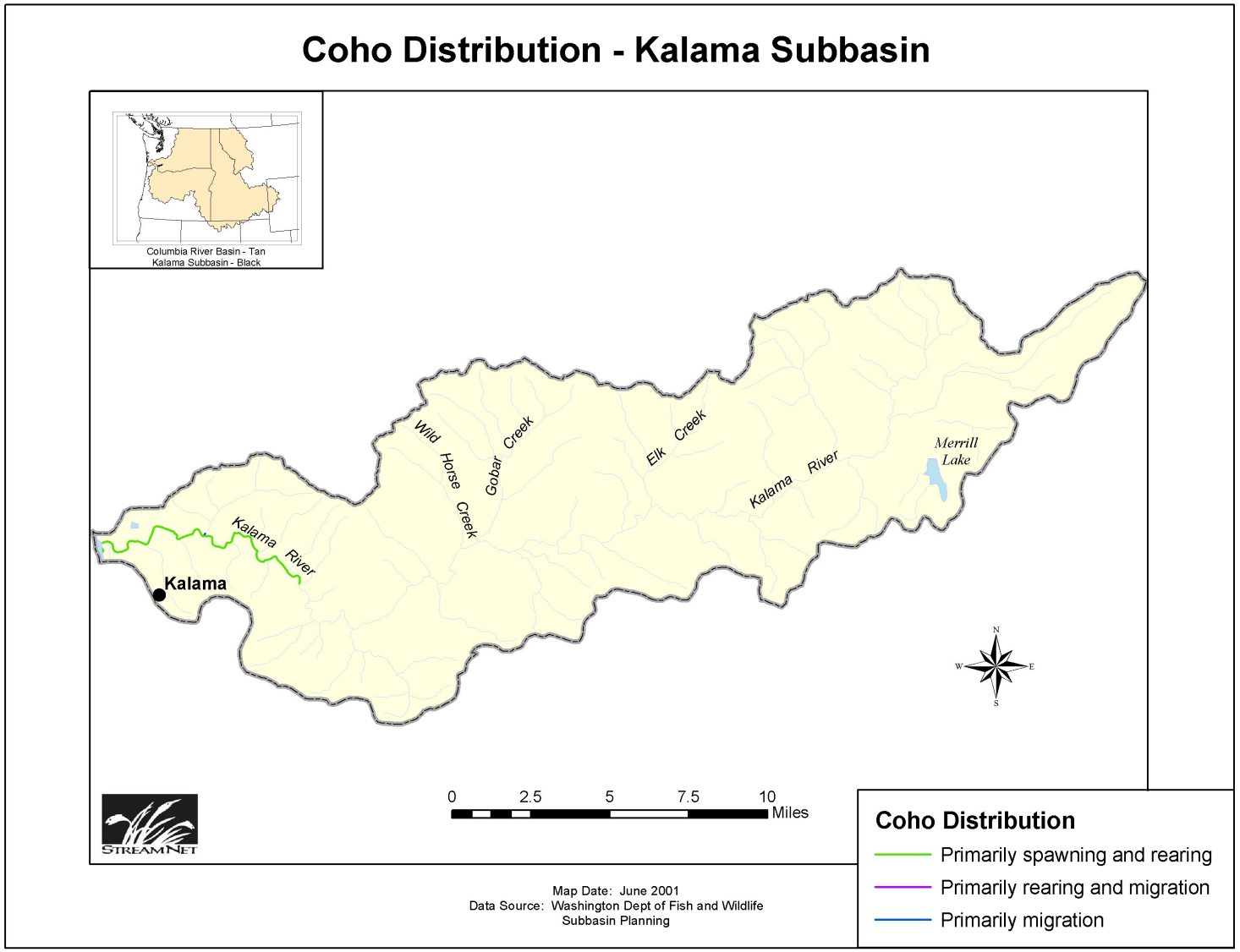
Appendix A. - Streamnet Maps

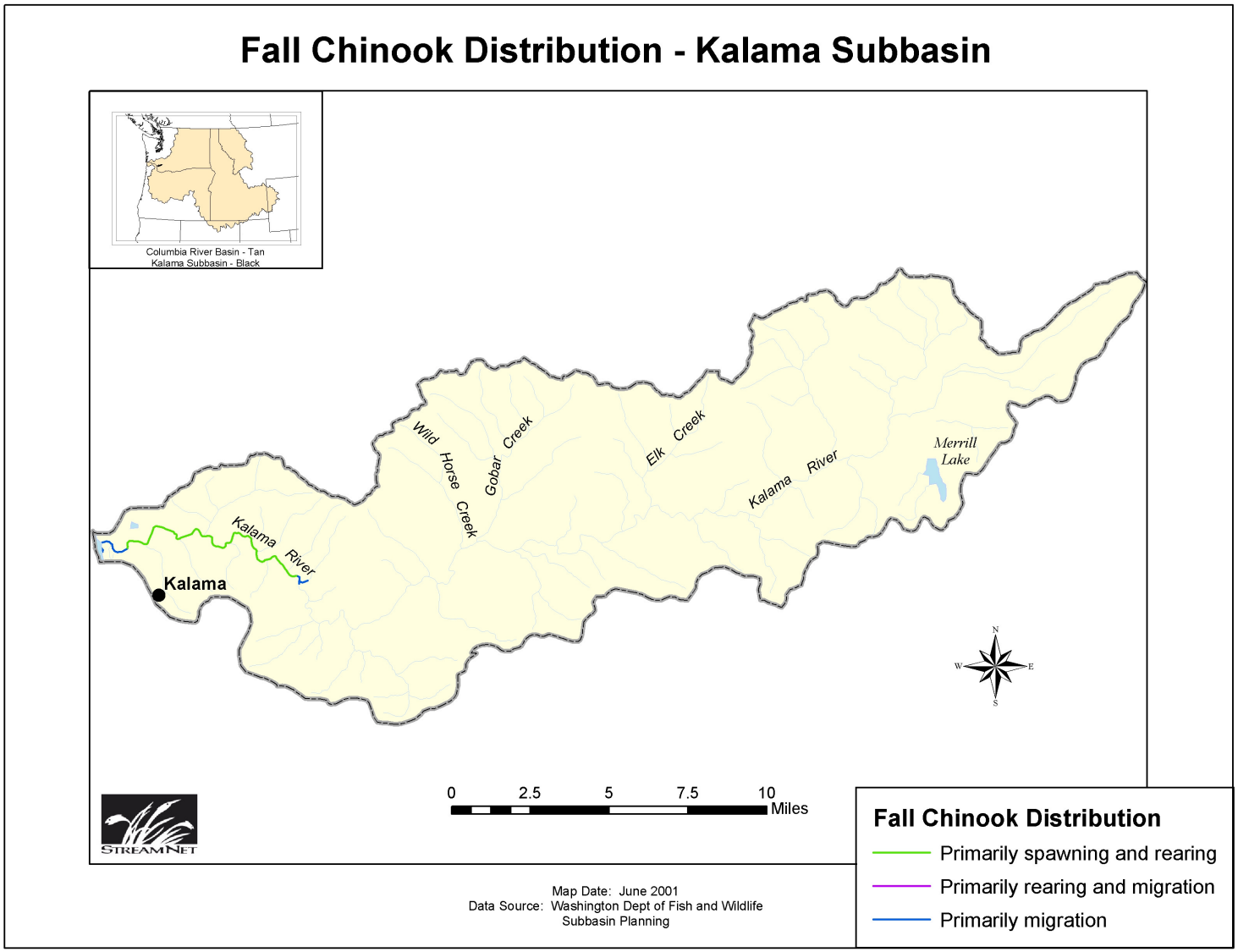
Bull Trout / Dolly Varden Distribution (Current and Historic) - Kalama Subbasin



Map Date: June 2001
Data Source: Washington Dept of Fish and Wildlife
Subbasin Planning


Chum Distribution - Kalama Subbasin
Columbia River Basin - Tan
Kalama Subbasin - Black
Wild Horse Creek
Gobar Creek
Elk Creek
Kalama River
Merrill Lake
Kalama River
Kalama
N
W
E
S
0 2.5 5 7.5 10
Miles
STREAMNET
Map Date: June 2001
Data Source: Washington Dept of Fish and Wildlife
Subbasin Planning
Chum Distribution
Primarily spawning and rearing
Primarily rearing and migration
Primarily migration


Coho Distribution - Kalama Subbasin
Columbia River Basin - Tan
Kalama Subbasin - Black
Wild Horse Creek
Gobar Creek
Elk Creek
Kalama River
Merrill Lake
Kalama River
Kalama
N
W
E
S
0 2.5 5 7.5 10
Miles
STREAMNET
Map Date: June 2001
Data Source: Washington Dept of Fish and Wildlife
Subbasin Planning
Coho Distribution
Primarily spawning and rearing
Primarily rearing and migration
Primarily migration


Fall Chinook Distribution - Kalama Subbasin
Columbia River Basin - Tan
Kalama Subbasin - Black
Wild Horse Creek
Gobar Creek
Elk Creek
Kalama River
Merrill Lake
Kalama River
Kalama
N
W
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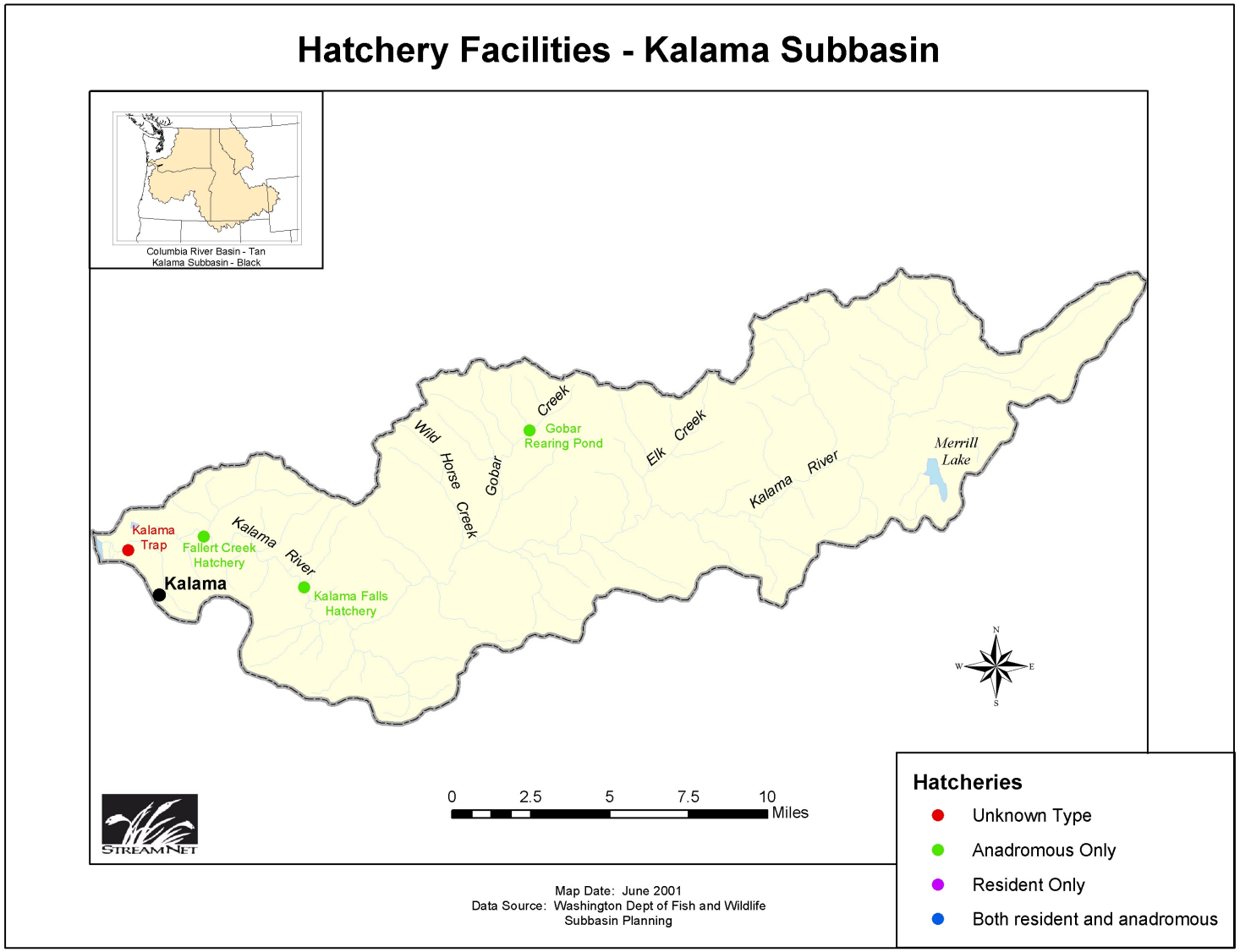
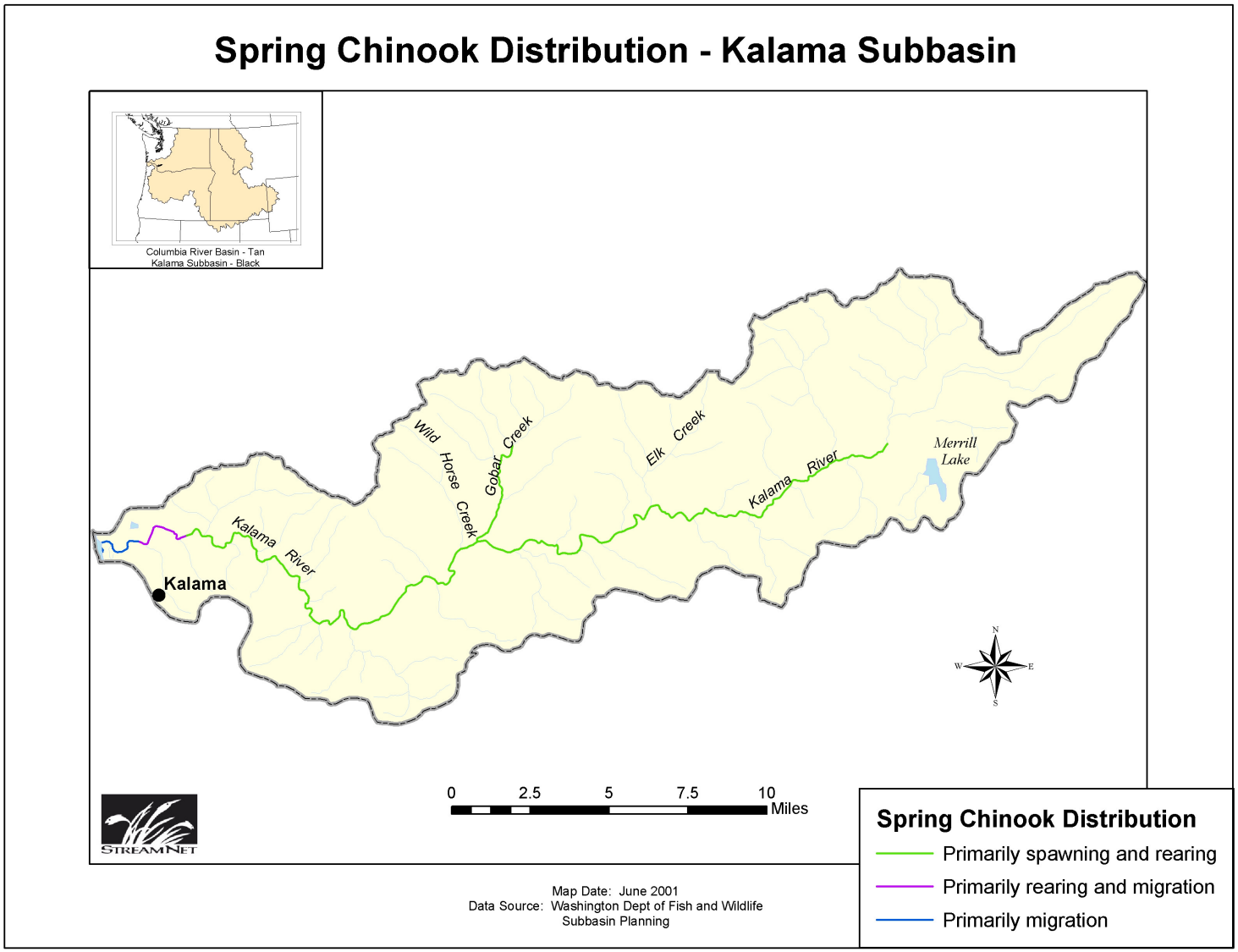
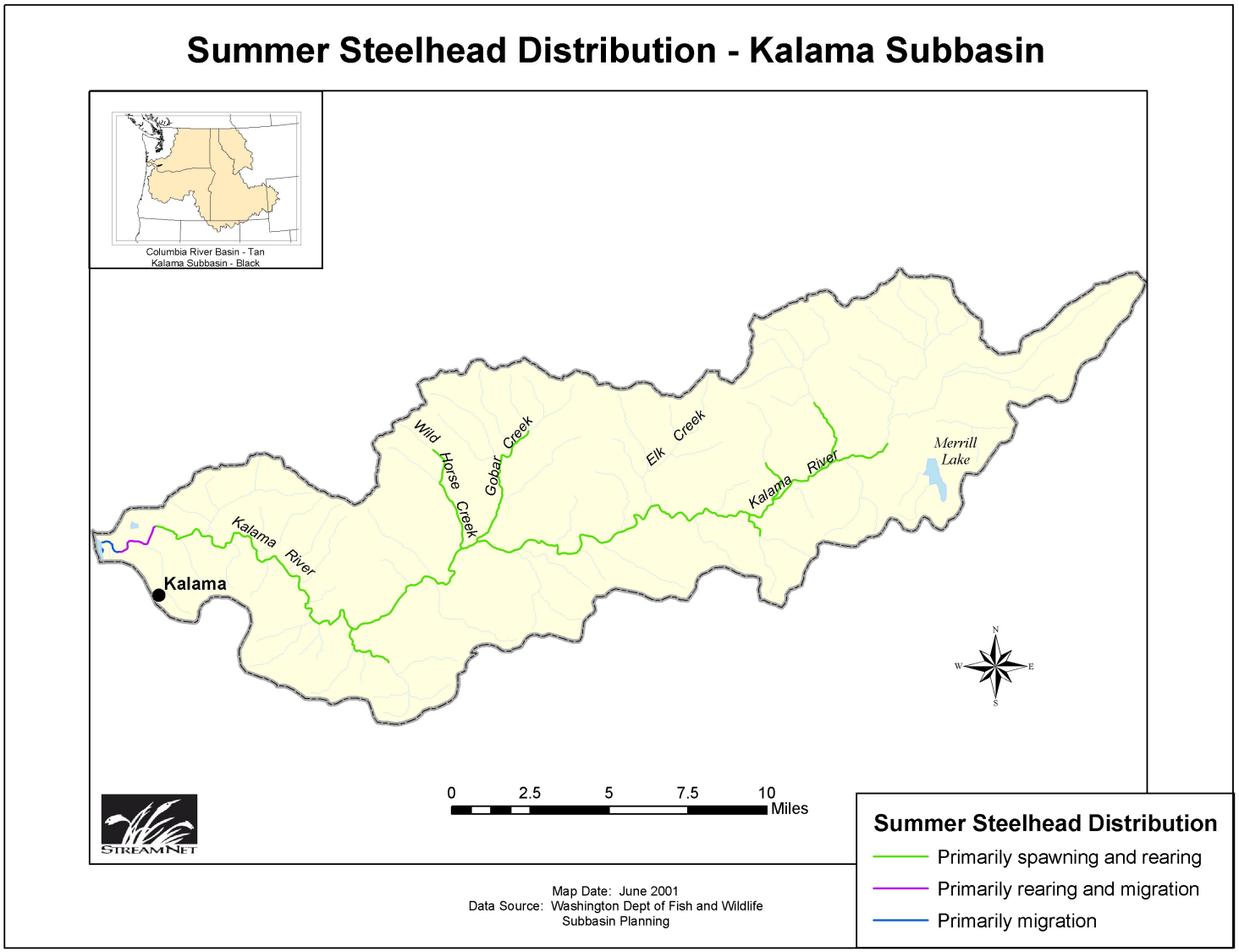
S
0 2.5 5 7.5 10
Miles
StreamNet
Map Date: June 2001
Data Source: Washington Dept of Fish and Wildlife
Subbasin Planning
Fall Chinook Distribution
Primarily spawning and rearing
Primarily rearing and migration
Primarily migration


Hatchery Facilities - Kalama Subbasin
Columbia River Basin - Tan
Kalama Subbasin - Black
Wild Horse Creek
Gobar Creek
Gobar Rearing Pond
Elk Creek
Kalama River
Merrill Lake
Kalama Trap
Fallert Creek Hatchery
Kalama River
Kalama
Kalama Falls Hatchery
N
W
E
S
0 2.5 5 7.5 10 Miles
StreamNet
Map Date: June 2001
Data Source: Washington Dept of Fish and Wildlife
Subbasin Planning
Hatcheries
Unknown Type
Anadromous Only
Resident Only
Both resident and anadromous


Spring Chinook Distribution - Kalama Subbasin
Columbia River Basin - Tan
Kalama Subbasin - Black
Wild Horse Creek
Gobar Creek
Elk Creek
Kalama River
Merrill Lake
Kalama River
Kalama
N
W
E
S
0 2.5 5 7.5 10
Miles
StreamNet
Map Date: June 2001
Data Source: Washington Dept of Fish and Wildlife
Subbasin Planning
Spring Chinook Distribution
Primarily spawning and rearing
Primarily rearing and migration
Primarily migration


Summer Steelhead Distribution - Kalama Subbasin
Columbia River Basin - Tan
Kalama Subbasin - Black
Wild Horse Creek
Gobar Creek
Elk Creek
Kalama River
Merrill Lake
Kalama River
Kalama
N
W
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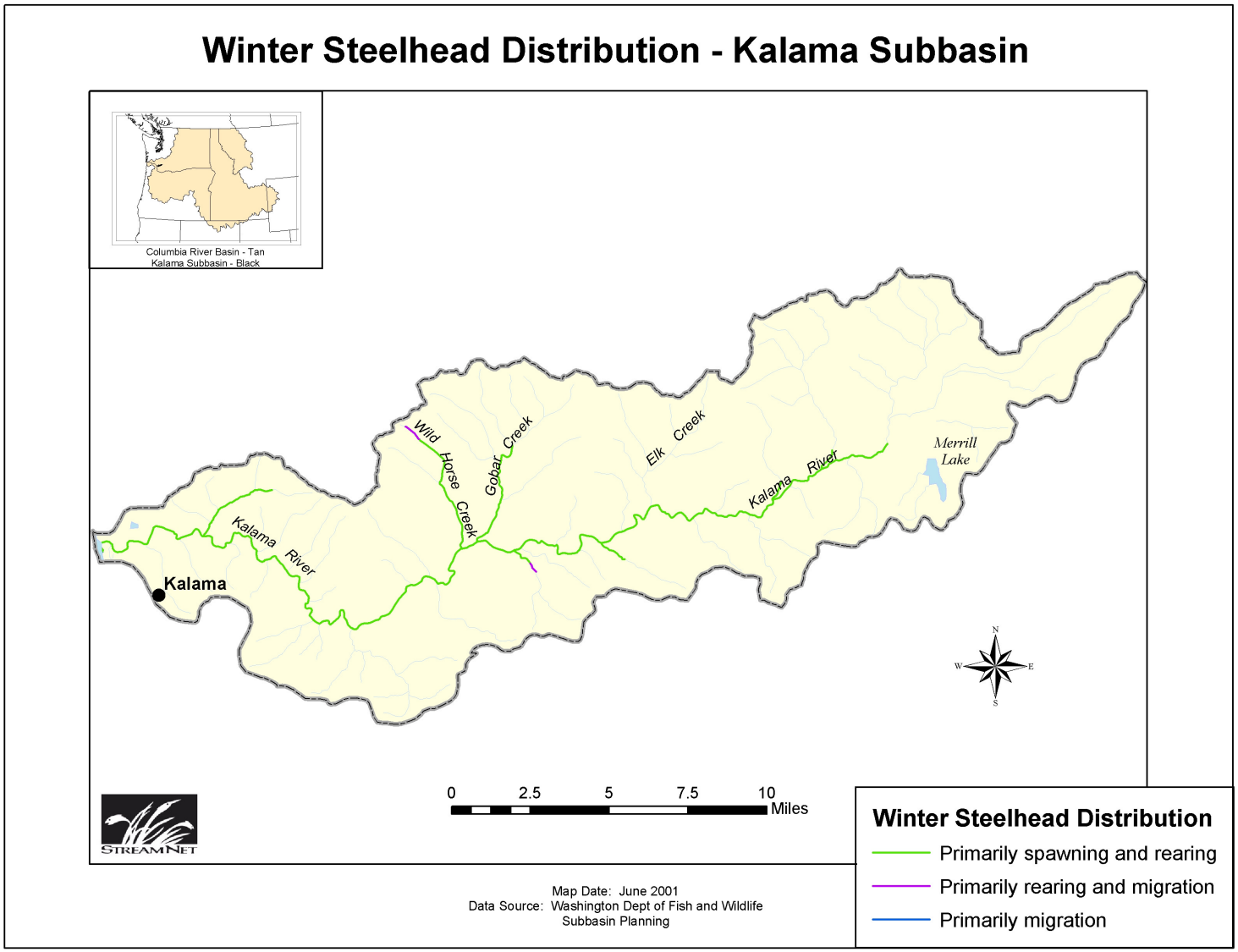
0 2.5 5 7.5 10
Miles
StreamNet
Summer Steelhead Distribution
Primarily spawning and rearing
Primarily rearing and migration
Primarily migration
Map Date: June 2001
Data Source: Washington Dept of Fish and Wildlife
Subbasin Planning


Winter Steelhead Distribution - Kalama Subbasin
Columbia River Basin - Tan
Kalama Subbasin - Black
Wild Horse Creek
Gobar Creek
Elk Creek
Kalama River
Merrill Lake
Kalama River
Kalama
N
W
E
S
0 2.5 5 7.5 10
Miles
StreamNet
Map Date: June 2001
Data Source: Washington Dept of Fish and Wildlife
Subbasin Planning
Winter Steelhead Distribution
Primarily spawning and rearing
Primarily rearing and migration
Primarily migration

Appendix B. - Hatchery Genetic Management Plans

Appendix B

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Kalama River "Wild" Summer Steelhead Program
Species or Hatchery Stock:	"Wild" Summer Steelhead (Onchorynchus mykiss) Kalama River
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Kalama River, tributary to Columbia River Washington state
Date Submitted:	April 04, 2001
Date Last Updated:	March 15, 2001

Appendix B

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Lower Columbia "Wild" Summer Steelhead Hatchery Program (Kalama River Complex)

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

Kalama River "Wild" Summer Steelhead (*Onchorynchus mykiss).*

1.3) Responsible organization and individuals

Name/Title:	Chuck Johnson, Region 5 Hatchery Operations Manager
	Mark Johnson, Complex Manager
	Pat Hulett
Organization	Washington Department of Fish and Wildlife
Address:	600 Capitol Way North, Olympia, WA 98501-1091
Telephone:	(360) 902-2653
	(360) 673-2098
	(360) 577-0197
Fax:	(360) 902-2943
	(360) 673-2995
	(360) 577-0387
E-mail:	johnscwj@dfw.wa.gov johnsmjj@dfw.wa.gov
	huletplh@dfw.wa.gov

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).

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

Kalama Falls Hatchery and trap located at RM 10 on the Kalama River (27.0002).

Fallert Creek Hatchery, a satellite facility, located 6 miles downstream (RM 4) of Kalama Falls Hatchery on the Kalama River (27.0002)
Gobar Pond (RM 3) on Gobar Creek (27.0075). Mouth of Gobar Creek is at Kalama River RM ~ 20. GIS coordinates for Gobar Pond X=122.611, Y=46.085

1.6) Type of program.

Integrated Harvest.

1.7) Purpose (Goal) of program.

The Kalama Falls "Wild" Summer Steelhead program is a mitigation and augmentation program with an intense monitoring and evaluation effort in place. Primary goals of the work are to develop a wild broodstock steelhead program to return adults to the fishery and supplement natural production. Ultimately, the research activities, in concert with the production portion of the program, will identify risks imposed upon natural production by the program, and identify strategies to manage those risks.

1.8) Justification for the program.

Wild broodstocks are increasingly being used or recommended for use in supplementation applications (intended to increase natural production of depressed stocks) and also in harvest augmentation applications (intended to provide harvest opportunity). Current theory indicates that genetic risks to wild populations might be contained if the degree of genetic similarity between hatchery and wild stocks is high. The presumption is that hatchery programs based upon or integrating locally adapted wild fish as broodstock pose the least risk to wild populations. Alternatively, interbreeding between wild fish and fish domesticated for any number of generations may pose an unacceptable level of risk by causing shifts in genetically based performance traits and affecting survival. To date, direct and conclusive empirical evidence in support of either conjecture is lacking. Production/research facilities and personnel in the Kalama Basin afford WDFW the opportunity to address these critical uncertainties. A thorough treatment of the justification for the program is provided in Sharpe et al. (2000)).

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."

Performance Standards and Indicators for lower Columbia River **Integrated Harvest** Steelhead programs.

Performance Standard	Performance Indicator	Monitoring and Evaluation Plan
Produce adult fish for harvest	Survival and contribution rates	Monitor catch and measuring survivals by periodical CWT data
Meet hatchery production goals	Number of juvenile fish released	Estimating number of fish planted (weighing / counting fish), smolt trap monitoring, monitoring proximity to hatchery production goals, number released recorded on hatchery divisions "plant reports", data available on WDFW database. Future Brood Document (FBD).
Manage for adequate escapement	Hatchery and wild return rates Catch rates	Monitoring hatchery/wild return rates through trapping (at the hatchery or at weir); spawning ground surveys plus catch records.

Minimize interactions with listed fish through proper broodstock management	Total number of broodstock collected	Measuring number of fish actually spawned and killed to meet egg take goal at the hatchery. Hatchery records.
	Sex ratios	Hatchery records
	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 database.
	Number of listed fish passed upstream	
	Hatchery stray rate	
	Number wild fish used in broodstock	Hatchery records.
	Return timing of hatchery / wild adults	CWT data and spawning ground surveys
	Adherence to spawning guidelines	Hatchery records
		Hatchery records
		Spawning guidelines

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Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	FBD and hatchery records
	Outmigration timing of listed fish / hatchery fish	
	Size, time and area of release	Hatchery records, historical natural out-migrant data, enumerating fish through counters and monitoring smolt traps
	Hatchery stray rates	FBD, hatchery records and Kalama Lab data base
		CWT data and mark / unmarked ratios of adults
Maintain stock integrity and genetic diversity	Effective population size	Spawning guidelines
	Hatchery-Origin Recruit spawners	Spawner surveys (only wild-origin hatchery spawners)

Maximize in-hatchery survival of broodstock and their progeny; and Limit the impact of pathogens associated with hatchery stocks, on listed fish	Fish pathologists will monitor the health of hatchery stocks on a monthly basis and recommend preventative actions / strategies to maintain fish health	Co-Managers Disease Policy Fish Health Exam Reports
	Fish pathologists will diagnose fish health problems and minimize their impact	
	Vaccines will be administered when appropriate to protect fish health	
	A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings	
	Fish health staff will present workshops on fish health issues to provide continuing education to hatchery staff.	
Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring	NPDES compliance	Monthly NPDES records

1.11) Expected size of program.

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

50 adults (25 males and 25 females).

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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	Gobar Pond (RM 3) on Gobar Cr. (27.0075) & multiple sites on Kalama River (27.0002) between RM 17 & RM 37	75,000

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

The program is new and no adults have returned yet. Very preliminary projections for smolt to adult returns are from 2% to 14% (mean of 7%) based on the most recent (10 yr) return rates of Skamania origin steelhead planted into the Kalama. Thus, annual adult return to the fishery and natural escapement of between 1,200 and 10,500 fish might be expected.

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

1999 broodyear.

1.14) Expected duration of program.

2001 broodyear with the potential for indefinite extension depending on the outcome of the monitoring and evaluation portion of the program.

1.15) Watersheds targeted by program.

The watershed targeted by the program is the Kalama River (WRIA 27.0002).

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

None applicable.

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.

Both natural-origin winter-and summer-run steelhead return to the Kalama River basin each year. Abundant life history and genetic information on these fish is available from the peer-reviewed literature (Leider et al. 1984, Chilcote et al. 1986, Leider et al. 1986, Leider et al. 1990).

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

Kalama River portion of listed Lower Columbia River Steelhead including both winter- and summer-run steelhead**.**

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

Lower Columbia Steelhead, Lower Columbia chinook, Lower Columbia Chum, Mid Columbia Steelhead, Upper Columbia Steelhead, Upper Columbia Spring chinook, Snake River Sockeye, Snake River chinook, Snake River Steelhead, Willamette Steelhead, Willamette 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.

The SASSI report (WDFW) describes the status of summer steelhead in the Kalama as "depressed".

Appendix B

- 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.

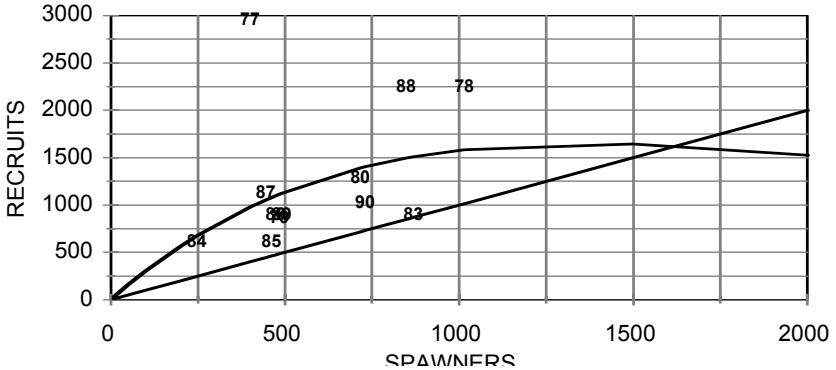

Figure 1. Spawner/recruit relationship for Kalama wild summer-run steelhead. Numbers in figure represent brood years. Source is unpublished WDFW/Kalama Research Team data.

- 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.

Table 1. Abundance of hatchery and wild summer-run steelhead in the Kalama River basin by broodyears (BY). Note: 1981 and 1982 are the years following the eruption on Mt. St. Helens and many of the apparent spawners in those years originated from out of the Kalama River basin. Wild return for BY 1999 includes spawners used as broodstock. Data for BY1997 through BY1999 is preliminary. Source is unpublished WDFW/Kalama Research Team data.

Brood Year	Wild Escapement	Wild Harvest	Wild Return	Hatchery Escapement	Hatchery Harvest	Proportion Wild Spawners
1988	950	217	1167	2199	5292	0.30
1989	684	90	774	2692	5394	0.20
1990	745	74	819	924	3609	0.45
1991	704	16	720	1034	2586	0.41
1992	1075	5	1080	1588	2612	0.40
1993	2283	204	2488	4905	4433	0.32
1994	1041	72	1113	2797	2775	0.27
1995	1302	9	1311	1741	1573	0.43
1996	614	15	629	1150	501	0.35
1997	598	38	636	2395	1012	0.20
1998	205	2	207	555	946	0.27
1999	189	26	237	187	372	0.50

- 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.

See Table 1, above.

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.

Listed summer-run steelhead not used as broodstock are trapped throughout the capture period. Fish volitionally enter the trap via a step and pool ladder at Kalama Falls Hatchery. Once in the trap they are transferred via overhead brail into a 1,000 gallon tanker truck. Fish are then trucked a short distance (100 yards) and released into a sorting pond measuring 10' X 26 X 4'. The fish are held for a short period, usually less than 24 hours, at which time biological data is gathered and the fish are tagged. Fish are either returned to the river or sequestered as broodstock to be held for up to 10 months before spawning the following winter and spring.

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

In recent years essentially all wild steelhead attempting to enter the upper Kalama watershed are captured and handled over the course of normal hatchery operations and the associated research programs in place. Since both winter and summer-run steelhead are listed in the Kalama, the total take is thus the sum of the run sizes returning to the area above the Kalama Falls Hatchery within a calendar year for each of the races. For 1998 and 1999, those totals were 677 and 681, respectively. Run size for 1999/2000 winter-run, however, was considerably larger (approximately 800 fish) and 2000 summer-run returns are also likely to be large (based on early returns, excellent smolt migration conditions in 1998, and apparently improved ocean conditions). Delayed mortality of wild summer-run steelhead for broodstock held nearly a year is less than 10%.

- 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).

See appended take table and Sharpe, et.al. (2000).

- 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.

Rates of adult collection for broodstock will be reduced (as will program size) if total adult return appears to be fewer than approximately 300 fish. In addition smolt traps are and will be pulled under periods of high flow (when risk of injury to smolts is high). Most importantly, all hatchery procedures and research protocols are continuously evaluated and reviewed so that the work can be adaptively modified to minimize risk to the threatened fish and maximize potential for success of the program.

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.

The Kalama wild broodstock hatchery program is integrated into the Lower Columbia Steelhead Conservation Initiative, especially the Monitoring and Evaluation elements of that initiative.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

The program is authorized under the Columbia River Fisheries Development Program, Columbia River Fish Management Plan and U.S. vs. Oregon.

3.3) Relationship to harvest objectives.

A harvest management plan is in development. Integration of this program into that plan and *vice versa* will occur when the plan is nearer completion.

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

Fisheries benefiting from the program will include sport fisheries in the Kalama Basin and the lower Columbia mainstem. The program is new and no adults have returned yet. A formal harvest management plan is in development. WDFW proposes the harvest of adult offspring of listed wild broodstock, the expectation is that harvest will occur at a level that: (1) ensures natural escapement of at least enough fish to replace broodstock removed from production, (2) avoids a genetic swamping effect of hatchery fish on wild fish, and (3) provides an adequate number of naturally spawning hatchery fish for a

statistically powerful design of the monitoring and evaluation portion of the program. Specifically, the latter point requires that enough wild broodstock hatchery fish spawn naturally as adults to permit accurate and precise estimates of the relative reproductive success of those spawners relative to that of wild fish. Details on the experimental methods are provided in Sharpe et al. (2000).

3.4) Relationship to habitat protection and recovery strategies.

Limiting factor analyses for steelhead in the Kalama watershed are currently under development. Likely major factors limiting production include degradation of freshwater habitat, impassible barriers (culverts), mainstem Columbia River predation on juveniles and adults, and poor ocean rearing conditions. Ongoing in-basin work addressing likely limiting factors includes replacement of impassable culverts on Wildhorse Creek (RM 19) and Gobar Creek (RM 19.5), nutrient enhancement using carcasses from Kalama Complex hatcheries and streambank protection (buffer strips) in logging operations. Actual short- and long-term benefits of the habitat work are unknown.

3.5) Ecological interactions.

Coastal cutthroat trout (*O. clarki*) are present in the Kalama watershed and are proposed to be listed under the ESA. Anadromous adult cutthroat are occasionally captured during adult trapping operations and downstream migrants are captured during smolt trapping operations. The steelhead hatchery program positively impacts the cutthroat in that very useful incidental data are collected on this species including spawner abundance indices and freshwater smolt production levels in addition to basic biological information on the species including size, sex, and run-timing. Kalama Research Team staff actively compile and distribute those data for the use of various entities engaged in planning of recovery efforts for the 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.

The hatchery water source and "natal" water source used by naturally spawning populations are the same with the exception of incubation and early rearing. The source for incubation and early rearing is obtained through a seasonal creek that is generally regarded as pathogen free. All water quality parameters are monitored under the NPDES permit number WAG13-1039. An additional pathogen-free water source is being developed as a supplement and emergency backup for incubation and early rearing. That water source is expected to be on-line by October, 1999.

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.

Hatchery intake screens conform with NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish. Effluent discharge is in compliance with NPDES standards.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Fish volitionally enter the trap via a step and pool ladder at Kalama Falls Hatchery. Once in the trap they are transferred via overhead brail into a 1,000 gallon tanker truck. Fish are then trucked a short distance (100 yards) and are released into a sorting pond measuring 10' X 80' X 4'.

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

A 1,000 gallon steel tank on a flat bed truck equipped with re-circulating pumps, supplemental oxygen system and adult release gate.

5.3) Broodstock holding and spawning facilities.

The sorting pond measures 10' X 80' X 4'. Fish utilized as broodstock are transferred to another holding pond with the same dimensions as the sorting pond. The holding pond has, in addition, floating covers to prevent jumping. Water flow is maintained at approximately 250 gallons per minute (gem) throughout the holding period.

5.4) Incubation facilities.

Incubation is done in vertical style incubators with flows set at 4 gem.

5.5) Rearing facilities.

The rearing facilities consist of intermediate troughs measuring 3' X 3' X 16' with a maximum flow of 50 gpm for fry and fingerling rearing. Raceway ponds measuring 20' X 80' X 3' (4,800 cu.ft.) with a maximum flow of 500 gpm per pond are used for continued fingerling and early yearling rearing.

5.6) Acclimation/release facilities.

At the present time a portion of the production is acclimated and released out of Gobar Pond which is an earthen pond with approximately 2 acres in surface area and a total pond volume of 430,000 cubic feet. The balance of the production is scatter planted throughout the upper Kalama River watershed during peak out-migration time frames.

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

No operational difficulties or disasters have been encountered that have led to significant mortality of this stock of fish.

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.

The hatchery is staffed full time and equipped with low water alarms on all fish rearing vessels and incubation facilities. Fish disease transmission is managed in accordance with the Co-managers Fish Health Manual (WDFW 1996).

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.

Broodstock for the program are collected at the Kalama Falls Hatchery trap (RM 10) on the Kalama River.

6.2) Supporting information.

6.2.1) History.

Wild Kalama summer-run steelhead are indigenous to the basin. They were present before annual stocking of Beaver Creek (Chambers Cr. Origin) winter-run steelhead stock began the late 1950s.

6.2.2) Annual size.

Approximately 15-25 pairs of wild summer-run steelhead will be used annually. The proportion of the natural population will, of course, vary with variation in annual return. But, in general, will be less than 33% (as low as 5% as wild run approaches 10 year average). A sex ratio of 1:1 will be imposed. Useful estimates for critical and viable population thresholds are not available for this stock (or to our knowledge any other).

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

Wild summer-run have never before been incorporated into the hatchery programs' smolt releases in the basin. The new program will be comprised entirely of wild summer-run broodstock.

6.2.4) Genetic or ecological differences.

Indigenous wild summer steelhead are genetically and behaviorally distinct from both the indigenous winter steelhead stock and hatchery summer and winter steelhead as judged by allozyme methods, run timing, and spawn timing (Leider et al. 1986, Sharpe et al. 2000). Regarding geographic and temporal spawning distribution, differences among races in geographic distribution are poorly understood. But, temporally, spawning of Kalama summer-run steelhead occurs in large part before that of the wild winter-run (Leider et al 1984).

The broodstock of wild summer-run origin are planted in such a way as to promote spawning throughout the upper watershed and selection for change in run or spawn timing is avoided. Thus, it is expected that spawning behavior of the hatchery summer-run will reflect that of the wild summer-run, except, as constrained by genetic and environmental effects on reproductive competence induced by a single generation in the hatchery (a topic that is the focus of the research portion of the program).

6.2.5) Reasons for choosing.

The Kalama summer-run is the indigenous stock and has demonstrably higher natural reproductive competence and smolt to adult return rates than the historical Skamania-origin summer-run stock.

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.

Broodstock will be collected systematically during the entire migration timing of the wild stock to minimize potential for altering that characteristic. High survival of the fish sequestered as broodstock will be promoted. The smallest viable number of broodstock will be removed from the wild.

SECTION 7. BROODSTOCK COLLECTION

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

Adults

7.2) Collection or sampling design.

Summer-run steelhead are systematically collected each year from the run at large reaching Kalama Falls Hatchery weir trap. Adult summer-run steelhead enter the trap between May and November each year. Capture efficiency is 100% for fish volunteering to the trap. The river is blocked with an impassable falls and barrier adjacent to the ladder exiting the trap preventing migration upstream of the capture point.

7.3) Identity.

The target population of wild-origin fish are identified by run timing, appearance, and the presence of an adipose fin. They are the only source used for broodstock. Some overlap in run timing between wild summer- and winter-run steelhead exists in late October and some potential exists to inadvertently include a wild winter-run fish as broodstock in the summer-run program. Also, some potential exists for out-of-basin strays to dip into the Kalama River and be included in the program. Finally, hatchery-origin (Skamania stock) fish return to the basin with run timing identical to that of wild Kalama River stock. Those rare fish that were inadvertently un-clipped as juveniles at their hatchery of origin, and also have non-stubbed dorsal fins, might be included in the Kalama program.

7.4) Proposed number to be collected:

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

50 adults (25 males and 25 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					
1996					
1997					
1998					
1999	22	27		92,407	

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.

Listed summer- run steelhead not used as broodstock are trapped throughout the capture period and held for usually less than 24 hours. At which time biological samples and data are gathered (including scales, tissue, length, sex, racial origin, presence of marine mammal scars or lesions) and then returned to the river.

If excess broodstock has actually been sequestered in the holding pond (i.e. run size is larger than anticipated) the extra spawners are to be returned to the river. Hatchery-origin broodstock collected at the hatchery site are not currently used as broodstock. All returning adults of hatchery-origin are recycled below Kalama Falls Hatchery to provide for recreational sport fishing until mid-November. After mid-November any returning summer-run fish are extracted from the system and are utilized for food banks or landlocked lake fisheries.

7.6) Fish transportation and holding methods.

Summer steelhead collected and held for spawning are maintained in a concrete raceway with a volume of 4,800 cubic feet. The pond is supplied with 250 gpm of fresh water. Typically spawners are obtained in green condition, held for up to 10 months (mean 7.5) and spawned between January and April. The holding pond is covered with floating covers and the fish receive a daily prophylactic formalin treatment at a 1,667 ppm drip for 1 hour.

7.7) Describe fish health maintenance and sanitation procedures applied.

Standard fish health protocols as defined in the Co-managers fish Health Manual (WDFW 1996) are adhered to. (See section 7.6 above).

7.8) Disposition of carcasses.

All fish are live-spawned and returned to river. Incidental mortalities are examined to determine cause of death.

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.

The risk of fish disease amplification will be minimized by following the sanitation and fish health maintenance and monitoring guidelines in the Co-managers Fish Health Manual (WDFW 1996).

SECTION 8. MATING

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

8.1) Selection method.

Broodstock are selected by taking approximately every third or fewer male and female throughout the course of the run with the exception that fish with large open lesions (generally marine mammal bites) are not taken, for fear that they might not survive the holding period prior to being spawned at the hatchery.

8.2) Males.

A back-up male is used in the modified factorial mating design. Jacks and repeat spawners are included in the proportions they represent in the run.

8.3) Fertilization.

The current fertilization protocol involves a modification of partial factorial crosses (2X2). Eggs from two females were split into two lots each (by weight) yielding four aliquots of eggs. Half of the eggs from each female were fertilized with milt from one male. Fifteen seconds after the initial fertilization, an aliquot of milt from a second male was used to back up the first. The remaining two buckets of eggs were treated similarly except that the second male was used as the primary source of milt and the first male became the backup.

Fish health procedures used for disease prevention include water hardening of eggs in an iodophor solution at spawning and biological sampling of spawners. Ovarian fluid is obtained for viral sampling from all females. Kidney and spleen samples are obtained from adults that die post spawning.

8.4) Cryopreserved gametes.

None.

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.

In addition to the use of a factorial mating design, only un-clipped wild origin fish will be used for this program. Hatchery-origin fish will not knowingly be incorporated into the gene pool.

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.

As data for only one brood year is available, the following should be considered provisional:

Brood year 1999 — Green to eyed eggs: 88 %
Eyed eggs - fry: 99.3 %
Fry to fingerling: 92.1 %
Fingerling to smolt: 97.8%

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

Extra eggs are taken as a measure against expected incubation mortality. In the unlikely event of accidents of program level of production, adjustments will be made to the hatchery-origin portion of the facility production by utilizing local landlocked lakes for fry stocking.

9.1.3) Loading densities applied during incubation.

Average size of the eggs for the 1999 brood year was 2,655 eggs per pound. The eggs are incubated in vertical incubators with 4 gpm of flow. Each individual females eggs are put down in individual incubator trays.

9.1.4) Incubation conditions.

Temperatures are monitored daily and range between 40 and 56 degrees F. Dissolved oxygen is generally at or near saturation at the influent with 7 ppm as the minimum acceptable effluent although it generally stays within 80% to 90% of saturation. Visual monitoring of sediments in the incubators is conducted daily and are flushed if necessary.

9.1.5) Ponding.

The degree of button up is usually a 1 to 2 mm slit in the ventral surface. Swim up and ponding are forced. Temperature units at ponding average 1,100. Average length is 29.5 mm with a co-efficient of variation averaging 2.53%.

9.1.6) Fish health maintenance and monitoring.

Current treatment is a 1,667 ppm drip of formalin for 15 minutes daily to control fungus on the eggs. Egg mortality is removed by hand picking. Fry mortality at ponding is generally less than 3%. Monitoring for disease is done on a continuous basis with

monthly scheduled visits by the area Fish Health Specialist. Disease treatment varies with the pathogen encountered but generally is antibiotic in nature for bacterial infections and bath or drip treatments with chemotheraputants for external infections.

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.

The water source for incubation is regarded as pathogen free and particulate matter is settled out prior to entering incubation units.

9.2) Rearing:

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..

Only one brood year is available.
1999 Fry to fingerling....98% Fingerling to smolt.....97.8%

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

Density and loading criteria vary with annual production goals. Current production goals allow for density indices to be kept at or below 0.5 and flow indices within accepted standards for the species at various temperatures. (Fish Hatchery Management, Piper et. al. 1982)

9.2.3) Fish rearing conditions

Temperature and dissolved oxygen are monitored and recorded daily during fish rearing. Temperatures during the rearing cycle range from a high of 72 to a low of 32 degrees F. Ponds are vacuum cleaned on an as-needed basis although generally weekly.

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.

MONTH	DATE	FPP	FL (mm)	W (gm)	CF	GROWTH (mm/d)
APRIL	NA	1700	NA	NA	NA	NA
MAY	NA	1371	NA	NA	NA	NA
JUNE	NA	376	NA	NA	NA	NA
JULY	NA	122	NA	NA	NA	NA
AUG.	NA	55	NA	NA	NA	NA
SEPT.	9/27/99	23.4	116.7	19.4	1.2	NA
OCT.	10/28/99	18.9	124.9	24.0	1.2	0.26
NOV.	11/29/99	15.4	137.2	29.4	1.1	0.38
DEC.	1/3/00	12.4	149.2	36.7	1.1	0.34
JAN.	1/31/00	10.9	155.0	41.5	1.1	0.21
FEB.	2/28/00	10.1	157.1	44.9	1.2	0.07
MAR.	3/30/00	7.5	174.8	60.4	1.1	0.57
APR.	4/26/00	6.5	185.3	69.9	1.1	0.39
MAY (RELEASE)	5/2/00	5.6	199.5	81.5	1.0	2.37

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

Growth rate data, expressed as mm FL/d are provided in 9.2.4, above. No energy reserve data are 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*).

Dry diets are currently used. Feed rate is applied in accordance with program goals not to exceed 0.1 to 0.15 lbs of feed per gallon per minute inflow depending on fish size. Average season feed conversion rates generally are expected to be no greater than 1.3: 1.

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

Fish health is monitored daily. Regular monthly scheduled visits are conducted by the area Fish Health Specialist. Treatment for disease is conducted under the advisement of the Fish Health Specialist. Sanitation procedures are done in accordance with the Co-managers Fish Health Manual, (WDFW 1996).

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

Visual examination of fish through rearing and release is conducted and outward signs of smoltification are noted, i.e. lack of parr marks, banding of caudal etc.

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

None.

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.

Survival is maximized and no culling occurs. Eggs obtained from later spawners are reared under an especially vigorous feeding regimen to promote growth to smolt size in a single year.

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	75,000	6	April-May	Gobar Pond (RM 3) on Gobar Cr. (27.0075) and multiple sites on Kalama River between RM 17 & RM 37.

Appendix B

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

Stream, river, or watercourse: Kalama River (27.0002)
Release point: Gobar Pond (RM 3) on Gobar Cr. (27.0075) & Kalama River between RM 17 & 37.
Major watershed: Kalama River
Basin or Region: Columbia River

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

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								
2000							73,931	6
Average								

10.4) Actual dates of release and description of release protocols.

A single brood (1999) has been released to date. Release was volitional then forced from Gobar Pond (see below) and occurs through April and May. The bulk of the fish were trucked as smolts from Kalama Falls and Fallert Creek Hatcheries. Released were from various sites (bridge crossings) between RM 17 and RM 37, occurred from 5/2/00 to 5/16/00, and coincided with peak timing of natural migration from the system.

10.5) Fish transportation procedures, if applicable.

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

10.6) Acclimation procedures.

A portion of the smolts were released from an acclimation pond, Gobar Pond, in the upper watershed. The remainder were released directly into the Kalama at various upstream release sites between RM 17 and RM 37. Presmolts are transferred to the acclimation pond in February and provided feed by hand and from demand feeders GIS coordinates for Gobar Pond X=122.611, Y=46.085.

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

A combination of freeze brands, adipose clips and blank wire snout tags are used to ensure positive identification of the outmigrating smolts and returning adults.

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

In the event of surplus fish to the program, total program numbers will be reduced through the reduction of hatchery-origin smolts planted. Hatchery-origin smolts, if in surplus numbers, will be planted in local landlocked ponds and lakes.

10.9) Fish health certification procedures applied pre-release.

As set forth in the Co-managers Fish Health Manual (WDFW, 1996).

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

Every effort will be made to avoid pre-programmed releases including transfer to alternate facilities. Emergency releases, if necessary, would be managed by removal of outlet screens and stoplogs of the rearing vessel. Such releases will occur from the Kalama Falls and Fallert Hatcheries which are below the majority of natural spawning and rearing reaches for wild listed steelhead.

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.

Rearing is conducted in such a way as to maximize smolt development and ensure minimum possible residualism. All fish are released at a time when the bulk of the natural outmigration is occurring.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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.

See section 1.10 also.

1. Smolt-to-adult survival and fishery contribution rates: Smolt to adult survival is to be assessed for both hatchery and wild steelhead in the Kalama basin. Multiple methods for estimating smolts out are in use: a subsample of smolts trucked to release sites are carefully weighed to establish average weight of fish being placed in each truckload and the total number of fish is established using the volumetric displacement method. Smolts volitionally leaving the acclimation pond are automatically counted using a commercially available array of counting tubes. Smolt traps fished in the upper watershed and at the Kalama Falls facility estimate migration rates (for wild and hatchery fish) out of the Kalama system. The number of adults back is estimated by counting fish handled at the adult trap at Kalama Falls Hatchery (see 12.5, below), adding in harvested fish estimated from harvest records, and by performing a comprehensive (mainstem and major tributaries) snorkel survey each year. In future years, after adult offspring of the wild broodstock begin to return, a creel survey will also be conducted.

2. Number of juveniles released: See 1, above.

3. Adult hatchery/wild return rates: See 1, above.

4. Total broodstock collection: Records for broodstock collection are maintained by hatchery personnel and by the Kalama Research Team.

5. Age and sex ratio of broodstock: Sex of fish handled after adult trapping is routinely noted. Broodstock fish are all uniquely tagged at the time of capture. Corrections to the noted sex occur after secondary sex characteristics become more pronounced when the adults are first handled for checking general condition and ripeness

6. Measure hatchery stray rates: Adults captured at the trap are tagged with Floy anchor tags containing contact information. Tag recoveries in basins other than the Kalama are noted and recorded.

7. Wild fish passed upstream: The numbers of wild-origin (and hatchery-origin) fish passed upstream are routinely recorded over the course of hatchery and research operations

8. Timing of adult collection: Adults are collected as broodstock in a manner designed to, as much as possible, reflect natural timing and avoid advancing run-timing.

9. Ratio of hatchery/wild broodstock: Only wild fish are retained as broodstock to ultimately produce the adult returnees that will be allowed upstream to spawn among themselves and with wild fish.

10. Return timing of hatchery vs. wild fish adult: Return timing is routinely noted and reported for adult fish captured in the adult trap.

11. Broodstock collection and spawning guidelines: Formal broodstock collection and spawning guidelines have been established and are presented in Sharpe et al. (2000).

12. Size at release: Growth and smoltification characteristics are routinely and intensively monitored for all fish reared and released from Kalama facilities including fork length, weight, condition, fin condition, and smolt coloration

13. Outmigration timing of hatchery vs. wild fish: See 1, above.

14. Divergence of hatchery fish morphology and behavioral characteristics from natural populations: Size, sex ratios, age structure, run timing and spawn timing is routinely noted over the course of normal hatchery and research operations.

15. Hatchery-origin spawners: The intent of the research portion of this program is to allow wild-origin hatchery offspring upstream to spawn among themselves and with wild fish. their abundance on the spawning grounds will be established as noted in 1, above.

16. Effective population size (to maintain stock integrity and genetic diversity): Effective population size is limited in this program. All broodstock are spawned using partial factorial crosses to partially alleviate that concern and only wild fish are used as broodstock (i.e. no intent to use returning hatchery fish as broodstock).

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

18. Water quality: NPDES monitoring is routinely conducted at Kalama facilities.

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

The existing monitoring and evaluation work at Kalama facilities has been in place for in excess of 20 years, continuously funded by NMFS as provided under the Mitchell Act. That history is the limit of our certainty of continued funding.

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.

Design and implementation of all research activities associated with monitoring and evaluation of Kalama facility operations follows peer review by internal (WDFW) staff as well as external interested parties including NMFS, USFWS, USGS-BRD, ODFW, and various academic entities.

SECTION 12. RESEARCH

12.1) Objective or purpose.

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

12.2) Cooperating and funding agencies.

WDFW and NMFS (Mitchell Act funding).

12.3) Principle investigator or project supervisor and staff.

Patrick Hulett (PI-Fish Biologist 3), Cameron Sharpe (Fish Biologist 2), and Chris Wagemann (Fish Biologist 2).

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

Threatened.

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

Adults are captured in the trap at the Kalama Falls Hatchery, loaded by braille into a fish transport truck and trucked approximately 200 meters to the sorting pond on station. The fish are periodically (2-5 times per week, depending on numbers of fish) crowded in the sorting pond, anaesthetized with CO_2 , tagged with a Floy tag, and either sequestered as broodstock or returned to the river to continue their upstream migration. A tissue sample (fin clip) is removed from all adults for DNA analysis. In addition, a small muscle biopsy is performed on a representative sub-sample (100-200 fish per year) to provide tissue for allozyme analyses and a scale sample obtained for aging. For adult fish sequestered as broodstock, the fish are held at low densities in covered hatchery ponds with daily prophylactic formalin treatments. The fish are disturbed as little as possible until the fish are sorted by sex and checked for ripeness. Sorting and, eventually, spawning are conducted under anesthesia (MS222). Females are live-spawned using the air injection method and males are strip spawned. Surviving adults are returned to the river to allow for the potential for repeat spawning in subsequent years. Mortalities are examined to ascertain cause of death.

To facilitate identification of hatchery-origin juveniles at all life history stages, all the fish receive blank wire snout tags. Juvenile fish are sampled from the hatchery facilities and from the river throughout rearing and during downstream migration as smolts. For samples taken during rearing, fish are netted from the rearing or acclimation ponds and anaesthetized with MS222. Length, weight, fin condition and degree of smolt development are recorded and the fish are returned to their rearing vessels. For samples taken from the river, juveniles (both wild and "hatchery") are captured primarily using two rotary screw traps at RM 37 and 20 and treated as described above. A representative sub-sample is wire tagged and injected with a fluorescent pigment and released above each trap site to allow estimation of trap efficiency. The remaining fish are released from the trap to continue their downstream migration. Instream juveniles are also sampled using electro-fishing (in compliance with NMFS Electrofishing Guidelines) and angling methods to estimate degree and patterns of residualism.

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

The research project as outlined above and detailed in Sharpe et al. (2000) will continue through 2011. The relatively intense monitoring of rearing, migration, and residualism will end with the out-migration of the 2001 brood in the spring and early summer of 2002. The balance of the research program will involve monitoring of smolt to adult returns and natural reproductive performance in subsequent years.

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

Refer to section 9.

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

Table 1. provides types and levels of take in this project. Virtually all adult steelhead attempting to enter the upper watershed will be captured and handled. Those fish are thus necessarily subjected to stress and risk of injury or mortality. However, the procedures used have been in place for over 20 years and, because of that experience, the potential for injury or mortality is low. All adults are handled quickly and efficiently in vessels of adequate volume and flow. The collection of important biological information and samples is carried out under anesthesia with attention paid to allowing sufficient recovery time before returning fish to the river. Adult fish sequestered as broodstock are held at low densities in covered hatchery ponds with daily prophylactic formalin treatments.

As with the adult sampling, the smolt trapping and other juvenile sampling operations subject fish to risk. Again, well established protocols are in place to ensure that the levels of risk and potential for injury or mortality are low. Also, only a fraction of the run of the river juvenile fish are sampled and most are of hatchery origin.

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).

See Table 1.

12.10) Alternative methods to achieve project objectives.

None.

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

Coastal cutthroat trout (*Onchorynchus clarki).* Ongoing smolt and adult trapping efforts regularly entrain cutthroat trout. Actual levels of mortality associated with those activities are unknown but are assumed to be negligible. Assuming, for example, maximum mortality of 5% and given that 358 cutthroat are captured in 2000 (WDFW unpublished data) while conducting steelhead research, 18 mortalities could have occurred in this year. Capture rate for future years of the project are expected to be similar to that of 2000.

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.

In addition to the measures describing care and handling of the listed fish provided in sections 2, 8, 9, 11, and elsewhere in this section (12), actual take will be determined on an annual basis and compared to the levels detailed in the appended take table. Causes for any take in excess of those provided in the take table will be identified and corrective action will be taken to remedy the problem.

SECTION 13. ATTACHMENTS AND CITATIONS

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Sharpe, C.S., P.L. Hulett, and C.W. Wagemann. 2000. Studies of hatchery and wild steelhead in the lower Columbia region. WDFW annual report for FY1998. WDFW FPA 00-10. 38 pp + appendices.

Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes. 1998. Co-managers of Washington fish health policy. Fish Health Division, Hatcheries Program. Washington Dept. Fish and Wildlife, Olympia.

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:_____

Table 1. Estimated listed salmonid take levels of by hatchery activity. Table combines take associated with both the wild winter-run and wild summer-run and, in addition, the hatchery winter-run portions of the Kalama program (i.e., take tables from three separate Kalama River winter- and summer-run HGMPs are not additive). This table by itself provides the total expected take of listed steelhead associated with hatchery activities in the Kalama watershed.

Listed species affected: Steelhead	**ESU/Population: lower Columbia Steelhead**			
Location of hatchery activity: Kalama River, WA	**Dates of activity: April-November (00-02) Hatchery program perator:_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)	0	0	0	0
Collect for transport b)	0	0	0	0
Capture, handle, and release c)	0	200[2]	0	0
Capture, handle, tag/mark/tissue sample, and release d)	0	3,000[3]	5,000[5]	0
Removal (e.g. broodstock) e)	0	0	80[6]	0
Intentional lethal take f)	1,000[1]	200[1]	0	0
Unintentional lethal take g)		150[4]	40[7]	0
Other Take (In-hatchery rearing) h)	0	116,000[7]	0	0

Footnotes:

[1] Maximum likely samples taken annually from naturally produced fish for genetic or physiological work in the watershed.

[2] Maximum likely number of juveniles sampled annually by smolt trap, electrofishing, and angling and then released without marks or tags.

[3] Maximum likely number of juveniles sampled annually by smolt trap, electrofishing, and angling and then released after insertion of a wire tag and/or injection with a fluorescent dye mark, and/or non-lethally tissue sampled.

[4] Maximum likely annual incidental mortality (5%) on naturally produced juveniles sampled by smolt trap, electrofishing, and angling.

[5] Includes handling during normal hatchery operations of all of the maximum likely number of naturally produced adult summer-run and winter-run adults attempting to enter the upper watershed

[6] Assumes maximum likely annual number of broodstock (80 adults) for both summer-run (50 fish) and winter-run (30 fish) portions of the wild broodstock program. Value does not incorporate post spawning survival after returning fish to river (i.e., assumes no male broodstock continue upstream to spawn naturally and no males or females return to spawn in later years).

[7] Assumes maximum likely mortality (1%) during handling of all wild summer-run and winter-run adults.

8 "Take" of eggs from wild broodstock implicitly included in expected maximum adult take of 80 fish.

Appendix B

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

Listed species affected: chinook	**ESU/Population: Lower Columbia chinook**			
Location of hatchery activity: Kalama River hatchery Dates of activity: April-November (00-02) 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**			
Location of hatchery activity: Kalama River hatchery Dates of activity: April-November (00-02) 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 (HGMP)

Hatchery Program:	Kalama River "Wild" Winter Steelhead Program
Species or Hatchery Stock:	"Wild" Winter Steelhead (Onchorynchus mykiss) Kalama River
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Kalama River, tributary to Columbia River Washington state
Date Submitted:	April 04, 2001
Date Last Updated:	March 15, 2001

Appendix B

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Lower Columbia "Wild" Winter Steelhead Hatchery Program (Kalama River Complex)

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

Kalama River "Wild" Winter Steelhead (*Onchorynchus mykiss).*

1.3) Responsible organization and individuals

Name(and title):	Chuck Johnson, Region 5 Hatchery Operations Manager Mark Johnson, Complex Manager Pat Hulett
Organization	Washington Department of Fish and Wildlife
Address:	600 Capitol Way North, Olympia, WA 98501-1091
Telephone:	(360) 902-2653 (360) 673-2098 (360) 577-0197
Fax:	(360) 902-2943 (360) 673-2995 (360) 577-0387
E-mail:	johnscwj@dfw.wa.gov johnsmjj@dfw.wa.gov huletplh@dfw.wa.gov

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 .

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

Kalama Falls Hatchery and trap located at RM 10 on the Kalama River (27.0002).

Fallert Creek Hatchery, a satellite facility, located 6 miles downstream (RM 4)of Kalama Falls Hatchery on the Kalama River (27.0002)

Gobar Pond (RM 3) on Gobar Creek (27.0075). Mouth of Gobar Creek is at Kalama River RM ~ 20.

1.6) Type of program. Integrated Harvest.

1.7) Purpose (Goal) of program.

The Kalama Falls "Wild" Winter Steelhead program is a mitigation and augmentation program with an intense monitoring and evaluation effort in place. It seeks to provide much needed information on critical uncertainties regarding the logistical challenges, benefits, and risks associated with hatchery production programs utilizing local wild broodstocks. The monitoring and evaluation component of the program will be conducted for at least the first three brood years (1998-2000) of the program. The information gained will be used in an adaptive management context to help guide changes in the production program beyond the 2000 broodyear as deemed appropriate. The information will also help guide decisions on whether and how to incorporate wild broodstock programs in other basins.

1.8) Justification for the program.

This program is intended to be used as a tool to aid in final development and evaluation of a full scale Kalama "Wild" Winter Steelhead hatchery production program. Our ultimate goals are to develop wild broodstock programs and quantify risks, especially genetic risks, imposed upon natural salmonid production by wild broodstock hatchery programs and to identify strategies to contain those risks. The pilot project is intended to resolve technical uncertainties and logistic obstacles associated with spawning wild steelhead adults and successfully rearing their offspring for volitional release as age 1 smolts. This information and experience is expected to substantially reduce the risk of failure of the production and intensive evaluation of the summer-run wild broodstock program. In addition, the pilot project is intended to directly compare the performance of the Beaver Creek Hatchery (BCH) winter-run program currently used in the Kalama River system to that of a wild broodstock program. Characteristics of the wild broodstock origin fish ("Kalama Lates") will be compared to those of two different Beaver Creek Hatchery origin groups: "Kalama Earlies" (derived from adults returning from previous plants of BCH strain smolts in the Kalama and reared in the Kalama Complex along with the wild broodstock fish) and "BCH Production" (fish identical in origin to Kalama Earlies but reared at BCH using normal production protocols and shipped as smolts or late pre-smolts to the Kalama for release). Information provided by these comparisons will be directly relevant to looming fish management decisions regarding the use of hatchery steelhead stocks in the Lower Columbia and elsewhere in Washington. Such information is urgently needed to address genetic risk and other wild stock conservation issues associated with the Wild Salmonid Policy, the Lower Columbia Steelhead Conservation Initiative and ESA listing considerations.

Adult returns from wild broodstock are intended to be available for harvest and have adipose fins removed. Only a small portion of these returning adults will be allowed into upstream spawning and rearing habitat to replace the number of returning adults that would have been naturally produced by the wild adults removed for hatchery broodstock. All

additional returning hatchery adults of wild broodstock origin will be removed at a barrier/trap facility at KFH (RM 10) and trucked to downstream release sites. This is intended to provide additional harvest opportunity while protecting the wild stocks in primary upriver spawning and rearing habitats from ecological and genetic interaction with the wild broodstock hatchery fish.

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

1.9) List of program "Performance Standards".

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."
Performance Standards and Indicators for lower Columbia River **Integrated Harvest** Steelhead programs.

Performance Standard	Performance Indicator	Monitoring and Evaluation Plan
Produce adult fish for harvest	Survival and contribution rates	Monitor catch and measuring survivals by periodical CWT data
Meet hatchery production goals	Number of juvenile fish released	Estimating number of fish planted (weighing / counting fish), smolt trap monitoring, monitoring proximity to hatchery production goals, number released recorded on hatchery divisions "plant reports", data available on WDFW database. Future Brood Document (FBD).
Manage for adequate escapement	Hatchery and wild return rates Catch rates	Monitoring hatchery/wild return rates through trapping (at the hatchery or at weir), spawning ground surveys plus catch records.
Minimize interactions with listed fish through proper broodstock management	Total number of broodstock collected	Measuring number of fish actually spawned and killed to meet egg take goal at the

	Sex ratios	hatchery. Hatchery records.
		Hatchery records
	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 database.
	Number of listed fish passed upstream	
	Hatchery stray rate	
	Number wild fish used in broodstock	Hatchery records.
	Return timing of hatchery / wild adults	CWT data and spawning ground surveys
	Adherence to spawning guidelines	Hatchery records
		Hatchery records
		Spawning guidelines

Minimize interactions with listed fish through proper rearing and release strategies	Juveniles released as smolts	FBD and hatchery records
	Outmigration timing of listed fish / hatchery fish	
	Size, time and area of release	Hatchery records, historical natural out-migrant data, enumerating fish through counters and monitoring smolt traps
	Hatchery stray rates	FBD, hatchery records and Kalama Lab data base
		CWT data and mark / unmarked ratios of adults
Maintain stock integrity and genetic diversity	Effective population size	Spawning guidelines
	Hatchery-Origin Recruit spawners	Spawner surveys (only wild-origin hatchery spawners)

Maximize in-hatchery survival of broodstock and their progeny; and Limit the impact of pathogens associated with hatchery stocks, on listed fish	Fish pathologists will monitor the health of hatchery stocks on a monthly basis and recommend preventative actions / strategies to maintain fish health	Co-Managers Disease Policy Fish Health Exam Reports
	Fish pathologists will diagnose fish health problems and minimize their impact	
	Vaccines will be administered when appropriate to protect fish health	
	A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings	
	Fish health staff will present workshops on fish health issues to provide continuing education to hatchery staff.	
Ensure hatchery operations comply with state and federal water quality standards through proper environmental monitoring	NPDES compliance	Monthly NPDES records

1.11) Expected size of program.

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

Up to 30 adults, 15 males and 15 females may be collected if average fecundity is low, but typically expect to collect only 12 pairs or 24 adults total.

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	Gobar Pond (RM 3) on Gobar Cr. (27.0075), tributary to Kalama River (27.0002)	45,000

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

Complete adult returns from the first (1998) brood year will not be available until 2002.

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

1998 brood year.

1.14) Expected duration of program.
2000 broodyear for production with evaluations to continue through at least 2004. Production program may be continued beyond 2000 broodyear depending on program success up to that point.

1.15) Watersheds targeted by program.

The watershed targeted by the program is the Kalama River (WRIA 27.0002).

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.
None applicable.

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.

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

Kalama River "Wild" Winter-run component of listed Lower Columbia River Steelhead.

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

Lower Columbia Steelhead, Lower Columbia chinook, Lower Columbia Chum, Mid Columbia Steelhead, Upper Columbia Steelhead, Upper Columbia Spring chinook, Snake River Sockeye, Snake River chinook, Snake River Steelhead, Willamette Steelhead, Willamette 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.

The SASSI report (WDFW) describes the status of winter steelhead in the Kalama as "healthy".

-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.

- 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.

See Table 2.2.2A below.

- 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.

See Table 2.2.2A below.

Table 2.2.2. Abundance of hatchery and wild winter-run steelhead in the Kalama River basin by broodyear (BY). (The wild stock is the indigenous Kalama winter-run stock and the hatchery stock is the Beaver Creek Hatchery stock that has historically been the primary source of hatchery winter-run smolts stocked in the Kalama River. Note that 1980 and 1981 are the years affected by the eruption of Mt. St. Helens and many of the apparent spawners in those years originated from out of the Kalama River basin. Wild return for BY

1998 and 1999 include spawners used as broodstock. Data for BY1997 through BY2000 is preliminary).

Brood Year	Wild Escapement	Wild Harvest	Wild Return	Hatchery Escapement	Hatchery Harvest	Proportion Wild Spawners
1977	774	1229	2003	172	170	0.82
1978	694	1114	1808	921	998	0.43
1979	371	647	1019	150	161	0.71
1980	1025	1067	2092	322	585	0.76
1981	2150	2162	4312	620	318	0.78
1982	869	1719	2589	239	453	0.78
1983	532	1020	1552	342	298	0.61
1984	943	959	1902	1064	617	0.47
1985	632	1487	2119	435	1126	0.59
1986	919	643	1562	1613	1179	0.36
1987	982	218	1199	812	647	0.55
1988	1079	486	1564	1056	943	0.51
1989	500	571	1065	269	1447	0.65
1990	356	424	780	400	970	0.47
1991	959	26	985	329	871	0.74
1992	1974	15	1988	873	1342	0.69
1993	843	75	917	312	790	0.73
1994	725	13	739	191	195	0.79
1995	1030	53	1083	285	270	0.78
1996	725	48	773	881	1088	0.45
1997	456	33	489	49	384	0.90
1998	372	4	388	0	290	1.00
1999	478	23	513	0	242	1.00
2000	~800	?	~800	0	?	1.00

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.

Listed winter run steelhead not used as broodstock are trapped throughout the capture period. Fish volitionally enter the trap via a step and pool ladder at Kalama Falls Hatchery. Once in the trap they are transferred via overhead brail into a 1,000 gallon tanker truck. Fish are then trucked a short distance (100 yards) and are released into a sorting pond measuring 10' X 80' X 4'. The fish are held for a short period, less than 24 hours, at which time biological data is gathered, and the fish are either returned to the river or sequestered as broodstock to be spawned the following winter and spring.

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

Not known.

- 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 appended "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.
Rates of adult collection for broodstock will be reduced (as will program size) if total adult return appears to be fewer than approximately 300 fish. In addition smolt traps are and will be pulled under periods of high flow (when risk of injury to smolts is high). Most importantly, all hatchery procedures and research protocols are continuously evaluated and reviewed so that the work can be adaptively modified to minimize risk to the threatened fish and maximize potential for success of the program.

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.

The Kalama wild broodstock hatchery program is integrated into the Lower Columbia Steelhead Conservation Initiative, especially the Monitoring and Evaluation elements of that initiative.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

The program is authorized under the Columbia River Fisheries Development Program, Columbia River Fish Management Plan and U.S. vs. Oregon.

3.3) Relationship to harvest objectives.

A harvest management plan is in development. Integration of this program into that plan and *vice versa* will occur when the plan is nearer completion.

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

Fisheries benefiting from the program will include sport fisheries in the Kalama Basin and the lower Columbia mainstem. The program is new and no adults have returned yet. A formal harvest management plan is in development. WDFW proposes the harvest of adult offspring of listed wild broodstock, the expectation is that harvest will occur at a level that include: (1) natural escapement of at least enough fish to replace broodstock removed from production and (2) avoids a genetic swamping effect of hatchery fish on wild fish. Details on the experimental methods are provided in Sharpe et al. (2000).

3.4) Relationship to habitat protection and recovery strategies.

Limiting factor analyses for steelhead in the Kalama watershed are currently under development. Likely major factors limiting production include degradation of freshwater habitat, impassible barriers (culverts), mainstem Columbia River predation on juveniles and adults, and poor ocean rearing conditions. Ongoing in-basin work addressing likely limiting factors includes replacement of impassable culverts on Wildhorse Creek (RM 19) and Gobar Creek (RM 19.5), nutrient enhancement using carcasses from Kalama Complex hatcheries and streambank protection (buffer strips) in logging operations. Actual short- and long-term benefits of the habitat work are unknown.

3.5) Ecological interactions.

Coastal cutthroat trout (*O. clarki*) are present in the Kalama watershed and seem likely to soon be listed under the ESA. Anadromous adult cutthroat are occasionally captured during adult trapping operations and downstream migrants are captured during smolt trapping operations. The steelhead hatchery program positively impacts the cutthroat in that very useful incidental data are collected on this species including spawner abundance indices and freshwater smolt production levels in addition to basic biological information on the species including size, sex, and run-timing. Kalama Research Team staff actively compile and distribute those data for the use of various entities engaged in planning of recovery efforts for the 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.

The hatchery water source and "natal" water source used by naturally spawning populations are the same with the exception of incubation and early rearing. The source for incubation and early rearing is obtained through a seasonal creek that is generally regarded as pathogen free. All water quality parameters are monitored under the NPDES permit number WAG13-1039. An additional pathogen-free water source is being developed as a supplement and emergency backup for incubation and early rearing. That water source is expected to be on-line by October, 1999.

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.

Hatchery intake screens conform with NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish. Effluent discharge is in compliance with NPDES standards.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Fish volitionally enter the trap via a step and pool ladder at Kalama Falls Hatchery. Once in the trap they are transferred via overhead brail into a 1,000 gallon tanker truck. Fish are then trucked a short distance (100 yards) and are released into a sorting pond measuring 10' X 80' X 4'.

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

A 1,000 gallon steel tank on a flat bed truck equipped with re-circulating pumps and supplemental oxygen system and adult release gate.

5.3) Broodstock holding and spawning facilities.

The sorting pond measures 10' X 80' X 4'.

5.4) Incubation facilities.

Incubation is done in vertical style incubators with flows set at 4 gpm.

5.5) Rearing facilities.

The rearing facilities consist of intermediate troughs measuring 3' X 3' X 16' with a maximum flow of 50 gpm for fry and fingerling rearing. Raceway ponds measuring 20' X 80' X 3' (4,800 cu.ft.) with a maximum flow of 500 gpm per pond are used for continued fingerling and early yearling rearing.

5.6) Acclimation/release facilities.

At the present time the production is acclimated and released out of Gobar Pond which is an earthen pond with approximately 2 acres in surface area and a total pond volume of 430,000 cubic feet.

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

No operational difficulties or disasters have been encountered that have led to significant mortality of this stock of fish.

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.

The hatchery is staffed full time and equipped with low water alarms on all fish rearing vessels and incubation facilities. Fish disease transmission is managed in accordance with the Co-managers Fish Health Manual (WDFW 1996).

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.

Broodstock for this new program (first broodyear is 1998) are Kalama wild winter-run steelhead collected at the Kalama Falls Hatchery trap (RM 10) via volunteers that are recruited through the Kalama River. There is some potential to include strays of neighboring or other wild winter-run populations if they penetrate the Kalama to the terminus of the fishway during the broodstock collection period (April). No hatchery origin steelhead (having clipped adipose fin and/or stubbed dorsal fin) are used as broodstock.

6.2) Supporting information.

6.2.1) History.

Wild Kalama winter-run steelhead are indigenous to the basin. They were present before annual stocking of Beaver Creek (Chambers Cr. Origin) winter-run steelhead stock began in the late 1950s. The wild escapement goal for the basin is 1000 spawners.

6.2.2) Annual size.

Approximately 15 pairs (1:1 sex ratio) are collected for broodstock, representing from 3-6% of the wild spawning escapement. It would seem unlikely that this low level of broodstock collection would affect the population status relative to critical and viable thresholds but it should be noted that useful estimates of critical and viable thresholds do not exist.

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

Wild winter-run have never before been incorporated into the hatchery programs' smolt releases in the basin prior to initiation of this program in 1998. The new program will be comprised entirely of wild broodstock.

6.2.4) Genetic or ecological differences.

Indigenous wild winter steelhead are genetically and behaviorally distinct from both the indigenous summer steelhead stock and hatchery winter and summer steelhead traditionally stocked in the target basin (Kalama River) as judged by allozyme methods, run timing and spawn timing (Sharpe et al. 2000; Leider et al. 1984, 1986).

6.2.5) Reasons for choosing.
Indigenous stock.

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.

Broodstock will be collected randomly during the peak migration timing (also coincides very closely to peak spawn timing) of the wild stock to minimize potential for altering the mean for those characteristics of the wild population.

SECTION 7. BROODSTOCK COLLECTION

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

Adults

7.2) Collection or sampling design.

Winter steelhead are collected at random from available ripe adults captured in the fishway trap at Kalama Falls Hatchery (RM 10). Ripe fish are spawned in two to three egg takes approximately one week apart at the time of the historical peak run time for the stock (mid-April; also coincides very closely to peak spawn timing) to minimize potential for altering the mean for those characteristics of the wild population. Capture efficiency is 100% for fish volunteering to the trap and a relatively small proportion (<25%) of the population is thought to spawn in the Kalama River below the trap. The river is blocked with an impassable falls and barrier adjacent to the entrance of the fishway that terminates in the trap preventing un-monitored passage upstream of the capture point.

7.3) Identity.

The target population of wild winter origin fish are identified by run timing, appearance, and the presence of an adipose fin. They are the only source used for broodstock.

7.4) Proposed number to be collected:

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

15 pairs (15 males and 15 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					
1996					
1997					
1998	12	12		46,114	
1999	12	12		42,458	

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.

Wild winter run steelhead not used as broodstock are trapped throughout the capture period (April)and held for a short period (0-14 days). During that time biological data is gathered and they are then returned to the river upstream of the fishway trap (RM 10). Data collected (under anesthesia) includes fork length, sex, and DNA samples (~75 mm^2 from caudal fin) from all adults. In addition to those data, scale samples and a dorsal muscle plug (~50 mm^3, for allozyme genetic data) are collected from 10-25% of the adults.

Returning hatchery adults beyond the small number intentionally passed upstream (to replace the natural production potential of wild adults used as broodstock) will be removed at the trap and trucked to downstream release sites. This provides additional harvest opportunity while protecting wild fish in upriver spawning and rearing habitats from ecological and genetic interaction with the wild broodstock hatchery fish.

Hatchery-origin broodstock collected at the hatchery site and not used as broodstock are recycled below Kalama Falls Hatchery to provide for recreational sport fishing until the first of February. After that time any returning winter run fish are extracted from the system and are utilized for food banks or landlocked lake fisheries.

7.6) Fish transportation and holding methods.

Wild winter steelhead collected and held for spawning are maintained in a concrete raceway with a volume of 4,800 cubic feet. The raceway is supplied with 250 gallons per minute (gpm) of fresh water. Typically spawners are obtained in ripe condition and spawned within 7 days of when they are captured in the trap (during peak return and spawn time in April). However, a few unripe adults could be detained for up to 14 days, prior to being spawned or released unspawned, if sufficient numbers of ripe adults are not available. No fish therapeutics are used during the brief holding period.

7.7) Describe fish health maintenance and sanitation procedures applied.

Standard fish health protocols as defined in the Co-managers Fish Health Manual (WDFW 1996) are adhered to.

7.8) Disposition of carcasses.

All fish are live-spawned and returned to river. Incidental mortalities are examined to determine cause of death.

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.

To minimize genetic effects to the wild population, broodstock is collected from the peak of the run over a two week period (not eliminating "tails" of distribution). This will comprise a relatively small component of the total run (so removal has minimal influence on genetic make-up of remaining wild spawners) and broodstock removed will be represented in the next generation of natural spawners by passage of a small number of their returning adult offspring into the spawning and rearing habitat above the fishway trap at KFH (RM 10).

The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy Manual (WDFW 1996) and fish health maintenance and monitoring guidelines.

SECTION 8. MATING

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

8.1) Selection method.

Unclipped fish are selected randomly from the returning adults. Ripe fish are spawned in two egg takes approximately one week apart at the time of historical peak run time for the stock. Spawners are randomly selected from fish available on those days.

8.2) Males.

A back-up male is used. No attempt is made to exclude any component of the run, including jacks or repeat spawners.

8.3) Fertilization.

The current fertilization protocol involves a modification of partial factorial crosses (2X2). Eggs from two females are split into two lots each (by weight) yielding four aliquots of eggs. Half of the eggs from each female are fertilized with milt from one male. Fifteen seconds after the initial fertilization, an aliquot of milt from a second male is used to back up the first. The remaining two buckets of eggs are treated similarly except that the second male was used as the primary source of milt and the first male became the backup.

Fish health procedures used for disease prevention include water hardening of eggs in an iodophor solution at spawning and biological sampling of spawners. Ovarian fluid and kidney / spleen samples are collected from female spawners to test for the presence of viral pathogens.

8.4) Cryopreserved gametes.

None.

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.

Only un-clipped wild origin fish will be used for this program. A 2X2 factorial mating scheme will be applied to enhance the expression of within population genetic diversity in this small program which incorporates a very limited portion of the wild population.

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.

Green egg to eye.....54,146 eggs taken....83.5% survival to eye. BY1998.
Green egg to eye.....44,781 eggs taken....94.8% survival to eye. BY1999.

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

Extra eggs are taken as a measure against expected incubation mortality. In the unlikely event of accidents of program level of production, adjustments will be made to the hatchery origin portion of the facility production by utilizing local landlocked lakes for fry stocking.

9.1.3) Loading densities applied during incubation.

Average size of the eggs has been approximately 2,491 eggs per pound. The eggs are incubated in vertical incubators with 4gpm of flow. Each individual females' eggs are put down in individual incubator trays.

9.1.4) Incubation conditions.

Temperatures are monitored daily and range between 40 and 56 degrees F. Dissolved oxygen is generally at or near saturation at the influent with 7 ppm as the minimum acceptable effluent although it generally stays within 80% to 90% of saturation. Visual monitoring of sediments in the incubators is conducted daily and are flushed if necessary.

9.1.5) Ponding.

The degree of button up is usually a 1 to 2 mm slit in the ventral surface. Swim up and ponding are forced. Temperature units at ponding average 1,100. Average length is 33.4 mm with a co-efficient of variation averaging 5.85%.

9.1.6) Fish health maintenance and monitoring.

Current treatment is a 1,667 ppm drip of formalin for 15 minutes daily to control fungus on the eggs. Egg mortality is removed by hand picking. Fry mortality at ponding is generally less than 3%. Monitoring for disease is done on a continuous basis with monthly scheduled visits by the area Fish Health Specialist. Disease treatment varies with the pathogen encountered but generally is antibiotic in nature for bacterial infections and bath or drip treatments with chemotheraputants for external infections.

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.

The water source for incubation is regarded as pathogen free and particulate matter is settled out prior to entering incubation units.

9.2) Rearing:

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..

As data for only one brood year is available (data for brood year 1999 were collected but have not yet been entered or analyzed), the following should be considered provisional:

Brood year 1998 ─ Green to eyed eggs: 84.0 %
Eyed eggs - fry: 99.0 %
Fry to fingerling: 86.0 %
Fingerling to smolt: 95.5%

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

Density and loading criteria vary with annual production goals. Current production goals allow for density indices to be kept at or below 0.5 and flow indices within accepted standards for the species. (Fish Hatchery Management, Piper et. al. 1982).

9.2.3) Fish rearing conditions

Temperature and dissolved oxygen are monitored and recorded daily during fish rearing. Temperatures during the rearing cycle range from a high of 72 to a low of 32 degrees F. Ponds are vacuum cleaned on an as-needed basis although generally weekly.

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.

MONTH	DATE	FPP	FL (mm)	W (gm)	CF	GROWTH (mm/d)
AUG.	8/31/98	105.0	NA	4.3	NA	NA
SEPT.	9/30/98	46.0	NA	9.9	NA	NA
OCT.	10/31/98	30.0	NA	15.1	NA	NA
NOV.	11/30/98	25.0	NA	18.2	NA	NA
JAN	2/5/99	14.4	139.1	31.4	1.2	NA
FEB	3/8/99	11.6	153.1	39.2	1.1	0.45
MAR	3/31/99	8.7	166.3	52.2	1.1	0.57
APR (1ST)	4/13/99	7.5	174.7	60.4	1.1	0.65
APR (2ND)	4/29/99	6.1	187.9	75.0	1.1	0.82
MAY (RELEASE)	5/4/99	6.7	191.1	67.9	1.0	0.63
MIGRATING SMOLTS	5/12/99	6.4	194.9	70.5	1.0	NA
MIGRATING SMOLTS	5/18/99	6.0	200.7	76.0	0.9	NA
MIGRATING SMOLTS	5/25/99	7.1	189.2	64.2	0.9	NA
MIGRATING SMOLTS	5/28/99	6.6	192.1	68.5	1.0	NA
MIGRATING SMOLTS	6/1/99	7.3	186.9	61.9	0.9	NA
POND RESIDUALS	6/1/99	7.0	186.6	64.6	1.0	NA

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

Growth rate data, expressed as mm FL/d are provided in 9.2.4, above. No energy reserve data are 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*).

Dry diets are currently used. Feed rate is applied in accordance with program goals not to exceed 0.1 to 0.15 lbs of feed per gallon per minute inflow depending on fish size. Average season feed conversion rates generally are expected to be no greater than 1.3 : 1.

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

Fish health is monitored daily. Regular monthly scheduled visits are conducted by the area Fish Health Specialist. Treatment for disease is conducted under the advisement of the Fish Health Specialist. Sanitation procedures are done in accordance with the Co-managers Fish Health Manual, (WDFW 1996).

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

Visual examination of fish through release sampling is conducted and outward signs of smoltification are noted, i.e. lack of parr marks, banding of caudal etc.

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

None.

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.
Survival is maximized and no culling occurs.

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	45,000	6	April-May	Gobar Pond (RM 3) on Gobar Cr.

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

Stream, river, or watercourse: Gobar Pond on Gobar Cr. (27.0075), trib to Kalama River (27.0002)
Release point: Gobar Pond (RM 3) on Gobar Cr.
Major watershed: Kalama River (27.0002)
Basin or Region: Columbia River

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

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							35,100	6.30
Average							35,100	6.30

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.

Release is volitional from Gobar Pond (see section 10.6 below), beginning in April and continuing through May. Exit screens are removed in late April and exit stop logs are incrementally pulled throughout May to stimulate out-migration of smolts ready to migrate. Minimum pool depth in the pond (removal of all stop logs) is achieved by the end of May. In 1999 (release of first program brood of 1998), fish that remained in the pond after achievement of minimum pool (~3% of the initial numbers) were forced out of the pond with a sub-sample externally marked with photonic tags. These were tagged to facilitate evaluation of there subsequent migration behavior. Because the forced fish residualized at a greater rate than volitional migrants, a different approach will be used for the 2000 smolt year (1999 brood). Fish remaining in the pond after achievement of minimum pool will be

held there, until fall, at full pond level. At which time they will be marked and released into Gobar Creek or removed (depending on numbers and size/other characteristics that are indicative of the fish's potential to contribute to the following spring's smolt out-migration). Protocol for disposition of non-voluntary migrants beyond the 2000 release year will be determined pending information gained from the 2000 release group.

10.5) Fish transportation procedures, if applicable.

Fish transported for off-station release at the acclimation site are in transit for approximately 1.0 hour. Loading densities are kept between 0.5 and 1.0 pounds per gallon. Salt is added to the tanker at a rate of 0.5% of the volume by weight. Temperature is monitored in the tank and tempering is performed at the release site if the difference between the tank and the release water is greater than 7 degrees F. Supplemental oxygen is administered at 2.5 liters per minute.

10.6) Acclimation procedures.

Winter-run smolts are to be released from an acclimation pond, Gobar Pond, in the upper watershed at a time when all life history stages of wild steelhead might be expected to be present. Pre-smolts are transferred to the acclimation pond in February and provided feed by hand and from demand feeders. Gobar Pond is located on Gobar Creek (12 miles up-stream from the Kalama Falls Hatchery). GIS coordinates for Gobar Pond X=122.611, Y=46.085

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

The entire 1999 brood was freeze branded, adipose clipped and tagged with blank wire in the right cheek. The freeze brand will only be applied every other year

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

In the event of surplus fish to the program the total program numbers will be reduced through the reduction of hatchery-origin smolts planted. Hatchery-origin smolts, if in surplus numbers, will be planted in local landlocked ponds and lakes.

10.9) Fish health certification procedures applied pre-release.

As set forth in the Co-managers Fish Health Manual (WDFW 1996).

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

Every effort will be made to avoid pre-programmed releases including transfer to alternate facilities. Emergency releases, if necessary, would be managed by removal of outlet screens and stoplogs of the rearing vessel.

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 fish will be released in a manner (see 10.4 above) to promote hatchery fish out-migration that mimics that of their wild counterpart. Spreading the release interval over a month or more results in a more gradual out-migration of hatchery fish at a time when wild fish are also actively migrating. This avoids undue disruption of wild fish migration behavior from short duration flushing of very large numbers of hatchery fish at a given time (e.g. "pied piper" effect or other behavioral perturbations).

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

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

See 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.

The existing monitoring and evaluation work at the Kalama facilities has been in place for in excess of 20 years, continuously funded by NMFS as provided under the Mitchell Act. That history is the limit of our certainty of continued funding.

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.

Design and implementation of all research activities associated with monitoring and evaluation of the Kalama facility operations follow peer review by internal (WDFW) staff as well as external interested parties including NMFS, USFWS, USGS-BRD, ODFW and various academic entities.

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.

The Kalama Falls wild winter steelhead broodstock program seeks to provide much needed information on critical uncertainties regarding the logistical challenges, benefits, and risks associated with hatchery production programs utilizing local wild broodstocks. The monitoring and evaluation component of the program will be conducted for at least the first three brood years (1998-2000) of the program and the information gained will be used in an adaptive management context to help guide changes in the production program beyond the 2000 broodyear as deemed appropriate. The information will also help guide decisions on whether and how to incorporate wild broodstock programs in other basins.

The extensive evaluation of this small scale program (33% of Kalama winter-run hatchery production program), will provide critical fish cultural and genetic and ecological risk information regarding wild broodstock steelhead hatchery production. This information also directly aids in the evaluation of a companion full scale Kalama wild summer-run steelhead hatchery production program. Our ultimate goals of these combined research efforts are to develop wild broodstock programs and quantify risks, especially genetic risks, imposed upon natural salmonid production by wild broodstock hatchery programs and to identify strategies to contain those risks. The winter-run wild broodstock program is intended to resolve technical uncertainties and logistical obstacles associated with spawning wild steelhead adults and successfully rearing their offspring for release as age 1 smolts. This information and experience is expected to substantially enhance the success of the both the production and intensive evaluation components of the summer-run wild broodstock program. In addition, the winter-run program will directly compare the performance of the Beaver Creek Hatchery (BCH) winter-run program currently used in the Kalama River system to that of a wild broodstock program. Characteristics of the wild broodstock origin fish ("Kalama Lates") will be compared to those of two different Beaver Creek Hatchery origin groups: "Kalama Earlies" (derived from adults returning from previous plants of BCH smolts in the Kalama River and reared in the Kalama Complex along with the wild broodstock fish) and "BCH Production" (fish identical in origin to Kalama Earlies, but reared at BCH or Elochoman Hatchery using normal production protocols and shipped as smolts or late pre-smolts to the Kalama for release -- see HGMP for that stock). Information provided by these comparisons will be directly relevant to looming fish management decisions regarding the use of hatchery steelhead stocks in the Lower Columbia and elsewhere in Washington. Such information is urgently needed to address genetic risk and other wild stock conservation issues associated with the Wild

Salmonid Policy, the Lower Columbia Steelhead Conservation Initiative, and ESA listing considerations.

Adult returns from the winter-run production from wild broodstock are intended to be available for harvest and have adipose fins removed. Only a small portion of these returning adults will be allowed into upstream spawning and rearing habitat to replace the number of returning adults that would have been naturally produced by the wild adults removed for hatchery broodstock. All additional returning hatchery adults of wild broodstock origin will be removed at a barrier/trap facility at KFH (RM 10) and trucked to downstream release sites. This is intended to provide additional harvest opportunity while protecting the wild stocks in primary upriver spawning and rearing habitats from ecological and genetic interaction with the wild broodstock hatchery fish. Overall, this integrated research and production program is expected to have a neutral or positive effect on listed steelhead in the Kalama River.

A more thorough treatment of goals and objectives of the program as well as justification for and benefits of the work in the Kalama Basin is provided in Sharpe et al. (2000).

12.2) Cooperating and funding agencies.

WDFW and NMFS (Mitchell Act funding).

12.3) Principle investigator or project supervisor and staff.

Patrick Hulett (PI-Fish Biologist 3), Cameron Sharpe (Fish Biologist 2), and Chris Wagemann (Fish Biologist 2).

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

Threatened.

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

Adults are captured in the trap at the Kalama Falls Hatchery, loaded by braille into a fish transport truck and trucked approximately 200 meters to the sorting pond on station. The fish are periodically (2-5 times per week, depending on numbers of fish) crowded in the sorting pond, anaesthetized with CO_2 , tagged with a Floy tag, and either sequestered as broodstock on station or returned to the river to continue their upstream migration. A tissue sample (fin clip) is removed from all adults for DNA analysis. In addition, a small muscle biopsy is performed on a representative sub-sample (100-200 fish per year) to provide tissue for allozyme analyses.

To facilitate identification of hatchery-origin juveniles at all life history stages all the fish receive blank wire tags in their right cheek. Juvenile fish are sampled from the hatchery

facilities and from the river throughout rearing and during downstream migration as smolts. For samples taken during rearing, fish are netted from the rearing or acclimation ponds and anaesthetized with MS222. Length, weight, fin condition and degree of smolt development are recorded and the fish are returned to their rearing vessels. For samples taken from the river, juveniles (both wild and "hatchery") are captured primarily using two rotary screw traps at RKm 37 and 20 and treated as described above. A representative sub-sample is wire tagged and injected with a fluorescent pigment and released above each trap site to allow estimation of trap efficiency. The remaining fish are released from the trap to continue their downstream migration. Instream juveniles are also sampled using electrofishing (in compliance with NMFS Electrofishing Guidelines) and angling methods to estimate degree and patterns of residualism.

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

The wild winter-run component of the research project as outlined above and detailed in Sharpe et al. (2000) will continue through 2004. The relatively intense monitoring of rearing , migration, and residualism will end with the out-migration of the 2000 brood in the spring and early summer of 2001. The balance of the research program will involve monitoring of smolt to adult returns and natural reproductive performance in subsequent years, with final 3-salt adult returns from the 2000 brood occurring in 2004.

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

Refer to Section 9.

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

Table 1. provides types and levels of take in this project. Virtually all adult steelhead attempting to enter the upper watershed will be captured and handled. Those fish are thus necessarily subjected to stress and risk of injury or mortality. However, the procedures used have been in place for over 20 years and, because of that experience, the potential for injury or mortality is low. All adults are handled quickly and efficiently in vessels of adequate volume and flow. The collection of important biological information and samples is carried out under anesthesia with attention paid to allowing sufficient recovery time before returning fish to the river. Adult fish sequestered as broodstock are held at low densities in covered hatchery ponds with daily prophylactic formalin treatments.

As with the adult sampling, the smolt trapping and other juvenile sampling operations subject fish to risk. Again, well established protocols are in place to ensure that the levels of risk and potential for injury or mortality are low. Also, only a fraction of the run of the river juvenile fish are sampled and most are of hatchery origin.

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).

See Table 1.

12.10) Alternative methods to achieve project objectives.

None.

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

Coastal cutthroat trout (*Onchorynchus clarki).* Ongoing smolt and adult trapping efforts regularly entrain cutthroat trout. Actual levels of mortality associated with those activities are unknown but are assumed to be negligible. Assuming, for example, maximum mortality of 5% and given that 358 cutthroat are captured in 2000 (WDFW unpublished data) while conducting steelhead research, 18 mortalities would have occurred in this year. Capture rate for future years of the project are expected to be similar to that of 2000.

12.11) 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.

In addition to the measures describing care and handling of the listed fish provided in sections 2, 8, 9, 11, and elsewhere in this section (12), actual take will be determined on an annual basis and compared to the levels detailed in the appended take table. Causes for any take in excess of those provided in the take table will be identified and corrective action will be taken to remedy the problem.

SECTION 13. ATTACHMENTS AND CITATIONS

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Kalama River, Washington. Canadian Journal of Fisheries and Aquatic Sciences 43:1398-1409.

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Piper, R.G. et. al. 1982. Fish Hatchery Management. United States Department of the Interior, Fish and Wildlife Service, Washington D.C. 517 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.

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:_____

Table 1. Estimated listed salmonid take levels of by hatchery activity. Table combines take associated with both the wild winter-run and wild summer-run and, in addition, the hatchery winter-run portions of the Kalama program (i.e., take tables from three separate Kalama River winter- and summer-run HGMPs are not additive). This table by itself provides the total expected take of listed steelhead associated with hatchery activities in the Kalama watershed.

Listed species affected: Steelhead ESU/Population: lower Columbia Steelhead				
Location of hatchery activity: Kalama River, WA Dates of activity: March-November (00-02)_ 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)	0	0	0	0
Collect for transport b)	0	0	0	0
Capture, handle, and release c)	0	200[2]	0	0
Capture, handle, tag/mark/tissue sample, and release d)	0	3,000[3]	5,000[5]	0
Removal (e.g. broodstock) e)	0	0	80[6]	0
Intentional lethal take f)	1,000[1]	200[1]	0	0
Unintentional lethal take g)	0	150[4]	40[7]	0
Other Take (In-hatchery rearing) h)	0	0	0	0

Footnotes:

[1] Maximum likely samples taken annually from naturally produced fish for genetic or physiological work in the watershed.

[2] Maximum likely number of juveniles sampled annually by smolt trap, electrofishing, and angling and then released without marks or tags.

[3] Maximum likely number of juveniles sampled annually by smolt trap, electrofishing, and angling and then released after insertion of a wire tag and/or injection with a fluorescent dye mark, and/or non-lethally tissue sampled.

[4] Maximum likely annual incidental mortality (5%) on naturally produced juveniles sampled by smolt trap, electrofishing, and angling.

[5] Includes handling during normal hatchery operations of all of the maximum likely number of naturally produced adult summer-run and winter-run adults attempting to enter the upper watershed.

[6] Assumes maximum likely annual number of broodstock (80 adults) for both summer-run (50 fish) and winter-run (30 fish) portions of the wild broodstock program. Value does not incorporate post spawning survival after returning fish to river (i.e., assumes no male broodstock continue upstream to spawn naturally and no males or females return to spawn in later years).

[7] Assumes maximum likely mortality (1%) during handling of all wild summer-run and winter-run adults.

8 "Take" of eggs from wild broodstock implicitly included in expected maximum adult take of 80 fish.

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: Chum	**ESU/Population: Lower Columbia Chum**			
Location of hatchery activity: Kalama River hatchery Dates of activity: March-November (00-02) 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.

Appendix B

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

Listed species affected: chinook	**ESU/Population: Lower Columbia chinook**			
Location of hatchery activity: Kalama River hatchery Dates of activity: March-November (00-02) 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.

Appendix B

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Kalama River "Type-N" Coho
Species or Hatchery Stock:	"Type N" Coho (*Oncorynchus kisutch*) Kalama River
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Kalama River, trib to Columbia River Washington state
Date Submitted:	, 2001
Date Last Updated:	August 24, 2001

Appendix B

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Kalama River "Type-N" Coho Program

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

Type-N coho, Kalama River stock, (*Onchorynchus kisutch).*

1.3) Responsible organization and individuals

Name(and title):	Chuck Johnson, Area Division Manager (360) 902-2653 Mark Johnson, Hatchery complex Manager
Organization	Washington Department of Fish & Wildlife
Address:	600 Capitol Way North, Olympia, Wa. 98501-1091
Telephone:	360-673-2098 Mark Johnson, Complex Manager.
Fax:	360-673-2995
Email:	johnsmjj@dfw.wa.gov

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

The coho program is funded through the Mitchell Act via 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 NMFS for the purpose of mitigation for lost fish production due to development within the Columbia River Basin.

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

Broodstock Capture: Kalama Falls Hatchery - located at about river mile 10 on the Kalama River. The mouth of the Kalama River is located at river kilometer 113.3 on the Washington side of the Columbia River. The aforementioned information applies to Broodstock Holding to Maturity, Fish Spawning, Incubation, Rearing & Rearing to Release.
GIS coordinates for Kalama Falls Hatchery X=122.732, Y=46.017

1.6) Type of program.

Integrated Harvest. ?? The Kalama Falls Type - N coho program is a mitigation and augmentation program. The production is to mitigate for activities within the Columbia River Basin that have decreased salmonid populations.

1.7) Purpose (Goal) of program.

The hatchery goal is to produce lower Columbia River Type-N coho that will contribute to the NE Pacific and Columbia River Basin commercial and sport fisheries while providing adequate escapement for hatchery production (IHOT 1995). The hatchery will do so in a manner that will not affect listed fish.

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).

1.9) List of program "Performance Standards".

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.

1.10.1) "Performance Indicators" addressing benefits.
(e.g. "*Evaluate smolt-to-adult return rates for program fish to harvest, hatchery broodstock, and natural spawning.*").

1.10.2) "Performance Indicators" addressing risks.
(*e.g. "Evaluate predation effects on listed fish resulting from hatchery fish releases."*).

1.11) Expected size of program.

The current, and future, expected size of the Kalama Falls hatchery Type-N coho program is currently 700,000 yearling smolt release.

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

400 females and 400 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	Kalama River WRIA 27.0002	700,000

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

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

The program has been ongoing since 1958.

1.14) Expected duration of program.

Ongoing.

1.15) Watersheds targeted by program.

The watersheds targeted by the program are the Columbia River below the confluence with the Kalama River (WRIA 36.0001) and the Kalama River (WRIA 27.0002).

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

None.

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

- 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).

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

Lower Columbia Steelhead, Chinook and Chum; Mid Columbia Steelhead; Upper Columbia Steelhead, Spring Chinook; Snake River Sockeye, Chinook, and Steelhead.

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").*

- 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.

- 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).

- 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.

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*").

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

- 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.*

- 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."*)

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.

The production program and the HGMP describing it are consistent with the following agreements or plans:
- Production Advisory Committee (PAC)
- Technical Advisory Committee (TAC)
- Integrated Hatchery Operations Team (IHOT)
- Pacific Northwest Fish Health Protection Committee (PNFHPC)
- In-River Agreements: State, federal and tribal representatives.
From (IHOT 1995)

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.

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 Kalama 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 .

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.

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.

Interspecific and intraspecific competition from hatchery coho smolts released and from coho juveniles produced from hatchery origin fish spawning naturally may play a

significant role in the Kalama River ecosystem. Significant predation on fall chinook juveniles by hatchery coho smolts has been documented in the Lewis River.

(1) negatively impact program:

None in the Kalama 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, common merganser, double crested cormorant, and caspian tern, does pose a large threat.

(2) be negatively impacted by program:

Less than ca 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 Kalama River drainage is thought to be inadequately seeded with anadromous fish carcasses and a program has been initiated with the use of volunteers (Low. Col. Riv. Enh. Group) to distribute coho carcases throughout the basin from hatchery coho returning to the Kalama Falls 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.

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.").

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).

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

5.3) Broodstock holding and spawning facilities.

5.4) Incubation facilities.

5.5) Rearing facilities.

5.6) Acclimation/release facilities.

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

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.).

Broodstock for the program are collected at the hatchery site trap via volunteers that are recruited through the Kalama River. During years where insufficient numbers of adults return, eggs may be obtained from any Columbia River Type-N hatchery coho if available (IHOT 1995). All adults recruited for use as broodstock have been of hatchery origin since 1998.

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.

Broodstock for the hatchery program has consisted of lower Columbia Type-N coho. For the past five years the hatchery has not been able to recruit escapement within the Kalama system.

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.

Annual run size for the last five years.

BROOD YEAR	NUMBER TRAPPED	SEX RATIO(♂ : ♀)
1994	572	2.38 : 1
1995	660	2.03 : 1
1996	233	6.06 : 1
1997	278	1.93 : 1
1998	426	4.30 : 1

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 brood stock is unknown prior to 1998. Since that time only hatchery origin returning brood stock have been used for propagation purposes identified by their missing adipose fin. 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 200 adults based on a production of 10,000 smolts. Wild smolts??

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 stock or natural stock in the Kalama River. Much of the remaining available (tributary) habitat below the lower falls was probably more conducive to later spawning coho (late November- February) pre-hatchery and skewed earlier due to early spawning hatchery coho.

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

Type-N provide for extended fishing opportunity for fisheries. 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 and 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*.").

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 intent of the broodstock collection procedure applied at the hatchery is to collect enough adults to maintain the hatchery production program. The hatchery goal for annual adult collection is cited in section 1.9. Surplus eggs may be used to backfill production shortages at other lower Columbia facilities. Adults are collected throughout the entire run to ensure that the run timing of the population under propagation is maintained.

Type - N coho are collected each year from the run at large reaching Kalama Falls hatchery weir trap during October, November and December. Broodstock are collected throughout the entire run to ensure that run timing for the population is maintained. Capture efficiency is 100% for fish volunteering to the trap and only adipose clipped fish are used as broodstock. The river is blocked with an impassable falls adjacent to the ladder exiting the trap preventing migration upstream of the capture point.

Adverse effects on listed fish that may be encountered incidentally during trapping are minimized through the following measures:

a. Other salmonids incidentally trapped are held for a minimal amount of time and are returned to the river without harm to continue their migration.
b. All downstream migrant fish are able to pass by the trap unimpeded.

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.

The target population of hatchery origin fish are identified by an adipose fin clip and are the only source used for broodstock.

7.4) Proposed number to be collected:

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

400 females and 400 males

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					
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.

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.

Type -N coho collected and held for spawning are maintained in concrete ponds with a volume of 10,000 cubic feet. The ponds are supplied with 800 gallons per minute (gpm) of re-use water. Fish may or may not receive prophylactic treatment for fungus control during the holding period depending on the environmental conditions of the season and the timing and condition of fish at arrival. Listed summer and winter run steelhead are trapped throughout the capture period held for a short period, at which time biological data is gathered, and then returned to the river with the exception of those fish used for research purposes (see the Wild Summer- run Steelhead HGMP).

7.7) Describe fish health maintenance and sanitation procedures applied.

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

Spawned and un-spawned carcasses may be sold to contract buyer or used for nutrient enhancement within the watershed.

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").

Natural origin coho will not be utilized as broodstock. The effects of the broodstock collection program on the timing of spawning of the target population and on the composition of the spawning population (e.g. hatchery versus wild origin, age class distribution, sex ratios) are unknown.

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 spawning protocol mandates the use of a spawning population of at least 500 adults. Spawners are selected and mated randomly from the population maintained in the hatchery holding pond. Fish are spawned throughout the entire run to help ensure that the run timing for the stock is maintained. A portion of each day's egg take is used for on-site hatchery production to help ensure that the return timing of the seasonal run is represented. Only fish of hatchery origin are used for spawning purposes.

8.2) Males.

When spawning fewer than 1 million eggs in a day, the male to female ratio will be 1:1. When spawning more than 1 million eggs in a day, the ratio will not be less than 1 male to 3 females. Males are combined in pools of five prior to fertilizing eggs from five females. Repeat spawners are not used.

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.

For daily egg takes, eggs from five females are spawned into a bucket, and the sperm from five males are then combined with the eggs.
Fish health procedures used for disease prevention include water hardening of eggs in an iodophor at spawning and biological sampling of spawners. Generally, sixty ovarian fluid and kidney/spleen samples are collected from female spawners to test for the presence of viral pathogens.

8.4) Cryopreserved gametes.

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".*).

No natural-origin fish will be knowingly utilized as broodstock. The effects of the mating protocol applied on within population diversity of the propagated and naturally spawning coho populations are not known.

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.
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.")*

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.")*

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				
Fingerling				
Smolts	700,000	13	April-June	Kalama R. WRIA 27.0002

The current production goal for Kalama Falls hatchery is the annual release of 700,000 yearling coho Type-S smolts at an average size of 32 gms (14 fish per pound (fpp)). Fish have been reared approximately 440 days prior to release in April and May. The 1995 through 1997 brood year average size at release was 11.58 fpp at 149.14 millimeters (mm) fork length. The range was 11.40 fpp to 12.30 fpp and 148 to 151 mm fork length.

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

Stream, river, or watercourse: *(include name and watershed code (e.g. WRIA) number)*
Release point: (*river kilometer location, or latitude/longitude*)**or river mile**
Major watershed: (e.g. "Skagit River")
Basin or Region: *(e.g. "Puget Sound")*

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	Yearling	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.

The coho are typically volitionally released during the first 3 weeks of April. Is final release "forced" i.e. do you push the last fish out??

They are released at the Kalama Falls Hatchery - located at about river mile 10 on the Kalama River. The mouth of the Kalama River is located at river kilometer 113.3 on the Washington side of the Columbia River.
GIS coordinates for Kalama Falls Hatchery X=122.732, Y=46.017

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.

None

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

The coho are supplied with river water during throughout the rearing cycle. Upon release they migrate down the Kalama river and subsequently to the Columbia and seaward.

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

Approximately 30,000 fish from each brood year are adipose clip-coded wire tag combination. The balance has been adipose clipped since the 1995 brood.

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

10.9) Fish health certification procedures applied pre-release.

Fish are checked, pre-release by the Area Fish Health Specialist.

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

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").*

Migrants shall be released in a manner which mimics natural migrant behavior to minimize possible effects upon wild origin fish. Unknown: Uncertainties pertaining to release strategies applied through the program that should be resolved to allow for adaptive management include the following: (1) the effect of broodstock collection on natural escapement levels, (2) the demographic aspects of returning hatchery adults, (3) the potential for genetic changes from the natural population from differing selective

processes associated with broodstock collection, selection, and mating; and hatchery propagation, and (4) the effects of hatchery releases upon natural juveniles.

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.

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:_____

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.

FISHERIES MANAGEMENT AND EVALUATION PLAN

Lower Columbia River

Prepared by
Washington Department of Fish and Wildlife

February 21, 2001

Appendix B

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

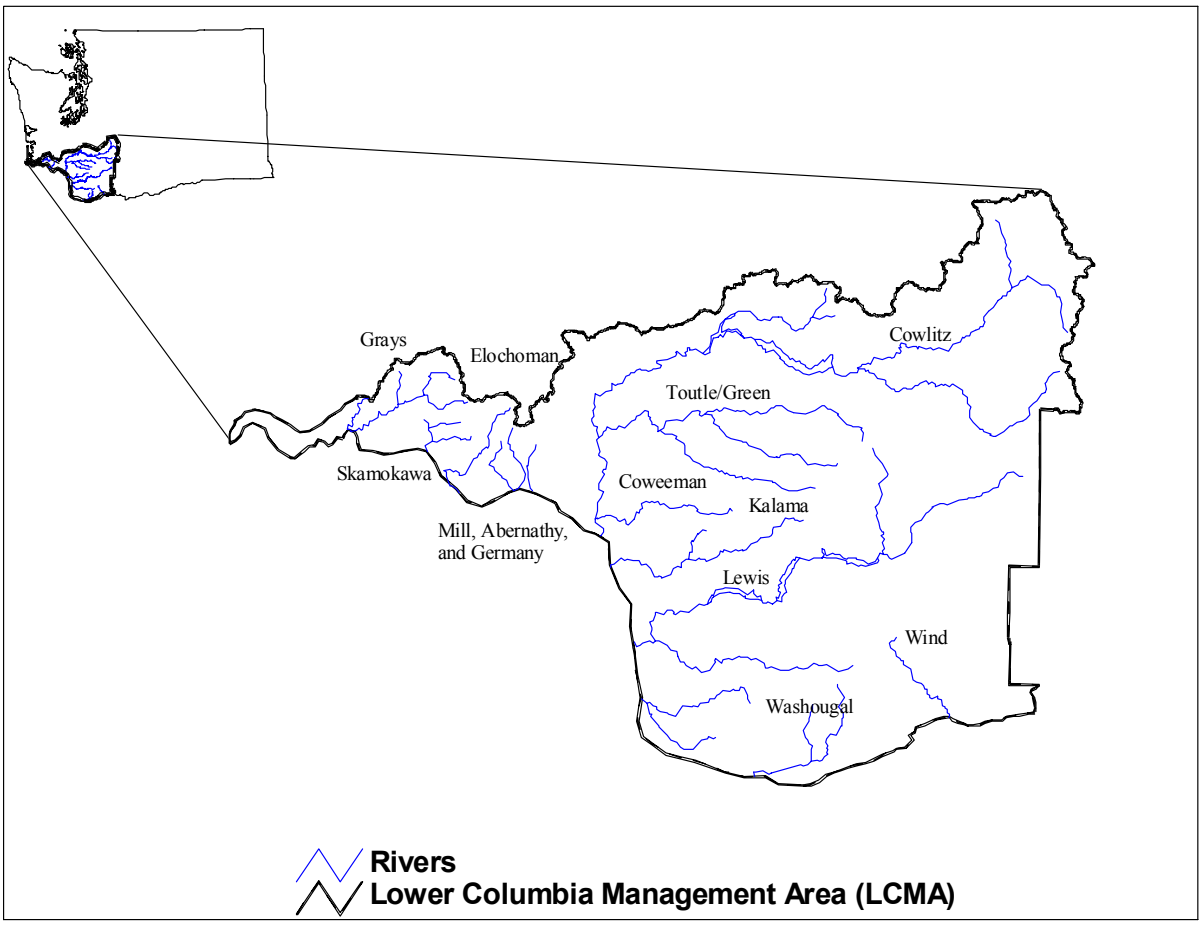

Figure 1. The Lower Columbia River Management Area**.**

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.

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 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

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

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

Natural Populations (or Management Units)	Associated hatchery stock(s)	Recovery Categories	Hatchery stock essential for Recovery? (Y or 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

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.

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).

1.3.2) 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

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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

Appendix B

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
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 169interception 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. 170 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.

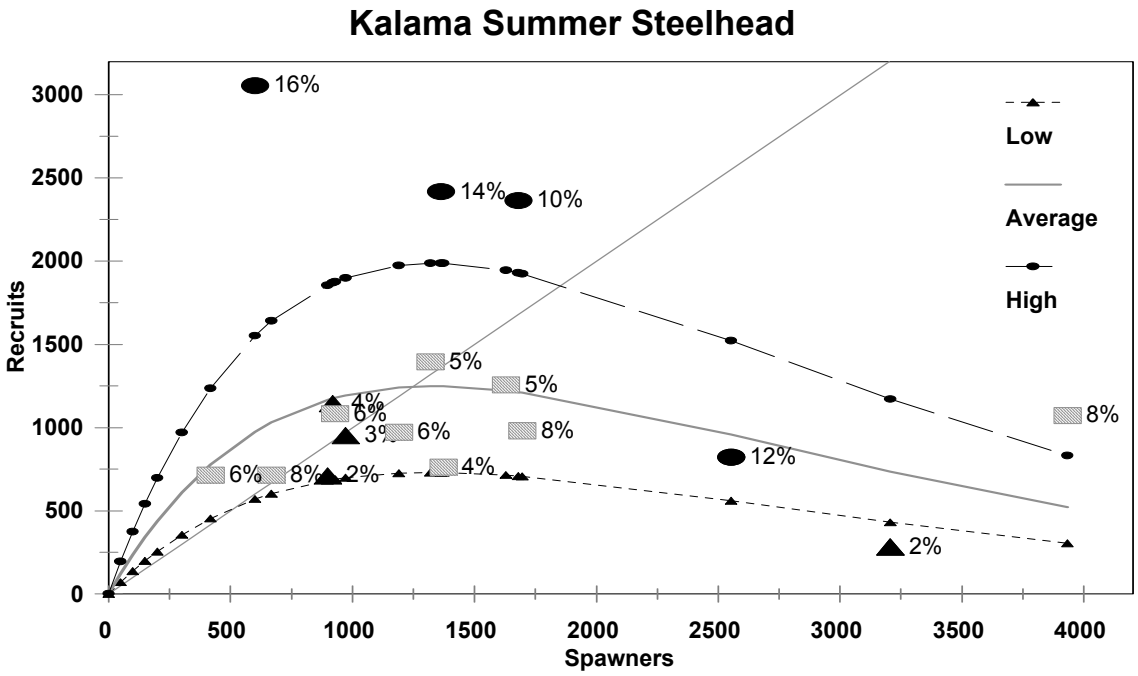
MSY harvest rates were also calculated during low 172ocean productivity and they were 22% and 37% for summer and winter steelhead, respectively. Although the data set did not include a measurement of observational error, we thought that it was low since most fish are trapped at Kalama Falls and others 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


Kalama Summer Steelhead
Recruits
Spawners
Low
Average
High
16%
14%
10%
12%
8%
6%
5%
4%
3%
2%
0
500
1000
1500
2000
2500
3000
3500
4000

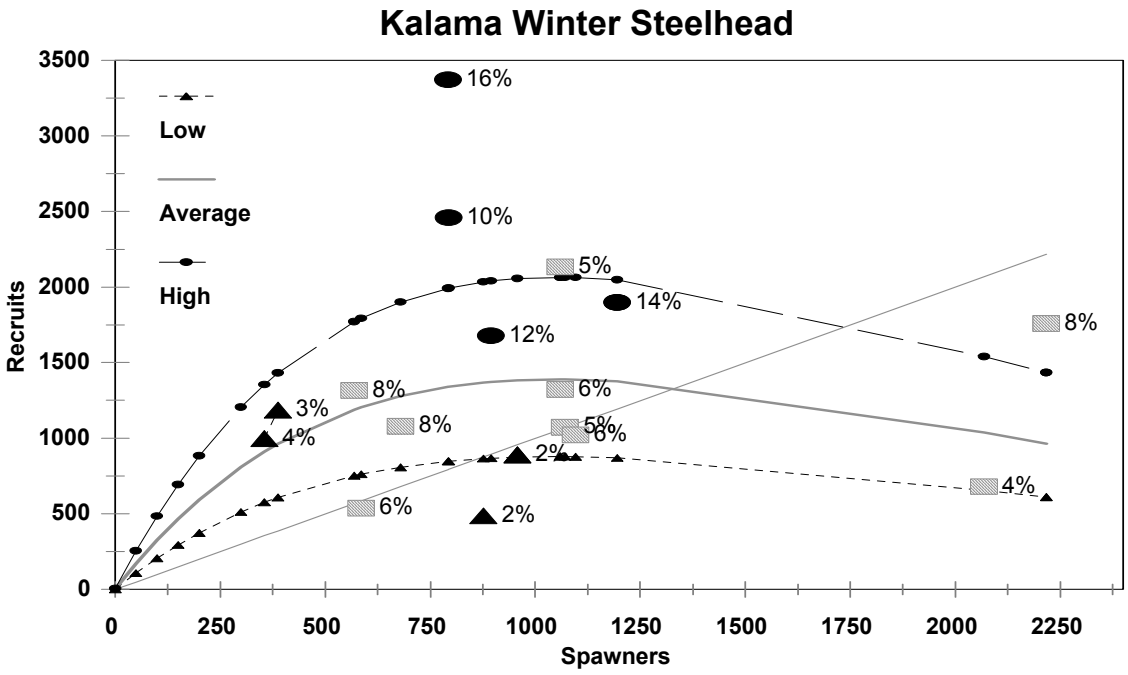


Figure 2. Spawner recruit model for wild winter and summer steelhead under low, average, and high ocean productivity, brood years 1977-93.

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.

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 177 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).

Appendix B

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 180 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.

Appendix B

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 181 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 [182]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 187listed 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).

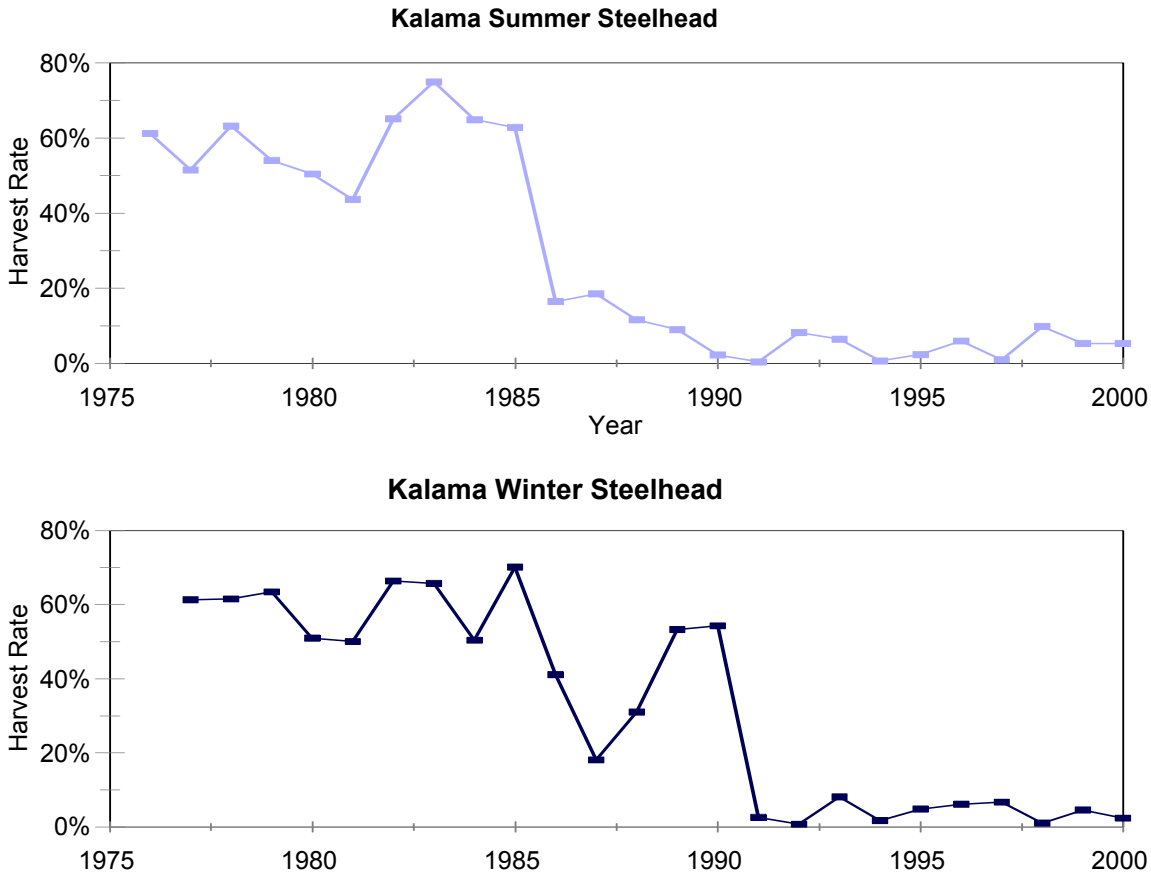


Figure 3. Wild steelhead harvest rates for winter and summer steelhead, 1976-1999. Harvest for winter steelhead after 1991 and summer steelhead after 1985 is adult morality due to hooking mortality in the wild steelhead release fisheries.

Spring 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.

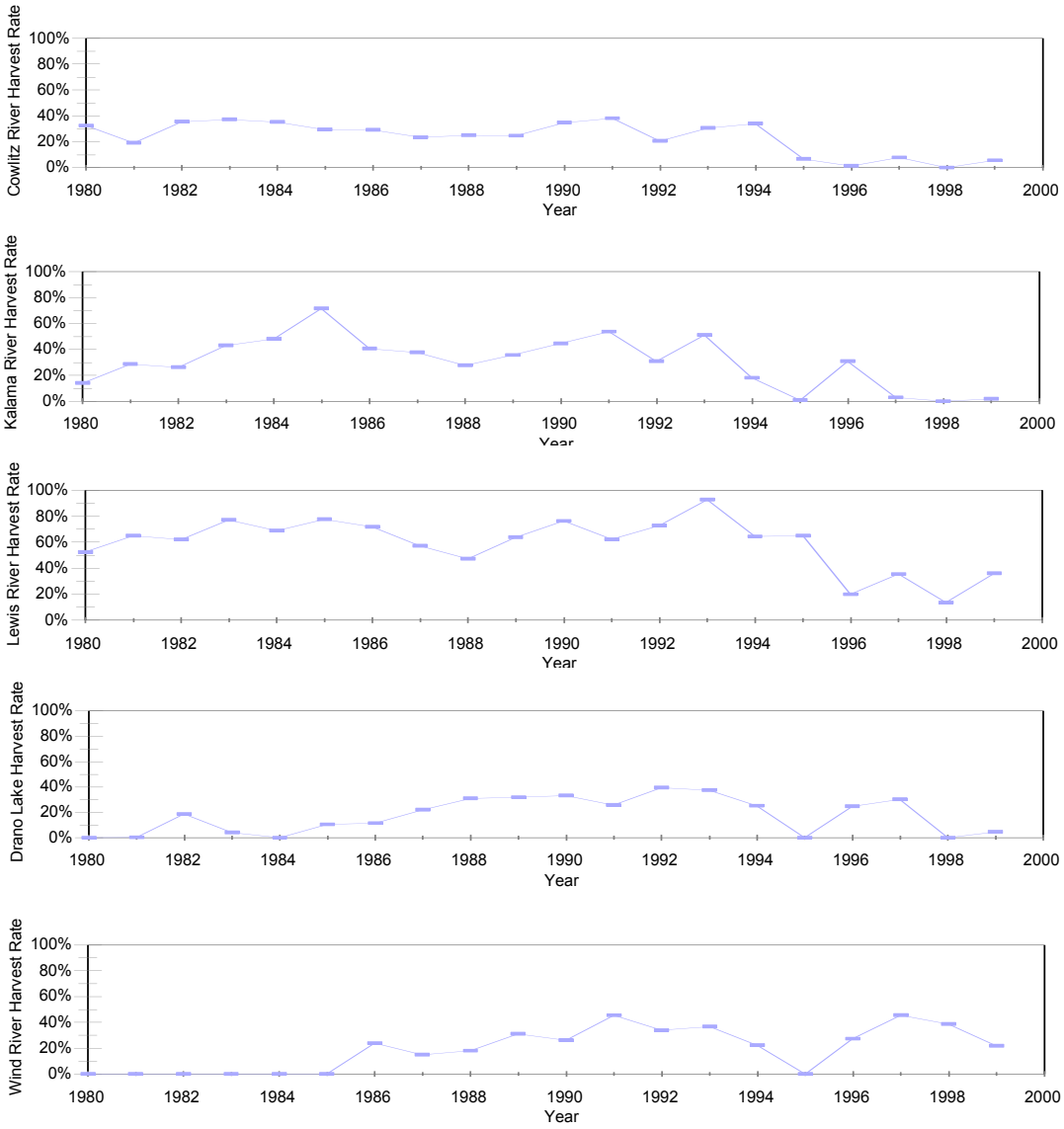


Figure 4. Spring chinook tributary harvest rate 1980-99. Harvest rate equals sport catch divided by run size at tributary mouth.

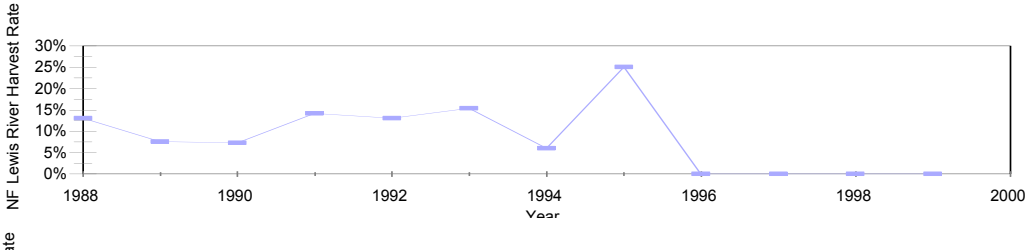

NF Lewis River Harvest Rate
30%
25%
20%
15%
10%
5%
0%
1988
1990
1992
1994
1996
1998
2000
Year

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%

[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**.

Appendix B

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]
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%
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										

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]
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									

Table 12. Continued

Affected stock	Fisheries									
	Steelhead		Salmon		Res. Trout		Others (eg. Whitefish, warmwater)		Harvest	Total take
	AE	EM	AE	EM	AE	EM	AE	EM		
Other Tributaries										
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 2002000b). 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.

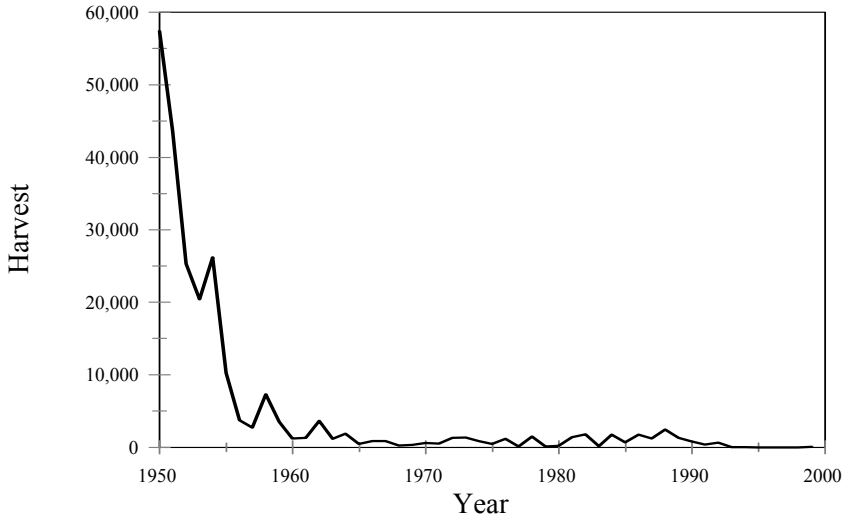


Figure 6. Commercial landings of chum salmon from the Columbia River, 1950-99.

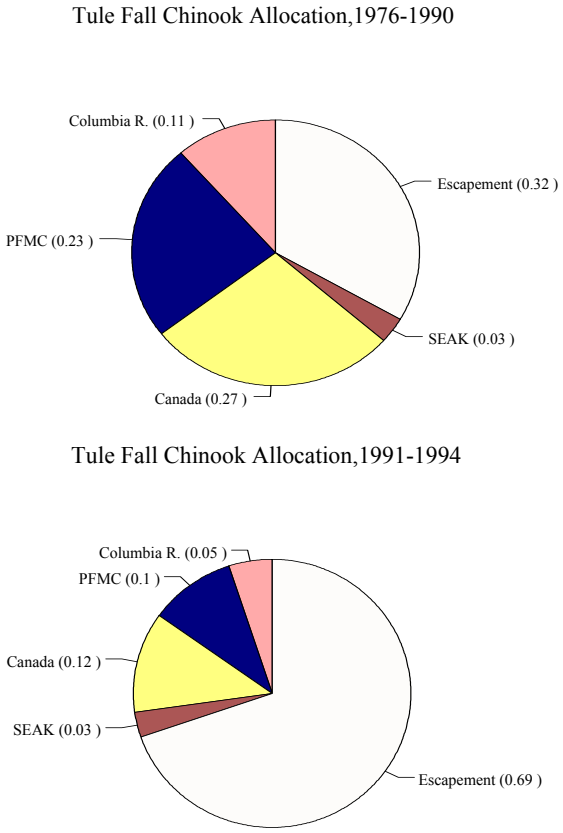


Figure 7. Tule fall chinook allocation pre and post 1991.

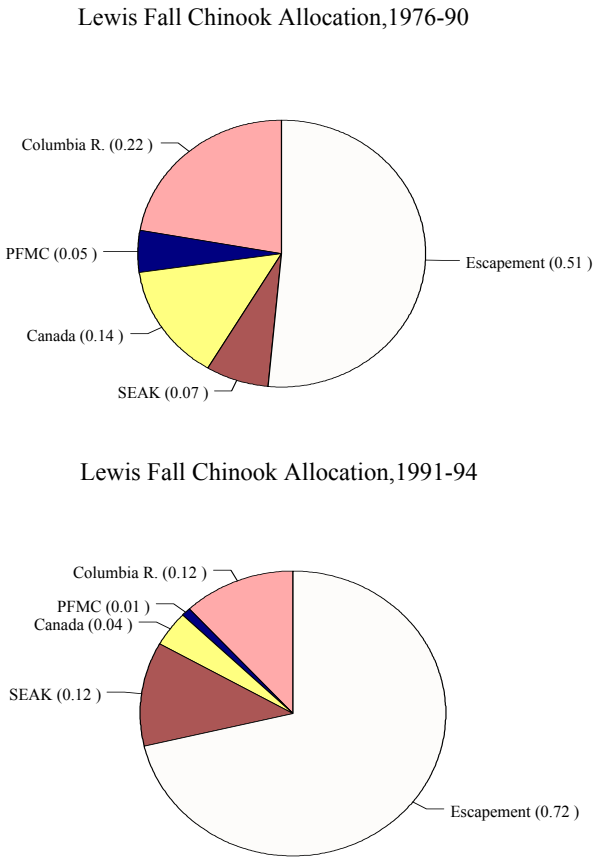


Figure 8. Lewis River chinook allocation pre and post 1991.

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 203 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 Coho	Live Counts	None	AUC	
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 209method. 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 210 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 211together 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 B

Species in Washington and Oregon Mainstem Fisheries of the Columbia River January Through July, 2001. Olympia WA. Portland OR.