Appendix A. HATCHERY AND GENETIC MANAGEMENT PLAN

Lewis River Spring Chinook

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Lewis River Spring Chinook Program \\
Species or Hatchery Stock:	Spring Chinook (Onchorynchus tshawytscha) Lewis River
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Lewis River, tributary to Columbia River Washington state
Date Submitted:	April 04, 2001
Date Last Updated:	February 12, 2001

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Lewis River Spring Chinook Program

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

Lewis River Spring Chinook Salmon (*Onchorynchus tshawytscha*)

1.3) Responsible organization and individuals

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

"Fish First", a volunteer group, raises 150,000 in a net pen with a release at RM 10.

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

Funding for this program is provided through Pacificorp.

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

Lewis River Hatchery trap is located at RM 13 and the Merwin trap is located at RM 16 (Lewis River 27.0168). Both used for broodstock collection.

Speelyai (located at east end of Merwin Reservior) and Lewis River (RM 13) Hatcheries.

"Fish First" net pens at RM 10.

School aquarium projects in Salmon Creek (28.0059) watershed.

GIS coordinates of Lewis River Hatchery X=122.618, Y=45.938
GIS coordinates of Merwin Hatchery X=122.568, Y=45.961
GIS coordinates of Speelyai Hatchery X=122.405, Y=45.989

1.6) Type of program.

Integrated Harvest

1.7) Purpose (Goal) of program.

Mitigation

The goal of this program is to mitigate for the loss of the naturally spawning spring chinook stock due to the development of hydroelectric dams and to provide harvest opportunity.

1.8) Justification for the program.

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

1. Release spring chinook as smolts with expected brief freshwater residence.

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

3. Only appropriate stock will be propagated.

4. Hatchery fish will be propagated using appropriate fish culture methods and consistent with Co-Managers Fish Health Policy and state and federal water quality standards; e.g., NPDES criteria.

5. Mark all reared fish.

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** Chinook programs.

Appendix A

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), monitoring proximity to hatchery production goals, number released recorded on hatchery divisions "plant reports", data available on WDFW data base. 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.

Appendix A

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 data base.
	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 and historical natural out-migrant data
	Hatchery stray rates	
		FBD and hatchery records
		CWT data and mark / unmarked ratios of adults
Maintain stock integrity and genetic diversity	Effective population size	Spawner surveys
	Hatchery-Origin Recruit 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).

800 adults (400 males and 400 females).

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	Lewis River Hatchery (27.0168), RM 13 "Fish First" Net Pens (27.0168), RM 10	900,000 150,000

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

Average smolt-to-adult survivals for 1988-1994 broodyears was .32%

Lewis River spring chinook natural spawning escapement:

Year	Estimated Abundance
1988	5,267
1989	3,483
1990	1,345
1991	1,607
1992	1,254
1993	1,412
1994	475
1995	270
1996	493
1997	410
1998	211
1999	240

For hatchery broodstock collection numbers see section 7.4.2

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

1974.

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.

Lewis River (27.0168).

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

Program goals are tieds to mitigation.

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.

None

- 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 spring chinook in the Lewis River 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.

Unknown.

- 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 section 1.12.

- 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.

Unknown.

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

WDFW estimates 100-300 fall chinook volunteer into the trap so there may be a potential for "take" of listed natural fish.

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

Unknown.

- 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.*

100-300 adult fall chinook volunteer into traps.

- 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.

With adult returns in 2002 (mass marking of 1998 brood spring chinook), WDFW will be able to differentiate between hatchery and natural-origin fish. Take was modeled as a "worst case" scenario and we do not expect to exceed these levels in the un-marked years. However, should this happen, NMFS would be consulted immediately.

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.

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

Mitigation agreement with Pacificorp.

3.3) Relationship to harvest objectives.

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

The in-river sport fishery occurs from late February through July in the 17 miles from the mouth upstream to the deadline below Merwin Dam and is generally seven days per week. The harvest rate of the total adult return has averaged 60%. Maximum harvest rate for mainstem and in-river sport and commercial fisheries has averaged 72% (1980-1999). The harvest rate on “natural” fish would approach zero once mass marking of the hatchery fish is complete for all returning broods. At that point WDFW will shift the sport fishery to a hatchery fish retention only fishery.

3.4) Relationship to habitat protection and recovery strategies.

Access to historic spawning areas blocked by hydroelectric dams inhibit natural production as well as reduced rearing habitat.

3.5) Ecological interactions.

(1) negatively impact program
Large numbers of northern pikeminnows tend to congregate at the mouth of the Lewis River during the spring chinook juvenile emigration time frame. Heavy predation on the juvenile chinook, both hatchery and "natural", by the northern pikeminnow could have a

strong negative effect on this stock of chinook. In addition, avian predation by species such as common merganser, double crested cormorant, and caspian tern can pose a large threat.

(2) be negatively impacted by program
The release of fish not fully smolted could impact listed stocks through competition and/or predation. This risk of competition and predation assumes significant temporal and spatial overlap between the hatchery-origin fish and the listed stocks. Large concentrations of migrating hatchery fish also increase the presence of predatory birds.

(3) positively impact program
Not known.

(4) be positively impacted by program
Hatchery fish spawning naturally could provide additional nutrients to increase the productivity of the watershed. If the hatchery-origin spring chinook and listed fish occupy the same areas at the same time, the large number of hatchery reared fish could overwelm established predators and give listed fish some protection.

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.

All adults trapped and selected for broodstock (from Lewis River and Merwin traps) are inoculated and transferred to Speelyai Hatchery (east end of Merwin Reservior) for holding. The holding pond is supplied with 100% Speelyai Creek water. Water quality is very good with good clarity and temperatures (52-58 degrees) providing for good adult holding. Water for incubation and early rearing is from the same source and feeds fifty stacks of vertical incubators, three deep troughs, four shallow troughs, twenty-four 10' x 80' x 4' raceways and two 1/4 acre rearing ponds. There is 166,800 cubic feet of rearing space with a total flow of approximately 9,200 gallons per minute (gpm). The water used at Speelyai is, of course, different from those spring chinook that spawn naturally. The water source for final rearing of spring chinook at the Lewis River Hatchery (RM 13) and the net pens at RM 10 is Lewis River. The Lewis River Hatchery has twelve 100' x 10' x 4' raceways and four 1/2 acre asphalt rearing ponds (approximately 228,000 cubic feet). At RM 10, there are seven in-river net pens with approximately 50,000 cubic feet of rearing space.

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.

Compliance with all NPDES related effluent monitoring and discharge permit conditions. No listed stocks exist above Merwin dam as well as the Speelyai Hatchery where water is withdrawn.

Lewis River Hatchery intake screens conform with NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish?.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

All spring chinook broodstock for the program are volunteers to the traps at Lewis River (RM 13) and Merwin (RM 16). Traps are open for collection during the entire length of the run (from April 15th to August 1st). Both traps have "V" weirs to prevent the escape of captured fish. The Lewis River trap is 200' x 7' x 5' with a flow of 3,500 gpm. The Merwin trap is approximately 60' x 12' x 7' with a flow of 25,000 gpm.

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

All fish selected for spawning are transferred from the two trap sites to the Speelyai Hatchery for holding. Fish for release are trucked to the Lewis River Hatchery for acclimation. Aproximately 160,000 are also trucked to a net pen site at RM 10. The three trucks used are hatchery assigned vehicles with tank capacity of 1,800, 1,100 and 1,100 gallons. Each of these vehicles are equipped with air stones for aeration or circulation pumps. Each vehicle is equipped to haul and off load both adults and juveniles.

5.3) Broodstock holding and spawning facilities.

All adults are held at the Speelyai Hatchery in a 45,000 cubic foot holding pond with a flow rate of 1,400 gpm. They are spawned at this site as well. The temperatures during adult holding range between 52-58 degrees.

5.4) Incubation facilities.

There are fifty stacks of vertical Heath incubators, three deep troughs and four shallow troughs. Incubation water is supplied from Speelyai Creek via gravity flow. Flow rates to each stack of Heath incubators is 3.6 gpm. Deep troughs and shallow troughs have flow rates of 7-9 gpm.

5.5) Rearing facilities.

Rearing facilities consist of twenty-four 10' x 80' x 4' raceways and two 1/4 acre ponds (166,800 cubic feet) at Speelyai Hatchery. Total water flow is approximately 9,200 gpm. At the Lewis River Hatchery the primary rearing structures include twelve 100' x 10' x 4' raceways and four 1/2 acre asphalt ponds (228,000 cubic feet). Flow is 21,000 gpm. The net pen site, located at RM 10, has seven net pens with approximately 50,000 cubic feet of rearing space.

5.6) Acclimation/release facilities.

The fish at Lewis are acclimated during the entire rearing and release program with water from their parent stream. Those fish transferred to the net pens are reared in Lewis River water for about 350 days prior to release and those from Speelyai are reared in Lewis River water for approximately 75 days prior to release.

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

Difficulties with the rearing program in past years has been associated with outbreaks of BKD and IHN during at least two broodyears. The only disaster associated with mortality was the early release of 1996 broodyear spring chinook due to historic flood conditions. The survival of those released is in serious question.

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.

Listed stocks are encountered only at the traps. Both traps have alternate water supplies and alarm systems. The hatcheries are staffed full time and frequent monitoring of traps has minimized the risk of adult loss.

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 used for this program is collected from the run volunteering to the two trap sites at Lewis River Hatchery (RM 13) and at Merwin (RM 16). The vast majority of the fish collected are of hatchery stock. The hatchery-origin stock is mass marked (adipose fin clip only) except for a group of 75,000 (coded-wire tag + no adipose fin clip) and another group of 75,000 that is coded-wire tagged and adipose fin clipped. When adults are handled, all fish with adipose fins are wanded (a wand-type device) alive to detect a snout tag. Those with adipose fins and no tags are marked and returned to the river as wild fish. If they return for a second time, they are removed from the river system. All hatchery-origin fish trapped are either marked and recycled, spawned as broodstock or sold/donated.

6.2) Supporting information.

6.2.1) History.

This stock was taken from Cowlitz River and Carson stocks originally in the 1970's. Since that time this stock has been propagated on a yearly basis. On two occasions during this time, supplemental eggs or adults have been brought in from a like stock (Kalama and Willamette stock).

6.2.2) Annual size.

With all hatchery reared spring chinook mass-marked no natural spawning spring chinook will be used for broodstock. The annual program broodstock goal is 800 adults (400 males and 400 females).

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

Presently we are not using progeny from natural spawning stocks in our egg taking operation. In the past (pre-mass marking), an unknown number of adults utilized for broodstock came from natural spawning parents. Once determined that enough wild stock are returning from natural spawning parents, it is possible that a portion of this stock may be used in the program.

6.2.4) Genetic or ecological differences.

There are no known genotypic, phenotypic, or behavioral differences between the hatchery stock or natural stock in the North Fork Lewis River.

6.2.5) Reasons for choosing.

There appears to be no known data that would suggest another stock more suitable for this program. The stock being used was originally propagated from native Lewis River stocks.

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.

With the mass marking program in place no listed natural fish will be used in broodstock selection.

SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2) Collection or sampling design.

Collection of spring chinook is at two traps located at RM 13 (Lewis River trap) and at the Merwin trap (base of Merwin dam) at RM 16. The adults volunteer into the traps between April through July. Collection is across the entire run time and is extremely efficient. All natural spawning fish are removed and returned to the river. At the Lewis River trap, fish move up a denile ladder, through a "V" weir and into a channel 200' x 7' x 5'. At the Merwin trap, fish have one step (of a ladder) to jump over to an opening into a "V" weir. The fish enter into a darkened single chamber approximately 60' x 12' x 7'.

7.3) Identity.

The target population is Lewis River spring chinook stock. This population is mass marked (adipose fin clip only) to identify them as being hatchery-origin. A group of 75,000 is marked with a coded-wire tag and no adipsoe fin clip. Another group of 75,000 is coded-wire tagged with an adipose fin clipped. This entails all captured fish returning with an adipose fin being wanded (a wand type device) for tag detection. If no tag is present the fish is released as being from natural spawning parents.

7.4) Proposed number to be collected:

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

800 adults (400 males and 400 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	362	272	3	1,522,000	
1996	403	306	5	1,612,000	
1997	407	379	3	1,696,000	
1998	497	498*	2	1,990,000	
1999	365	394**	40	1,460,000	

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

* 331 males were live spawned.
** 107 males were live spawned.

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

Excess hatchery-origin fish are recycled to the lower river for recreational opportunity one time. Those fish recycled are identified by marking. The second time they are captured, they are killed and provided to tribal or local food bank programs.

7.6) Fish transportation and holding methods.

All fish collected at the two traps are inoculated with erythromycin (for BKD) and then transferred to the Speelyai Hatchery for holding. During the holding period they are inoculated twice more with erythromycin. The pond is supplied with 100% first run Speelyai Creek water. Daily one hour standard formalin drip treatments are made to combat fungus problems. Yearly holding mortality is approximately 5% which is within a targeted objective of less than 7%. In hauling adults, we generally use two trucks with 1,100 gallon tanks attached. A normal hauling load is approximately 700 pounds of fish which translates to 45 fish or less per load. These fish remain in the tank for approximately 20-25 minutes between the capture point and the Speelyai pond.These fish handle and haul extremely well with mortality being extremely rare. There is no application of anesthetics or salves required.

7.7) Describe fish health maintenance and sanitation procedures applied.

During the holding period they are inoculated twice with erythromycin. The pond is supplied with 100% first run Speelyai Creek water. Daily one hour standard formalin drip treatments are made to combat fungus problems. Yearly holding mortality is approximately 5% which is within a targeted objective of less than 7%.

7.8) Disposition of carcasses.

All spawned carcasses are taken to the local landfill for disposal. All mortality is taken to the landfill for disposal.

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.

With the mass marking program in place no listed natural fish will be used for broodstock.

SECTION 8. MATING

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

8.1) Selection method.

Spawners are selected from fish arriving at both traps over the entire run time.

8.2) Males.

A ratio of one male to one females (1:1) no matter how large the egg take.

8.3) Fertilization.

For all egg takes we use one fish pool of eggs and a matrix for fertilization. One male's sperm is provided as a primary and then later another males sperm is provided as backup. We also use a 2% use of jack sperm over the entire days egg take. Fish health procedures used for disease prevention include water hardening of all eggs in an iodophor solution for one hour. We also do a sixty fish sample for ovarian fluid and kidney/spleen samples to test for viral pathogens. Agency spawning guidelines are closely followed (Seidel, 1983).

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.

No listed natural fish are being mated with hatchery-origin fish being identified now with a adipose fin clip (mass marking program).

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.

Year	Eggs Taken	Loss To Eye-Up	Eyed To Ponding
1995	1,556,000	60,000 - 3.86%	4,000 - .27%
1996	1,612,000	74,500 - 4.62%	8,700 - .57%
1997	1,690,048	145,803 - 8.63%	4,800 - .31%
1998	2,267,527	145,631 - 6.42%	6,837 - .32%
1999	1,604,596	92,877 - 5.79%	6,118 - .40%
2000	1,579,630	45,440 - 2.96%	6,706 - .44%

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

Due to the fact that we are doing on-going ELISA work on this stock, each year we take eggs in excess of our needs to insure that we will have our program needs after the moderate and high tiders are removed. We, of course, take some extra eggs each year as a safeguard against higher than normal incubation losses. Unwanted eggs due to the ELISA work are destroyed. At the time the fish are marked and enumerated, if any excess exists, they are released into Merwin Reservoir.

9.1.3) Loading densities applied during incubation.

Loadings per Heath tray are one female (ELISA Requirement) or approximately 4,200 eggs to eyed stage. Once they have been determined to be "clean", they are put down to hatch at 8,000 eggs per tray (consistent with loading densities recommended by Piper et al. 1982) and the flows to the incubators are 3.6 gpm.

9.1.4) Incubation conditions.

Gas levels at Speelyai have never been an issue but influent is periodically monitored to check the total gas levels. Water quality is good with no apparent silt problems.

9.1.5) Ponding.

All fry are ponded at near total button up (slit< 1 millimeter (mm)). Arrived at this method of ponding by using the length and weight factors to arrive at the proper K-factor which has equated to 1,200 Temperature Unit's (TU's).

9.1.6) Fish health maintenance and monitoring.

All eggs are water hardened in iodophor (for viral pathogens) and formalin is used to control fungus outbreaks during incubation. All disease control procedures are conducted consistent with the Co-Managers Fish Health Policy (1996). Egg mortality is removed by the use of an automatic egg picker and then a final hand pick is made before the eggs are put down to hatch.

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.

No eggs are to be used from listed fish.

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..

Year	Fry To Fingerling	Fingerling To Smolt
1996	96.5%	6.3%
1997	87.8%	4.3%

1998	95.7%	* 17.3%
1999	98.4%	1.5%

* High mortality due to chronic BKD problems

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

Loading densities consistent with those recommended by Piper et al. (1982).

9.2.3) Fish rearing conditions

Influent dissolved gas levels are a problem at the Lewis River Hatchery. Since Lewis River is located below four hydroelectric generation facilities, the water system is closely watched and monitored at all times. Lewis River Hatchery is equipped with four de-gassing towers that have proved to be very efficient in treating incoming water with high total gas levels.

Gas levels at Speelyai have never been an issue but influent is periodically monitored to check the total gas levels.

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.

Not available.

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

Not 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*).

Commercial-grade semi-moist feed is used in the production of this stock. Feed sizes are adjusted to accommodate the growth of the fish. Feed schedules have been carefully worked out over the history of this program to allow for a steady growth pattern over the full length of the production program. Feed rates range from .55% to 2.3% B.W./day. The feed conversion efficiency rate is <1:1.

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

Fish health is continuously monitored in accordance with the Co-Manager Fish Health Policy (1996). Fish health is monitored at least monthly by an WDFW pathologist and daily by trained hatchery staff. Specific fish health monitoring and disease control

activities that apply to the Lewis River and Speelyai's facilities are detailed in IHOT (1996).

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

Not applicable.

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.

No listed fish are to be propagated.

SECTION 10. RELEASE

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

Appendix A

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	900,000 150,000	5 5	Feb 22-Mar 31 Feb 22-Mar 31	Lewis River (RM 13) Lewis River (RM 10)

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

Stream, river, or watercourse: Lewis River (27.0168)
Release point: Lewis River RM 10 and RM 13
Major watershed: Lewis 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							1,122,400	6
1997							1,108045	6
1998							1,096,841	6.5
1999							868,180	8.5
Average							1,048,886	6.75

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.

Released from February 22 to March 31. Release strategies are to ensure that hatchery fish migrate from the hatchery/release site with a minimal amount of interaction with native fish populations. Yearly seining is conducted by WDFW staff to collect data in an effort to evaluate the success of our release strategy and to provide data for improvement.

10.5) Fish transportation procedures, if applicable.

No off-station releases where tansporting of fish takes place.

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

Spring chinook reared at the Lewis River Hatchery and at the net pens are acclimated to Lewis River water. Those held at the Speelyai Hatchery for an extended period are acclimated to Lewis River water for the last 75 days prior to release.

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

Recently all hatchery-origin spring chinook are mass marked (adipose-fin clip only). There are two groups of 75,000 that get a coded-wire tag only plus a adipose- fin clip/coded-wire tag, respectively.

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

Releases have always been below permitted levels and within 10% of our program goals.

10.9) Fish health certification procedures applied pre-release.

Routine fish health inspection by Area Fish Health Specialist.

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

Depending upon the circumstances release fish with either the highest probability of surviving to adulthood or the fish with the highest probability of sustaining catastrophic loss if held at hatchery.

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 released are smolted to ensure that the hatchery-origin fish have a minimal amount of interaction with listed fish at time of migration.

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.

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

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

SECTION 12. RESEARCH

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

12.1) Objective or purpose.

1) Measure fecundity of spring chinook salmon at Speelyai Hatchery each year to determine temporal changes.

2) Compare these data to calculate fecundities obtained from hatchery records

3) Compare these data to data obtained at other Columbia Basin hatcheries.

12.2) Cooperating and funding agencies.

National Marine Fisheries Service (NMFS) and Washington Department of Fish & Wildlife (WDFW).

12.3) Principle investigator or project supervisor and staff.

Howard Fuss
Research Scientist
600 Capitol Way N
Olympia, WA 98501-1091

Jim Byrne
Fish & Wildlife Biologist
600 Capitol Way N.
Olympia, Wa. 98501-1091

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

Hatchery progeny only.

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

Length of individual females are taken. Age is determined from coded-wire tags or scales (if not tagged). Fecundity is determined by passing the eggs through an electronic fish counter. The accuracy of the fish counter is greater than 95%. Fecundity by age is determined and the average measured fecundity of the brood is compared among broods and age classes.

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

September through December.

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

Each lot of eggs is carefully passed through the fish counter before standard shocking and picking activities by the hatchery crew. Total number o f eggs are counted and the lot of eggs is placed in the incubator for subsequent incubation and care by the hatchery crew.

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

No mortality to adults due to activity. Unfertilized eggs are usually identified by the mechanical shock received in the process. Live eyed eggs are unharmed.

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).

A total of 20-30 females are used in the study.

12.10) Alternative methods to achieve project objectives.

Two alternatives exist: use estimated fecundities obtained by dividing total egg collection by total females spawned and the second method is to hand count the eggs.

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

Fall chinook, coho, steelhead. No associated mortality to other species due to this activity.

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.

Only hatchery-origin fish used in the research activities.

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.

Busack, C., and A. Marshall. 1991. Genetic analysis of YFP chinook salmon stocks. Pages 2-45 *in* C. Busack, C. Knudsen, A. Marshall, S. Phelps, and D. Seiler. Yakima Hatchery Experimental Design. Progress Report, DOE/BP-00102. Bonneville Power Administration, Portland, OR.

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

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

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

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.

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

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

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

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.

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

Washington Department of Fish and Wildlife, 1996. Fish Health Manual. Hatcheries Program, Fish Health Division, Washington Department of Fish and Wildlife, Olympia.
Piper, Robert, et. al., 1982. Fish Hatchery Management; U. S. Department of Interior, Fish and Wildlife Service, Washington, D. C.

Seidel, Paul. 1983. Spawning Guidelines for Washington Department of Fish and Wildlife Hatcheries. Washington Department of 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:_____

Appendix A

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

Listed species affected: Chinook ESU/Population: lower Columbia Chinook Activity: Hatchery				
Location of hatchery activity: Lewis R. Dates of activity: April-March Hatchery program operator: WDFW				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			100-300*	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)	Unknown	Unknown	10-30*	
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.
*** This includes trapping for summer steelhead (do not double count).**

Instructions:

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

Appendix A

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

Listed species affected: Steelhead ESU/Population: lower Columbia Steelhead Activity: Hatchery				
Location of hatchery activity: Lewis R. Dates of activity: April-March 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	Unknown	
Other Take (specify) h)				

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

Instructions:

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

Appendix A

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

Listed species affected: Chum	**ESU/Population: lower Columbia Chum**		**Activity: Hatchery**	
Location of hatchery activity: Lewis R.	**Dates of activity: April-March**	**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)			0	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)	Unknown	Unknown	0	
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

Lewis River Summer Steelhead

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

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

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Lewis River Summer Steelhead Program

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

Lewis River Summer Steelhead *(Onchorynchus mykiss*)

1.3) Responsible organization and individuals

Name (and title): Chuck Johnson, Region 5 Operations Manager
Robin Nicolay, Complex Manager
Agency or Tribe: Washington Department of Fish and Wildlife
Address: 600 Capitol Way North, Olympia, Wa. 98501-1091
Telephone: (360) 902-2653
(360) 225-2120
Fax: (360) 902-2943
(360) 225-6330
Email:
johnscwj@dfw.wa.gov
nicolrbn@dfw.wa.gov

Also contact: Dan Rawding (360)906-6747
rawdidr@dfw.wa.gov
Fax: (360)906-6776

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

Pacificorp (formerly Pacific Power and Light (PPL)) is the mitigation funding source on the North Fork Lewis River. They provide funding for operations of the three existing fish cultural facilities located on the North Fork system.

The local enhancement group "Fish First" is involved in the operation of net pens located in Merwin Reservoir and at Echo Cove (in-river). Summer steelhead (60k) are reared in the Merwin net pens and released in the North Fork Lewis.

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

Funding for this program is provided through Pacificorp.

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

Lewis River Hatchery and trap (for broodstock collection) are located at RM 15.7 on the

N.F. Lewis River (27.0168). The Merwin Hatchery and trap are located at RM 19 below Merwin dam.

Merwin Reservoir net pens are located at the east end of the reservoir in Speelyai Bay. This site is at RM 28. The other net pens are located in Echo Cove (RM 12).

1.6) Type of program.

Integrated Harvest

1.7) Purpose (Goal) of program.

The goal of this program is to mitigate for the loss of summer steelhead due to the development of the hydroelectric dams in the Lewis River basin and to provide harvest opportunities.

1.8) Justification for the program.

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

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

2. Only appropriate stocks will be propagated.

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

4. Fish will be acclimated before release when possible.

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

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

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

1.9) List of program “Performance Standards”.

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

Appendix B

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), monitoring proximity to hatchery production goals, number released recorded on hatchery divisions "plant reports", data available on WDFW data base. 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 data base.
	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 and historical natural out-migrant data
	Hatchery stray rates	FBD and hatchery records
		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

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).

430 fish (215 males and 215 females).

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	Lewis River (27.0168) RM 4	235,000

Note (1): an additional 50,000 smolts (Skamania stock) are programmed to be released from lower Lewis River (27.0168) net pen.
Note (2): an additional 20,000 smolts (Skamania stock) are programmed to be released into the E.F. Lewis River (27.0173).

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

Hatchery Trapping Of Adult Summer Steelhead

Brood Year	Lewis Trap	Merwin Trap	Total Trapped
1995	117	1228	1345
1996	209	1210	1419
1997	429	1190	1619
1998	280	935	1215
1999	30	1078	1108
2000	27	1060	1087

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

1995.

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.

N.F. Lewis River (27.0168)

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

Goals are presently being met.

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.

None

- 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 mainstem (N.F.) Lewis as "depressed".

- 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.

*See below (other measures of productivity).

- 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.

*For the EF Lewis River, the annual spawning abundance for wild summer steelhead were:

Year	Number
1996	93
1997	85
1998	61
1999	60
2000	99

- 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.

Not known.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take *(see "Attachment 1" for definition of "take")***.**

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

Broodstock collection at the two traps (Lewis River, RM 15.7 and Merwin, RM 19) directed at summer steelhead has a potential for take on listed fall chinook. The incidence of capturing fall chinook has ranged between 100 and 300 adults yearly (volunteered into traps). The take on other listed fish (spring chinook, winter and summer steelhead) has been low. A total of 6 and 8 wild summer steelhead volunteered into the traps in 1999 and 2000, respectively.

Releasing fish that are not fully smolted may impose a take by competing directly/indirectly as well as preying on listed fish.

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

100-300 listed fall chinook volunteer into traps yearly (trapping mortality =7 adults).
8 listed winter steelhead volunteered into traps in 1998 (no trapping mortality).
6 listed summer steelhead volunteered into traps in 1998 (trapping mortality = 1).
8 listed summer steelhead volunteered into traps in 1999 (no trapping mortality).
14 listed winter steelhead volunteered into traps in 1999 (no trapping mortality).
31 listed winter steelhead volunteered into traps in 2000 (no trapping mortality).

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).
*Complete the appended "take table" (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.*

100-300 adult fall chinook that volunteer into traps.
1-40 adult winter steelhead that volunteer into traps.
1-40 adult summer steelhead that volunteer into traps.

- 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.

No plan has been discussed with hatchery staff as yet. We are making every effort to avoid stress and mortality on all listed stocks and to process all fish from our traps in a timely manner. All wild stocks are carefully handled and trucked to a point in the river system that would enhance their spawning ability and reduce their opportunity to re-enter one of our traps.

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.

Lower Columbia Steelhead Conservation Initiative; WDFW Wild Salmonid Policy; IHOT.

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

Existing agreements include the Columbia River Fish Management Plan (CRFMP).

3.3) Relationship to harvest objectives.

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

The releases of adipose-fin clipped summer steelhead provide sport harvest opportunity for anglers in the Lewis and lower Columbia rivers. They enter fisheries from March through October and most of the catch occurs from late May through August. Selective harvest regulations allow only the harvest of adipose-fin clipped summer steelhead in the lower Columbia River to protect wild summer steelhead. Specific harvest rates for the hatchery steelhead are unknown, however, punch card estimates for total harvest of marked hatchery steelhead are available by month for all areas open to sport harvest.

Only wild steelhead release fisheries are permitted in the Lower Columbia Management Area (LCMA). Estimated tributary fisheries exploitation (includes incidental mortality due to other-species targeted fisheries) rate in the LCMA on wild summer steelhead is < or = to 10%.

3.4) Relationship to habitat protection and recovery strategies.

Natural production has been affected by habitat degradation in Lewis River tributaries and the passage barrier at Merwin Dam. Habitat restoration efforts have been taking place on some of the tributaries such as Cedar Creek.

3.5) Ecological interactions.

Negatively impact program:
1). Competition for food when summer steelhead are released may increase their mortality as well as predation from increasing number of birds such as mergansers and terns. Although northern pikeminnows are present, the free flowing characteristics of the lower river and water temperatures during emigration don't suggest that the species poses significant risk to steelhead smolts.

Be negatively impacted by program:
2). Competition and predation of listed stocks by hatchery-origin summer steelhead will depend on the number, size, and release and residence time of the hatchery-origin fish. This risk of competition and predation assumes significant temporal and spatial overlap between the hatchery-origin summer steelhead and the listed fish (steelhead are released below chinook rearing areas to minimize interaction). Releasing large numbers of hatchery fish can stimulate premature outmigration of wild (listed) fish (Hillman and Mullin 1989). This can reduce survival because they would be smaller than normal at outmigration, making them more vulnerable to predation.

Positively impact program:
3). Not known.

Be positively impacted by program:

4). If the hatchery-origin summer steelhead and listed fish occupy the same areas at the same time, the large number of hatchery-origin fish may provide listed fish some protection from other salmonids and non-salmonids as well as avian predators.

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 holding ponds at the Merwin site are supplied with 100% Lake Merwin water (600 gallons per minute (gpm)). Water temperatures range below and above generally acceptable levels (42-61 degrees) during adult holding. Water clarity is good. Water for incubation and rearing is from the same source and feeds 15 vertical incubators, six intermediate ponds, four shallow troughs, ten raceways (9.5' x 80' x 2.5') and four 1/4 acre rearing ponds. Total flow to these is approximately 5,000 gpm. Program complies with all NPDES permits.

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

Compliance with all NPDES related effluent monitoring and discharge permit conditions. Intake screens meet all present NMFS requirements at Lewis River and Merwin Hatcheries.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

All summer steelhead broodstock for the program are volunteers to the Lewis River (RM 15.7) and Merwin (RM 19) traps. Traps are open for adult collection for approximately 7 months to allow for collection over the entire run time. Both traps have "V" weirs to prevent the escape of captured fish. The Lewis River trap is 200' x 7' x 5' with a flow of 3,500 gpm. The Merwin trap is approximately 60' x 12' x 7' with a flow of 25,000 gpm.

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

All fish selected for spawning at the traps are transported via 1,100 gallon tanker truck to the holding ponds at the Merwin Hatchery. When juveniles are released they are trucked from the Merwin Hatchery to the release site at RM 4 on the Lewis River. Three trucks are used; two are 1,100 gallon capacity and the other truck is a 1,800 gallon capacity tanker. All three trucks are supplied with water re-circulation pumps as well as oxygen defusion systems.

5.3) Broodstock holding and spawning facilities.

There are four holding ponds (7.5' X 33' X 4') at Merwin Hatchery where the summer steelhead are spawned. Flow rate is 150 gpm for each pond.

5.4) Incubation facilities.

There are 15 stacks of vertical Heath incubators utilized for egg incubation and hatching. Flows to each stack is 3.6 gpm.

5.5) Rearing facilities.

The rearing facilities consist of six intermediate ponds (4.5' X 34' X 2'), ten 9.5' x 80' x 2.5' raceways and four 1/4 acre ponds.

5.6) Acclimation/release facilities.

Acclimation facilities consist of the rearing ponds referenced above in section 5.5 (Lewis River water). Fish are collected at the rearing site, trucked and released at RM 4 on the Lewis River.

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

Despite the fact that all water supplied during incubation and early rearing for this stock is ozone treated, we still experience periods of high mortality. These losses would be in the category of difficulties rather than disasters. The condition or diseases associated with these losses are saprolegniasis and low temp.We have also experienced high losses in the adults being held for spawning during each of the past five seasons. These losses are associated with saprolegniasis and IHN.

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.

Listed fish are encountered only at the traps. All listed fish encountered are carefully handled and taken back to the river to an area to reduce recapture. Both traps have alternate water supplies and alarm systems. Frequent monitoring of traps has minimized the risk of adult loss.

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.

Adipose-fin clipped summer steelhead returning the Lewis and Merwin traps.

6.2) Supporting information.

6.2.1) History.

The stock was originally Skamania (Washougal River)/Klickitat River crosses (1950's). Historically, plants of this stock were made into the Lewis River system from the Skamania Hatchery. Since the hatchery was built on the Lewis River, the broodstock has derived from taking eggs from returning summers in the Lewis system or importing eggs from the Skamania Hatchery.

6.2.2) Annual size.

430 adults.

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

None

6.2.4) Genetic or ecological differences.

Earlier return/spawning time than natural stocks.

6.2.5) Reasons for choosing.

To provide harvest opportunity while minimizing genetic and ecological risks to natural fish. Locally adapted.

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.

Not selecting broodstock from listed natural summer steelhead.

SECTION 7. BROODSTOCK COLLECTION

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

Adults.

7.2) Collection or sampling design.

Collection of hatchery-origin summer steelhead is at two traps located at RM 15.7 (Lewis River trap) and the Merwin trap (base of Merwin dam) at RM 19. The Lewis River trap is operated from April 15th to December 31st while the Merwin trap is open year round, beginning in 2001. At the Lewis River trap, fish move up a denil ladder, through a "V" weir and into a channel 200' X 7' X 5'. At the Merwin trap, fish have one step (of a ladder) to jump over to an opening into a "V" weir. The fish enter into a darkened chamber approximately 60' x 12' x 7'. All fish volunteer into trap.

7.3) Identity.

1. Limited time period of broodstock collection (mid-June through August).

2. All hatchery-origin summer steelhead are adipose-fin clipped.

7.4) Proposed number to be collected:

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

215 males and 215 females

Appendix B

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	53	*		230,060	
1996	82	*		276,500	
1997	19	19		66,500	
1998	99	199		247,500	
1999	116	224		325,200	

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

*- Records not available for the number of males spawned (live-spawning took place, but no data available).

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

Differentially marked and returned to river for increased recreational opportunity until late in the run timing period. At that time, all adults trapped in excess of spawning needs are transported to local lakes for fishing opportunity.

7.6) Fish transportation and holding methods.

All fish selected for spawning are transported from the traps to the holding ponds at the Merwin site. Traps are worked at least once each week and usually twice. Actual transport time from Merwin trap is 5 minutes, from Lewis trap 10 minutes.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adults are treated with formalin or hydrogen peroxide or a combination of both to control fungus growth. Fish health measures are consistent with the Co-Managers Fish Health Policy.

7.8) Disposition of carcasses.

All carcasses are taken to the local landfill for disposal.

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

No listed natural spawning fish are taken for broodstock and are returned to the river. Listed fish are transported to the river immediately upon handling. It is possible that a wild fish could be held in one of our traps for a week in the worst case. Both traps are fish friendly with stress and mortalities being extremely low.

SECTION 8. MATING

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

8.1) Selection method.

Only marked summer steelhead seen for the first time from mid-June through August are chosen.

8.2) Males.

A spawning matrix of one primary male for fertilization backed up by a second male to insure fertilization is always used no matter how large the egg take.

8.3) Fertilization.

The eggs of one female and a matrix for fertilization is used. One males' sperm is provided as a primary and than later another males' sperm is used as a backup. Disease prevention includes water hardening of all eggs in a iodophore solution for one hour. A 100% sampling of ovarian fluid and kidney/spleen samples taken for virus check.

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.

Early spawning hatchery fish have been selected to decrease the chances of mating with listed natural spawning fish. Also, all hatchery-origin fish are marked.

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

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

Brood Year	Eggs Taken	% survival to eye up / ponding
1995	Could not find available data	
1996	276,500	62.9 %
1997	Received 252,000-Skamania	99.6 %
1998	410,608	81.3 % *
1999	444,263	78.6 % *
2000	440,609	71.3 % *

* Includes eggs destroyed due to IHN.

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

With mortality rates of approximately 22.56%, due to poor fertilization (green males) and past disease problems (IHN), extra eggs have been taken. Smolt releases have never exceeded the program release goal of 235,000.

9.1.3) Loading densities applied during incubation.

Loadings per Heath tray are approximately 8,000 and the flows to the incubators are 3.6 gallons per minute (gpm).

9.1.4) Incubation conditions.

Water is pumped from the Merwin Reservoir and provides silt free water to the incubators. Since all the water to the hatchery is oxonated, runs through an enclosed stripper and has additional packed columns, the water is disbursed of any entrained gases and well oxygenated. They are closely monitored and have been well within appropriate levels.

9.1.5) Ponding.

All fry are ponded at or near button up (slit < 1 mm). Arrived at this method of ponding by using length and weight factors to arrive at the proper K-factor which is equated to 1,200 Temperature Units (TU's). Ponding dates each year run between February 25th and April 5th. Swim-up is volitional where ponding is forced.

9.1.6) Fish health maintenance and monitoring.

All eggs are treated with iodophore during water hardening for disease prevention. They are also treated with formalin during incubation for prevention of fungus. Yolk-sac malformation is of such low levels as to provide no concern. Most egg losses are due to lack of fertilization. Egg mortality removal is done on a daily basis by use of hand pickers. All data is recorded each day.

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.

No eggs are used from listed fish.

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..

Brood Year	Fry To Fingerling Survival	Fingerling To Smolt Survival
1995	87.04%	95.28%
1996	93.53%	98.73%
1997	92.20%	98.48%
1998	93.93%	97.15%
1999	88.55%	95.26%

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

Loading densities consistent with those recommended by Piper et. al. (1982).

9.2.3) Fish rearing conditions

Water is pumped from the Merwin Reservoir and provides silt free water to the incubators and rearing facilities. Since all the water to the hatchery is oxonated, runs through an enclosed stripper and has additional packed columns, the water is disbursed of

any entrained gases and well oxygenated. They are closely monitored and have been well within appropriate levels. Standard pond management as per Piper et. al. (1982).

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.

BY	Length	Weight	CV
95	208	6.0 fpp	8.75
96	194	6.2 fpp	6.68
97	196	6.3 fpp	9.53
98	208	5.7 fpp	7.71

Information is available on a monthly length, weight and CV for most of the rearing period. This information can be obtained from hatchery archive records.

* fish per pound (fpp).

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

Most of the information asked for in this section is not in our staffs area of expertise, therefore, is not taken. Growth rates are somewhat dictated by the water temperatures that we experience. We, of course, have a target growth curve that we follow to arrive at the programmed fish size at time of release. This course provides for a steady growth rate to achieve the desired size while meeting the body fat levels deemed acceptable by our hatcheries section.

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*).

Commercial-grade dry feed is used in the rearing of hatchery-origin summer steelhead. Feed sizes are adjusted to accommodate the growth of the fish. Feed schedules have been worked out over the history of this program to allow for a s teady growth over the full rearing period. Feed rates range from a low of .55% to 3.6% B.W./day. Food conversion efficiency is < 1.1%.

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

Fish health is continously monitored in compliance with the Co-Manager Fish Health Policy standards. Fish health is checked at least monthly by an agency pathologist and daily by trained hatchery staff. Specific fish health monitoring and disease control activities that are detailed in IHOT (1996) are specific to the Merwin facility.

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

Not applicable.

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.
No listed fish are under propogation.

SECTION 10. RELEASE

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

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

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Smolts	235,000	5	Mid-April - May 10	Lewis River (RM 4)

Note: An additional 60,000 (1997-2000) were transferred from Skamania Hatchery to the net pens in Echo Cove to be acclimated for 30 days and released at RM 13.

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

Stream, river, or watercourse: Lewis River (WRIA 27.0168)
Release point: RM 4, RM 13 (refer to "note" above)
Major watershed: Lewis 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							117,024	6.1
1996							122,279	5.8
1997							173,943	6.4
1998							151,058	6.4
1999							197,545	5.7
Average							152,370	6.1

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 from mid-April to May 10th. Actual days of release are usually on all weekdays between the above mentioned period. Fish are allowed to volitionally migrate from the rearing ponds to the smolt collection ponds where they are pumped into tank trucks on a daily basis and hauled to the release sites. Some days have only a haul or two and on other days several hauls are required to move all of the fish collected.

10.5) Fish transportation procedures, if applicable.

Fish are loaded via pump into the truck at 3/4 pound per gallon capacity and hauled for approximately 20 minutes (12 miles) to the release site. Temperatures are dictated by the natural temperature levels of the river water being used to transport. The tank water is re-circulated via pumps and oxygen is defused into the system at a set rate.

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

Acclimated to appropriate river water their entire life.

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

100% of hatchery-origin summer steelhead are adipose-fin clipped.

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

Fish surplus to program have been planted in Merwin Reservoir. We have no excess fish at time of smolt releases.

10.9) Fish health certification procedures applied pre-release.

Routine fish health inspection by Area Fish Health Specialist.

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

Depending upon the circumstances, release fish with either the highest probability of surviving to adulthood or the fish with the highest probability of sustaining catastrophic loss if held at hatchery.

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.

Release smolts at RM 4 to ensure that the hatchery-origin fish have minimal amount of interaction with listed fish at time of migration.

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.

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

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

SECTION 12. RESEARCH

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

12.1) Objective or purpose.

A Steelhead Rearing Density Study to help define the rearing capacity of Merwin Hatchery. It may determine that fewer steelhead can be released to produce the same number of adults. This decrease could benefit listed natural stocks by reducing potential competition.

A Steelhead Precocity Study to help define the effects of feeding regimes and juvenile size on precocity. Reducing precocity rates would decrease residualism which would reduce competition with listed natural juveniles. This could also reduce release numbers, as well.

12.2) Cooperating and funding agencies.

WDFW and Pacificorp.

12.3) Principle investigator or project supervisor and staff.

Jack Tipping and Todd Hillson.

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

Juveniles from hatchery stock are used.

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

Steelhead Rearing Density Study. Capture was done either with dip net or by seining ponds. MS-222 was used to anesthetize fish when needed. 300 juveniles were sampled just prior to release to determine mean length and K-factor. Study groups (approximately 60,000 in each group) were identified with blank coded-wire tags located in the cheek. Standard hatchery fish culture protocols were used throughout the rearing period.

Steelhead Precocity Study. Approximately 6,000 juvenile fish reared in raceways are involved. Capture was done with dip nets. MS-222 was used to anesthetize fish when needed. 300 juveniles were sampled to determine a length distribution in mid-August. the largest 10 percent were then graded off and marked with a coded-wire tag. Three equal groups were made from the remaining fish and then equal numbers of marked fish were added into the three groups. These three groups were then fed different levels (power fed, normal ration, reduced ration) during the remainder of August and through September. All fish will be sampled/examined in late December and, again, prior to release for precocity.

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

Steelhead Rearing Density Study. Summer steelhead released in 1999-2001.

Steelhead Precocity Study. August to release, 2000-02.

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

As described in section 9 of this document unless noted above.

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

None.

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).

None.

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.

None.

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.

No listed natural fish will be used.

SECTION 13. ATTACHMENTS AND CITATIONS

Washington Department of Fish and Wildlife, 1996. Fish Health Manual. Hatcheries Program, Fish Health Division, Washington Department of Fish and Wildlife, Olympia, Wa.

Piper, Robert, et. al., 1982. Fish Hatchery Management; U. S. Department of Interior, Fish and Wildlife Service, Washington, D. C.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Appendix B

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

Listed species affected: Chinook	**ESU/Population: Lower Columbia Chinook**		**Activity:Hatchery Operations**	
Location of hatchery activity:Lewis River/Merwin	**Dates of activity: April -January**	**Hatchery program operator: WDFW**		
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)			100-300 *	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown	10-30*	
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.
*** This includes trapping for spring chinook also (do not double count)**

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: Steelhead	**ESU/Population: Lower Columbia Steelhead**			**Activity:Hatchery Operations**
Location of hatchery activity:Lewis River/Merwin	**Dates of activity: April -January**		**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)			80	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown	20	
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
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

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

Appendix B

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

Listed species affected: Chum ESU/Population: Lower Columbia Chum Activity: Hatchery Operations				
Location of hatchery activity:Lewis River/Merwin Dates of activity: April -January 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	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
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

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

Appendix C. HATCHERY AND GENETIC MANAGEMENT PLAN

Lewis River Winter Steelhead

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Lewis River Winter Steelhead Program Progra
Species or Hatchery Stock:	Winter Steelhead (Onchorynchus mykiss) Lewis River
Agency/Operator:	Washington Department of Fish and Wildlife
Watershed and Region:	Lewis River, tributary to Columbia River Washington state
Date Submitted:	April 04, 2001
Date Last Updated:	March 18, 2001

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Lewis River Winter Steelhead Program

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

Lewis River Winter Steelhead (*Onchorynchus mykiss*)

1.3) Responsible organization and individuals

Name (and title):	Chuck Johnson, Region 5 Operations Manager Robin Nicolay, Complex Manager
Agency or Tribe:	Washington Department of Fish and Wildlife
Address:	600 Capitol Way North, Olympia, Wa. 98501-1091
Telephone:	(360) 902-2653 (360) 225-2120
Fax:	(360) 902-2943 (360) 225-6330
Email:	**johnscwj@dfw.wa.gov** **nicolrbn@dfw.wa.gov**
Also contact:	Dan Rawding (360)906-6747 **rawdidr@dfw.wa.gov** Fax: (360)906-6776

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

Pacificorp (formerly Pacific Power and Light (PPL)) is the mitigation funding source on the North Fork Lewis River . They provide funding for operations of the three existing fish cultural facilities located on the North Fork system.

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

Funding for this program is provided through Pacificorp.

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

Lewis River Hatchery and trap (for broodstock collection) is located at RM 15.7 and the Merwin Hatchery and trap is located at RM 19 on the Lewis River (27.0168).

1.6) Type of program.

Appendix C

Integrated Harvest

1.7) Purpose (Goal) of program.

The goal of this program is to mitigate for the loss of winter steelhead due to the development of the hydroelectric dams in the Lewis River basin and to provide harvest opportunity.

1.8) Justification for the program.

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

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

2. Only appropriate stocks will be propagated.

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

4. Fish will be acclimated before release when possible.

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

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

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

1.9) List of program "Performance Standards".

1.10) 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	Number of juvenile fish	Estimating number of fish planted (weighing / counting

goals	released	fish), monitoring proximity to hatchery production goals, number released recorded on hatchery divisions "plant reports", data available on WDFW data base. 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 data base.
	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 and historical natural out-migrant data
	Hatchery stray rates	
		FBD and hatchery records
		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

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).

400 fish (200 males and 200 females).

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

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling		
Smolts	Lewis River (27.0168), RM 4	100,000

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

Hatchery Trapping of Adult Winter Steelhead

Brood Year	Lewis Trap	Merwin Trap	Total Trapped
1995	248		248
1996	109	203	312
1997	127	453	580
1998	317	267	584
1999	140	246	386

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

1995.

1.14) Expected duration of program.

Ongoing

1.15) Watersheds targeted by program.

N.F. Lewis River (27.0168)

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

Goals are presently being met.

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.

None

- 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 mainstem (N.F.) Lewis as "depressed".

- 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.

See below (other measures of productivity)*

- 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.

*For Cedar Creek (tributary to the Lewis River) the annual spawning abundance for wild winter steelhead were:

Year	Number
1996	70

1997	78
1998	38
1999	52

- 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.

Not 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.

Broodstock collection at the traps directed at winter steelhead has a "low" potential to take listed spring chinook. There has been "low" incidence of take on listed summer and winter steelhead. WDFW estimates 100-300 fall chinook volunteer into the trap so there may be a potential for "take" of listed natural fish.

Releasing fish that are not fully smolted may impose a take by competing directly/indirectly as well as preying on listed fish.

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

100-300 listed fall chinook volunteer into the traps yearly (trapping mortality =7 adults).
8 listed winter steelhead volunteered into traps in 1998 (no trapping mortality).
6 listed summer steelhead volunteered into traps in 1998 (trapping mortality = 1).
8 listed summer steelhead volunteered into traps in 1999 (no trapping mortality).
14 listed winter steelhead volunteered into traps in 1999 (no trapping mortality).
31 listed winter steelhead volunteered into traps in 2000 (no trapping mortality).

-Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).
*Complete the appended "take table" (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.*

100-300 adult fall chinook that volunteer into traps.
1-40 adult winter steelhead that volunteer into traps.
1-40 adult summer steelhead that volunteer into traps.

- 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.

No plan has been discussed with hatchery staff as yet. We are making every effort to avoid stress and mortality on all listed stocks and to process all fish from our traps in a timely manner.All wild stocks are carefully handled and trucked to a point in the river system that would enhance their spawning ability and reduce their opportunity to re-enter one of our traps.

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.

Lower Columbia Steelhead Conservation Initiative; WDFW Wild Salmonid Policy; IHOT.

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

Existing agreements include the Columbia River Fish Management Plan (CRFMP).

3.3) Relationship to harvest objectives.

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

The releases of adipose-fin clipped winter steelhead provide sport harvest opportunity for anglers in the Lewis and lower Columbia rivers. Fisheries targeting winter steelhead are concentrated from December through February and extend through May 31 on the Lewis River. Selective harvest regulations allow only the harvest of adipose-fin clipped winter steelhead in the lower Columbia River to protect wild winter steelhead. Specific harvest rates for the hatchery steelhead are unknown, however, punch card estimates for total harvest of marked hatchery steelhead are available by month for all areas open to sport harvest.

Only wild steelhead release fisheries are permitted in the Lower Columbia Management Area (LCMA). Estimated tributary fisheries exploitation (includes incidental mortality due to other-species targeted fisheries) rate in the LCMA on wild winter steelhead is < or = to 10%.

3.4) Relationship to habitat protection and recovery strategies.

Natural production has been affected by habitat degradation in Lewis River tributaries and the passage barrier at Merwin Dam. Habitat restoration efforts have been taking place on some of the tributaries such as Cedar Creek.

3.5) Ecological interactions.

Negatively impact program:
1). Competition for food when winter steelhead are released may increase their mortality as well as predation from increasing numbers of birds such as mergansers and terns. Although northern pikeminnows are present, the free flowing characteristics of the lower river and water temperatures during emigration don't suggest that the species poses significant risk to steelhead smolts.

Be negatively impacted by program:
2). Competition and predation of listed stocks by winter steelhead will depend on the number, size and release time and stream residence time of the hatchery fish. This risk of competition and predation assumes significant temporal and spatial overlap between the hatchery-origin fish and the listed fish (steelhead are released below chinook rearing areas to minimize interaction). Releasing large numbers of hatchery fish can stimulate premature outmigration of wild (listed) fish (Hillman and Mullan 1989). This can reduce survival because they would be smaller than normal at outmigration, making them more vulnerable to predation.

Positively impact program:
3). Not known.

Be positively impacted by program:
4). If the hatchery-origin steelhead and listed stocks occupy the same areas at the same time, the large number of hatchery-origin winter steelhead may provide listed salmonids some protection from other salmonids and non-salmonids as well as avian predators.

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 holding ponds at the Merwin site are supplied with 100% Lake Merwin water (600 gallons per minute (gpm)). Water temperatures range below and above generally acceptable levels (42-61 degrees Fahrenheit) during adult holding. Water clarity is good. Water for incubation and rearing is from the same source and feeds 15 vertical incubators, six intermediate ponds, four shallow troughs, ten raceways (9.5' x 80' x 2.5') and four 1/4 acre rearing ponds. Total flow to these is approximately 5,000 gpm. Program complies with all NPDES permits.

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

Compliance with all NPDES related effluent monitoring and discharge permit conditions. Intake screens meet all present NMFS requirements at Lewis River and Merwin Hatcheries.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

All winter steelhead broodstock for the program are volunteers to the Lewis River (RM 15.7) and Merwin (RM 19) traps. Trapping for broodstock collection begins in December and runs through January 31. The trap at Merwin Dam will be operated year round (beginning in 2001) to remove hatchery-origin adults that volunteer to the trap outside the broodstock collection period. Both traps have "V" weirs to prevent the escape of captured fish. The Lewis River trap is 200' x 7' x 5' with a flow of 3,500 gpm. The Merwin trap is approximately 60' x 12' x 7' with a flow of 25,000 gpm.

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

All fish selected for spawning at the traps are transported by a 1,100 gallon tanker truck to the holding ponds at Merwin Hatchery. When juveniles are released they are trucked from the Merwin Hatchery to the release site at RM 4 on the Lewis River. Three trucks are used; two are of 1,100 gallon capacity and the other truck is a 1,800 gallon capacity tanker. All three trucks are supplied with water re-circulation pumps as well as oxygen defusion systems.

5.3) Broodstock holding and spawning facilities.

There are four adult holding ponds (7.5' X 33' X 4' each) at Merwin Hatchery where the winter steelhead are spawned. Flow rate is 150 gpm for each pond.

5.4) Incubation facilities.

There are 15 stacks of vertical Heath incubators utilized for egg incubation and hatching. Flows to each stack is 3.6 gpm.

5.5) Rearing facilities.

The rearing facilities consist of six intermediate ponds (4.5' X 34' X 2'), ten 9.5' x 80' x 2.5' raceways and four 1/4 acre ponds.

5.6) Acclimation/release facilities.

Acclimation facilities consist of the rearing ponds referenced above in section 5.5 (Lewis River water). Fish are collected at the rearing site, trucked and released at RM 4 on the Lewis River.

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

Despite the fact that all water supplied during incubation and early rearing for this stock is ozone treated, we still experience periods of high mortality. These losses would be in the category of difficulties rather than disasters. The condition or diseases associated with these losses are saprolegniasis and low temp.We have also experienced high losses in the adults being held for spawning during each of the past five seasons. These losses are associated with saprolegniasis and IHN.

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.

Listed stocks are encountered only at the traps. All stocks encountered are carefully handled and taken back to the river to an area to reduce re-capture. Both traps have alternate water supplies and alarm systems. Frequent monitoring of traps has minimized the risk of adult fish loss.

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.

Adipose-fin clipped winter steelhead returning to the Lewis and Merwin traps.

6.2) Supporting information.

6.2.1) History.

Origin is a mix of Beaver Creek, Skamania winter hatchery stocks.

6.2.2) Annual size.

400 adults.

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

None

6.2.4) Genetic or ecological differences.

Earlier return/spawning time than natural stocks.

6.2.5) Reasons for choosing.

To provide harvest opportunity while minimizing genetic and ecological risks to natural fish. Locally adapted.

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.

Not selecting broodstock from listed natural winter steelhead.

SECTION 7. BROODSTOCK COLLECTION

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

Adults

7.2) Collection or sampling design.

Collection of hatchery-origin winter steelhead is at two traps located at RM 15.7 (Lewis River trap) and at the Merwin trap (base of Merwin dam) at RM 19. The Lewis River trap is operated from April 15th to December 31st while the Merwin trap is open year round, beginning in 2001. At the Lewis River trap, fish move up a denil ladder, through a "V" weir and finally into a channel 200' X 7' X 5'. At the Merwin trap, fish have one step (of a ladder) to jump over to an opening into a "V" weir. The fish enter into a darkened chamber approximately 60' x 12' x 7'. All fish volunteer into trap.

7.3) Identity.

All hatchery-origin fish are adipose-fin clipped.

7.4) Proposed number to be collected:

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

200 males and 200 females.

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

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
1988					

Appendix C

Year	Adults Females	Males	Jacks	Eggs	Juveniles
1989					
1990					
1991					
1992					
1993					
1994					
1995	117	*		570,657	
1996	191	*		573,000	
1997	136	48**		401,575	
1998	190	190		546,000	
1999	101	202		282,800	

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

*- Records not available for the number of males spawned (live-spawning took place, but no data available).
**- 48 males spawned and killed, but no data available on number of live-spawned.

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

Returned to river for increased recreational opportunity until late in the run timing period. At that time, all adults trapped in excess of spawning needs are transported to local lakes for fishing opportunity.

7.6) Fish transportation and holding methods.

All fish selected for spawning are transported from the traps to the holding ponds at the Merwin site. Traps are worked at least once each week and usually twice. Actual transport time from Merwin trap is 5 minutes, from Lewis trap 10 minutes.

7.7) Describe fish health maintenance and sanitation procedures applied.

Adults are treated with formalin or hydrogen peroxide or a combination of both to control fungus growth. Fish health measures are consistent with the Co-Managers Fish Health Policy (1996).

7.8) Disposition of carcasses.

All carcasses are taken to the local landfill for disposal. No carcasses are provided for nutrient enhancement, primarily due to disease (IHNV) concerns.

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

No listed natural spawning fish are taken for broodstock and are returned to the river. Listed fish are transported to the river immediately upon handling. It is possible that a wild fish could be held in one of our traps for a week in the worst case. Both traps are fish friendly with stress and mortalities being extremely low.

SECTION 8. MATING

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

8.1) Selection method.

Marked winter steelhead are chosen over the entire run.

8.2) Males.

A spawning matrix of one primary male for fertilization backed up by a second male to insure fertilization is always used no matter how large the egg take.

8.3) Fertilization.

The eggs from one female and a matrix for fertilization is used. One male's sperm is provided as a primary and than later another males sperm is used as a backup. Disease prevention includes water hardening of all eggs in an iodophore solution for one hour. A 100% sampling of ovarian fluid and kidney/spleen samples taken for virus check.

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.

Hatchery fish have been selected for early spawning (December and January) to decrease the chances of mating with listed natural fish. Also, all hatchery-origin fish are marked.

SECTION 9. INCUBATION AND REARING -

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

9.1) Incubation:

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

Brood Year	Eggs Taken	% survival to eye up / ponding
1995	Could not find available data	
1996	573,000 **	55.38 %
1997	466,375 **	79.52 %
1998	675,839 **	91.94 % *
1999	416,288	70.10 % *
2000	371,957	64.64 % *

* Loss percentage includes includes eggs destroyed due to IHN positive results.
** Includes eggs shipped green and eyed.

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

With mortality rates of approximately 16%, due to poor fertilization (green males) and past disease problems (IHNV), extra eggs have been taken. Smolt releases have never exceeded the program release goal of approximately 125,000 which now is adjusted down to 100,000.

9.1.3) Loading densities applied during incubation.

Loadings per Heath tray are approximately 8,000 and the flows to the incubators are 3.6 gpm.

9.1.4) Incubation conditions.

Water is pumped from the Merwin Reservoir and provides silt free water to the incubators. Since all the water to the hatchery is oxonated, runs through an enclosed stripper and has additional packed columns, the water is disbursed of any entrained gases and well oxygenated.They are closely monitored and have been well within appropriate levels.

9.1.5) Ponding.

All fry are ponded at or near button up (slit < 1 mm). Arrived at this method of ponding by using length and weight factors to arrive at the proper K-factor which is equated to 1,200 Temperature Units (TU's). Ponding dates each year run between April 15th and May 5th. Swim-up is volitional where ponding is forced.

9.1.6) Fish health maintenance and monitoring.

All eggs are treated with iodophore during water hardening for disease prevention. They are also treated with formalin during incubation for prevention of fungus. Yolk-sac malformation is of such low levels as to provide no concern. Most egg losses are due to lack of fertilization. Egg mortality removal is done on a daily basis by use of hand pickers. All data is recorded each day.

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.

No eggs are used from listed fish.

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..

Brood Year	Fry To Fingerling Survival	Fingerling To Smolt Survival
1995	83.34%	95.67%
1996	86.38%	98.02%
1997	67.92%	95.75%
1998	78.44%	98.33%
1999	89.33%	99.51%

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

Loading densities consistent with those recommended by Piper et. al.(1982).

9.2.3) Fish rearing conditions

Water is pumped from the Merwin Reservoir and provides silt free water to the incubators. Since all the water to the hatchery is oxonated, runs through an enclosed stripper and has additional packed columns, the water is defused of any entrained gases

and well oxygenated.They are closely monitored and have been well within appropriate levels. Standard pond management as per Piper et. al. (1982).

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.

BY	Length	Weight	CV
95	208	5.9 fpp *	7.75
96	205	6.2 fpp	5.52
97	198	5.9 fpp	6.95
98	203	5.5 fpp	6.20

Information is available on a monthly length, weight and CV for most of the rearing period. This information can be obtained from hatchery archive records.
*fish per pound (fpp).

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

Most of the information asked for in this section is not in our staffs area of expertise, therefore, is not taken. Growth rates are somewhat dictated by the water temperatures that we experience. We, of course, have a target growth curve that we follow to arrive at the programmed fish size at time of release. This course provides for a steady growth rate to achieve the desired size while meeting the body fat levels deemed acceptable by our hatcheries section.

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*).

Commercial-grade dry feed is used in the rearing of hatchery-origin winter steelhead. Feed sizes are adjusted to accommodate the growth of the fish. Feed schedules have been worked out over the history of this program to allow for a steady growth over the full rearing period. Feed rates range from a low of .55% to 3.6% B.W./day. Food conversion efficiency is < 1.1%.

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

Fish health is continously monitored in compliance with the Co-Manager Fish Health Policy standards. Fish health is checked at least monthly by an agency pathologist and daily by trained hatchery staff. Specific fish health monitoring and disease control activities that are detailed in IHOT (1996) are specific to the Merwin facility.

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

Not applicable.

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.

No listed fish are under propogation.

SECTION 10. RELEASE

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

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

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Smolts	100,000	5	mid April - May 10	Lewis River (RM 4)

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

Stream, river, or watercourse: Lewis River (27.0168)
Release point: RM 4
Major watershed: Lewis 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								

Appendix C

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Smolts	Avg size
1995							122,566	5.5
1996							123,248	5.8
1997							123.956	6.4
1998							104,018	6.1
1999							101,542	5.7
Average							115,066	5.9

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.

Released from mid-April to May 10th. Actual days of release are usually on all weekdays between the above mentioned days. Fish are allowed to volitionally migrate from the rearing ponds to the smolt collection ponds where they are pumped into tank trucks on a daily basis and hauled to the release sites. Some days have only a haul or two and on other days several hauls are required to move all of the fish collected.

10.5) Fish transportation procedures, if applicable.

Fish are loaded via pump into the truck at 3/4 pound per gallon capacity and hauled for approximately 20 minutes (12 miles) to the release site. Temperatures are dictated by the natural temperature levels of the river water being used to transport. The tank water is re-circulated via pumps and oxygen is defused into the system at a set rate.

10.6) Acclimation procedures .

Acclimated to appropriate river water their entire life.

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

100% of hatchery-origin winter steelhead are adipose-fin clipped.

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

Fish surplus to program have been planted in Merwin Reservoir at the time of marking (20 fpp). No excess fish at time of release.

10.9) Fish health certification procedures applied pre-release.

Routine fish health inspection by Area Fish Health Specialist.

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

Depending upon the circumstances, release fish with either the highest probability of surviving to adulthood or the fish with the highest probability of sustaining catastrophic loss if held at hatchery.

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.

Release of smolts at RM 4 to ensure that the hatchery-origin fish have a minimal amount of interaction with listed fish at time of migration.

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.

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

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

SECTION 12. RESEARCH

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

12.1) Objective or purpose.

Radio tracking of hatchery-origin adult male winter steelhead. to determine length of residence time.

12.2) Cooperating and funding agencies.

WDFW and Pacificorp.

12.3) Principle investigator or project supervisor and staff.

Todd Hilson and Jack Tipping.

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.

Adults are trapped at Merwin Dam. MS-222 is used to anesthetize fish when needed. Length of fish are recorded. A floy tag is used as a secondary mark on radio tagged adults.

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

Adults trapped between the end of December through January will be used.

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

After tagging, adults are trucked downstream to RM 3.5 and released.

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

None expected.

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).

None. Only marked, hatchery-origin adults are used.

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.

None.

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.

Listed fish will not be used for this study.

SECTION 13. ATTACHMENTS AND CITATIONS

Washington Department of Fish and Wildlife, 1996. Fish Health Manual. Hatcheries Program, Fish Health Division, Washington Department of Fish and Wildlife, Olympia.

Piper, Robert, et. al., 1982. Fish Hatchery Management; U.S Department of Interior, Fish and Wildlife Service, Washington, D.C.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

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

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Appendix C

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

Listed species affected: Chinook	**ESU/Population: Lower Columbia Chinook**			**Activity:Hatchery Operations**
Location of hatchery activity:Lewis River/Merwin trap Dates of activity:April -January 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)			300	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown	15	
Other Take (specify) h)				

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

Instructions:

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

Appendix C

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

Listed species affected: Steelhead **Activity:Hatchery Operations**	**ESU/Population: Lower Columbia Steelhead**			
Location of hatchery activity:Lewis River/Merwin trap Dates of activity:April -January _ 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)			80	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)		Unknown	20	
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.

Appendix C

Listed species affected: Chum	**ESU/Population: Lower Columbia Chum**	**Activity:Hatchery Operations**		
Location of hatchery activity:Lewis River/Merwin trap Dates of activity:April -January_ 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 D. FISHERIES MANAGEMENT AND EVALUATION PLAN

for the Lower Columbia River

FISHERIES MANAGEMENT AND EVALUATION PLAN

Lower Columbia River

Prepared by
Washington Department of Fish and Wildlife

February 21, 2001

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

Chinook

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

Steelhead

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

Chum

Lower Columbia	≤4%

Title.

Fishery Management and Evaluation Plan: Lower Columbia River Region

Responsible Management Agency.

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

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

SECTION FISHERIES MANAGEMENT

1.1) General objectives of the FMEP.

The objectives of the Washington Department of Fish and Wildlife's (WDFW) Fish Management and Evaluation Plans (FMEP) are based on the WDFW Wild Salmonid Policy. In that policy, it states that harvest rates will be managed so that 1) spawner abundance levels abundantly utilize available habitat, 2) ensure that the number and distribution of locally adapted spawning populations will not decrease, 3) genetic diversity within populations is maintained or increased, 4) natural ecosystem processes are maintained or restored, and 5) sustainable surplus production above levels needed for abundant utilization of habitat, local adaptation, genetic diversity, and ecosystem processes will be managed to support fishing opportunities (WDFW 1997a). In addition, fisheries will be managed to insure adult size, timing, distribution of the migration and spawning populations, and age at maturity are the same between fished and unfished populations. By following this policy, fisheries' impacts to listed steelhead, chinook salmon, and chum salmon in the Lower Columbia River (LCR) Evolutionary Significant Unit (ESU) will be managed to promote the recovery of these species and not at rates that jeopardize their survival or recovery.

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

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

Performance indicators of fish populations include parameters such as abundance, freshwater carrying capacity, survival through the migration corridor, ocean productivity, intrinsic productivity of the stock, and recruits per spawner. Based on these parameters, fisheries and

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

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

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

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

Harvest of salmon and steelhead in the LCMA is managed to meet wild salmon and steelhead escapement objectives and to meet the objectives of artificial propagation programs. To manage harvest to meet these goals, WDFW has developed escapement objectives for all hatchery populations, and some wild populations; interim maximum harvest rates have been established for the remaining wild stocks. Fishing seasons are then established based on a forecast of salmon and steelhead returning to the LCMA. In years where run size to the tributaries is forecast to be below escapement requirements, harvest in tributaries is eliminated, or reduced to limited mortality from wild salmon or steelhead release. Harvest reductions are accomplished by time and area closures, gear restrictions, or changes in the daily catch limits. When forecasts are not made, conservative harvest rates are established. These rates are less than the estimated maximum sustainable yield (MSY) harvest rates under low ocean productivity or Recovery Exploitation Rates established by the National Marine Fisheries Service (NMFS) (NMFS 2000a). To the extent possible, WDFW uses selective fisheries to maximize harvest rates on hatchery stocks while setting wild stock harvest rates consistent with wild stock protection and/or rebuilding. Artificial propagation programs within the LCMA have three purposes: 1) rebuild wild populations that are at risk and/or re-establish wild populations that have been extirpated, 2) determine the benefits and risks of artificial propagation programs have on wild populations through research and develop strategies that maximize benefits and minimize risks, and 3) provide for harvest opportunity.

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

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

Research Programs
To better understand the risks and benefits to wild populations from hatchery programs, gene flow, reproductive success, and ecological interactions between hatchery and wild fish are studied. Research projects are developed that address specific needs, and go through a peer

review process including assessment of experimental design to accomplish the objectives and a risk analysis. Only after this rigorous review process are projects approved. A variety of internal and external marks are used to evaluate different test groups and replicates. Harvest of these experimental fish may be controlled to meet study design goals through selective fisheries.

Harvest Programs

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

For programs designed for steelhead harvest, WDFW tries to minimize natural escapement of hatchery fish to protect the genetic diversity of wild stocks. The first most commonly used approach for steelhead management is to maximize the difference between hatchery and wild stocks, so that if hatchery fish spawn, they are not likely to interbreed with wild spawners. When hatchery fish do spawn, their reproductive success in the wild is "very" low and few offspring are produced (Chilcote et al. 1986 and Leider et al. 1990). Strategies used by WDFW to limit genetic and ecological risks include these actions: 1) limit the number of hatchery spawners by providing intense selective fisheries, and maintaining high trapping efficiency at the hatcheries or adult traps that remove hatchery fish prior to spawning; 2) advance the spawning timing of Chambers Creek and Skamania type steelhead stocks, so these fish spawn three months earlier than wild stocks, minimizing interbreeding between these two groups; 3) keep hatchery steelhead spawners in the lower river away from prime wild steelhead spawning areas through lower river releases and acclimation; 4) since the reproductive success of Chambers Creek stock is 11% of wild winter steelhead and Skamania Stock is 18% of wild summer steelhead, the few fish that do survive to spawn will produce few offspring; 5) use hatchery management practices, acclimation, timing, and lower river releases to limit steelhead residualism and the competition and predation that can occur when steelhead smolts residualize; and 6) Follow the Integrated Hatchery Operations Team (IHOT 1995) guidelines to limit disease risks from hatchery steelhead.

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

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

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

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

1.2) Fishery management areas

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

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

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

Fisheries in LCMA tributaries occur year-round. Recreational fisheries include targeted spring chinook, fall chinook, summer steelhead, winter steelhead, coho, trout, sturgeon, smelt, crayfish, shad, and fisheries directed at other native and non-native species. Most harvest impacts to listed species occur in the targeted fishery and few impacts occur in non-targeted fisheries. Chinook fisheries are closed year-round unless specifically listed as open. Spring chinook fisheries commence as fish begin entering the tributaries in February and March and typically close in August to protect spawners. Tributary fall chinook fisheries occur from August through January. Tule stocks are present in most LCMA tributaries and fisheries peak in September. The Lewis River fall chinook stock is a later timed stock with peak fishing in October. Chum salmon are

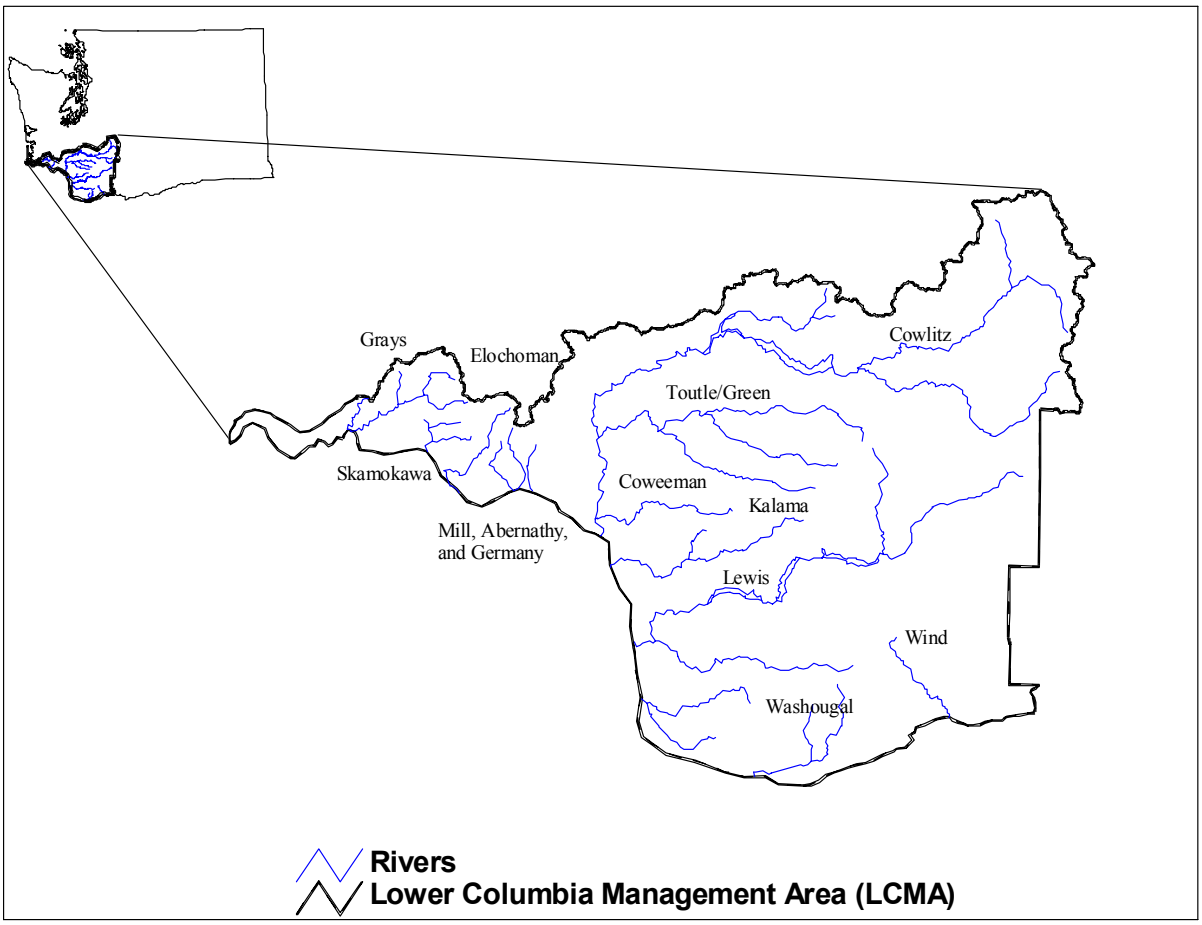

Figure 1. The Lower Columbia River Management Area**.**

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

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

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

WDFW has identified two population centers for chum salmon near the Grays River and below Bonneville Dam. The Grays River population consists of fish spawning in the mainstem Grays, WF Grays, Crazy Johnson, and Gorley subbasins. The below Bonneville Dam population consists of fish spawning in the mainstem Columbia, Hardy Creek, and Hamilton Creek. Other basins where chum salmon have been observed include: Skamokawa, Elochoman, Mill, Abernathy, Germany, Cowlitz, Lewis, Washougal, small independent Columbia Gorge tributaries, mainstem Columbia River near I-205, and the Columbia River above Bonneville

Appendix D

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
Kalama Spring Chinook	Kalama	2	N

Appendix D

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

1994	688	706	2,648	525	2,512			47	516	316	0	2,020	395	9,939	218	3,625	1,101	11
1995	144	230	689	774	2,231			29	375	172	30	3,044	200	9,718	402	2,969	278	4
1996	508	59	368	2,148	1,602			351	667	39	351	10,630	167	14,166	67	2,821	58	166
1997	1,875	103	484	1,328	2,710	282	1,125	12	560	262		3,539	307	8,670	8	4,529	220	148
1998	220	29	274	144	2,108		784	93	1,287	138	66	4,318	104	5,929	50	2,971	953	202
1999	706	75	376	93	997	118	633	303	678	251	42	2,617	217	3,184	124	3,105	46	126

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

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

1.4) Harvest Regime

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

Hooking Mortality

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

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

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

Interception Rates

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

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

caught because they are more mature and may move quickly through the fishery to sanctuary waters, and 3) some of the wild fish caught and released may be summer steelhead and not winter steelhead.

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

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

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

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

the fishery. The harvest rate is calculated by dividing the harvest by the run size. Harvest is calculated from statistical creel surveys or from CRC returns.

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

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

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

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

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

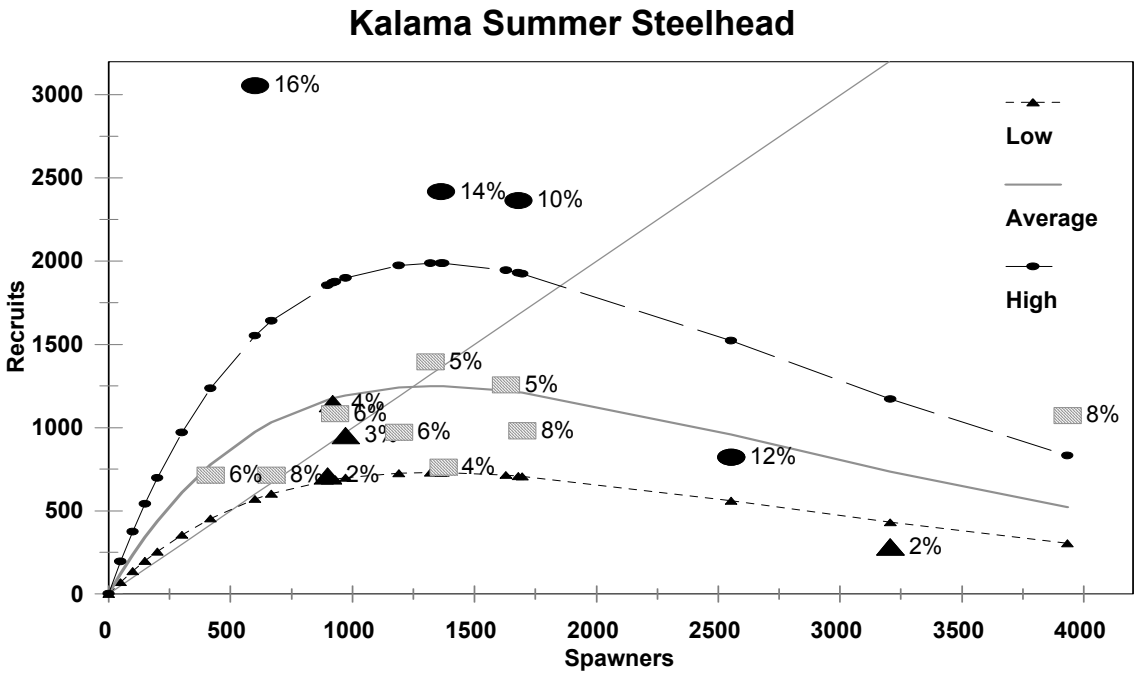
Until VSP levels are established for each population, WDFW has proposed interim maximum exploitation rates for tributary fisheries. The exception is the NF Lewis River fall chinook population, where fisheries will be managed to meet the 5,700-adult escapement goal. Due to concerns about low spawner abundance, WDFW has eliminated the direct harvest of adult steelhead and chum salmon in these fisheries through the use of selective fisheries that require all anglers to release all wild steelhead and chum salmon. In addition, WDFW has used time and area closures to establish sanctuaries, which are closed to fishing for these species. WDFW has proposed the same selective fishery rules for spring chinook salmon below Bonneville, beginning with the 2002 return when all hatchery spring chinook stocks in the LCMA will be marked. In addition, WDFW is supportive of developing selective fisheries for tributary fall chinook fisheries, is working to help develop technology for mass marking of hatchery fish, and to secure funding for mass marking when technologies can be implemented.

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

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

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

For winter and summer steelhead populations below Bonneville, we are estimating a maximum10 percent mortality in WDFW steelhead selective fisheries. We are also estimating this level of mortality for winter steelhead populations above Bonneville Dam. However, this level of mortality in the tributary fishery may jeopardize recovery of summer steelhead populations above Bonneville Dam given the impacts from the operation



of Bonneville Dam, fisheries research, and mainstem harvest. Due to these impacts, WDFW has closed the Wind River above Shipherd Falls since 1996, and believes harvest impacts on Wind River summer steelhead should be less than 4%.

There is limited data to determine appropriate harvest rates for chum salmon in the LCR. In a meta-population analysis, Myers et al. (1999) indicated Ricker ln(α) values were around 1.3, which is similar to those observed for Kalama winter steelhead. Since sustainable exploitation rates are only dependent on the Ricker α parameter, the proposed winter steelhead harvest rates applied to chum salmon would be consistent with recovery. However, to be more conservative we followed and used the 8.3% harvest rate NMFS suggested was appropriate for listed Puget Sound summer chum salmon in the PST analysis (NMFS 2000a). We estimate a maximum 4% harvest rate on chum salmon during tributary fisheries.

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

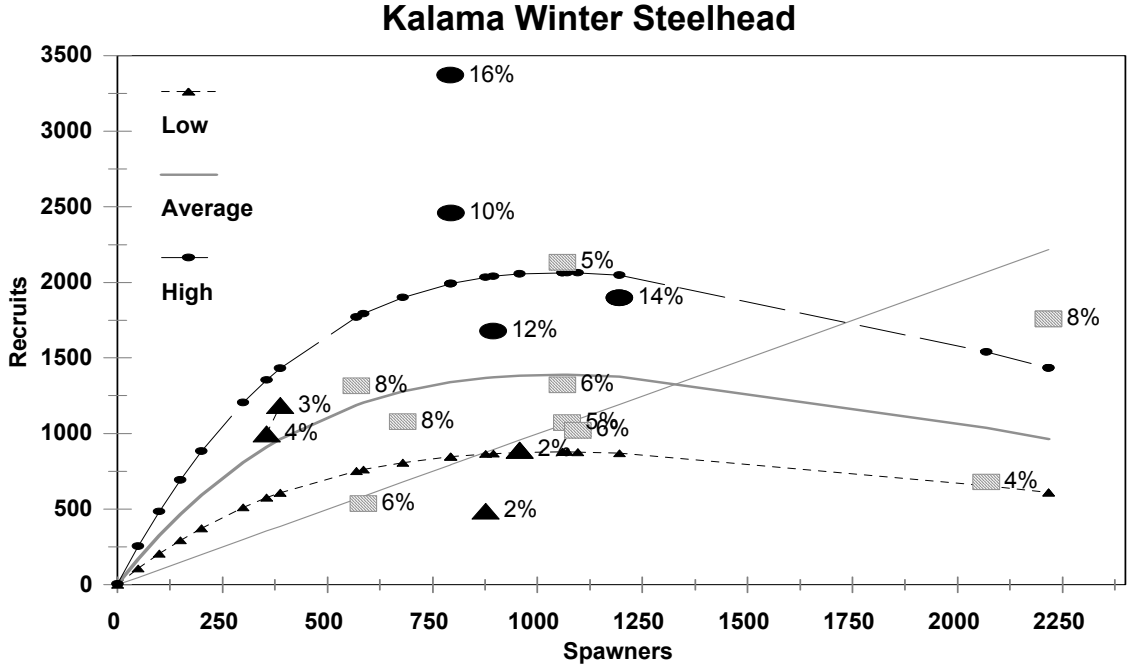


Figure 2. Spawner recruit model for wild winter and summer steelhead under low, average, and high ocean productivity, brood years 1977-93.

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 Lewis River and Recovery Exploitation Rates for the remaining tule chinook stocks. Juvenile fall chinook and chum salmon are not intercepted in fisheries because their small size does not allow them to recruit to resident fisheries. Age 1+ juvenile steelhead can recruit to the trout fishery. In recognition of this, WDFW delays the opening of the trout season to June 1, until 95% of the steelhead migrants emigrated from the tributaries. In addition, the 8-inch minimum size in tributaries protects 99% of the juvenile steelhead in these tributaries. It is also unlikely that juvenile spring chinook recruit to the fishery, since they are smaller than steelhead juveniles. It is illegal to harvest juvenile salmon in resident fisheries but if anglers do misidentify them as trout, the size minimum limits for trout protects more than 99% of the juvenile salmon from harvest.

1.5) Annual Implementation of the Fisheries

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

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

WDFW In-season regulation changes
In-season changes to the adopted rules may be made, depending on changes in run sizes or other information, to further restrict the fishery for conservation needs or to expand a

fishery when population status of the target species warrants, and when impacts to weak stocks can be minimized. The in-season modifications to the planned fisheries are promulgated by emergency rule changes under the State Administrative Procedures Act.

U.S. v. Oregon/Columbia River Compact
U.S. v. Oregon/Columbia River Compact fisheries are not discussed in this FMEP, but the Technical Advisory Committee impact assessments are evaluated through Section 7/10 consultation process. Commercial fishery seasons on the portion of the mainstem Columbia River where the states of Oregon and Washington share a common boundary are regulated by a joint Oregon and Washington regulatory body (the Columbia River Compact). The ODFW and WDFW directors or their delegates comprise the Compact and act consistent with delegated authority by the respective state commissions. Columbia River seasons are also regulated by the U. S. v. Oregon process which dictates sharing of Columbia River fish runs between treaty Indian and non-Indian fisheries. The Compact receives input from the tribes, states, the federal government, and the fishing industry through a series of meetings held throughout the year. These meetings assist the Compact in developing harvest allocations and decisions related to monitoring harvest quotas. Meetings are held in late January of each year to establish the harvest guidelines for the spring and summer fisheries and in late July to establish guidelines for fall fisheries.

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

SECTION 2 EFFECTS ON ESA-LISTED SALMONIDS

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

Fishing rates identified in this plan do not appreciably reduce the likelihood of survival and recovery of wild chum salmon, chinook salmon, and steelhead. WDFW adopted the exploitation rates established by NMFS for LCMA spring chinook and tule fall chinook fishery impacts that occur in fisheries regulated by the Pacific Salmon Treaty (NMFS 2000a). By definition, these rates do not appreciably reduce the likelihood of survival and recovery of these fish. We are estimating a maximum 65% harvest rate for tule chinook

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

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

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

The data was fit with Ricker and Beverton-Holt stock recruitment curves and the results showed a similar goodness of fit. The Beverton-Holt form is sometimes cited (Gibbons et. al. 1985, Ward 1996, and McGie 1994) as most consistent with the life history of this species, i.e., its extended juvenile residence time in freshwater suggests that density-dependent spawning effects will be of lesser importance than the limiting nature of the

freshwater environment. Hence, an empirical relationship between recruits and spawners would be expected to show some asymptotic, maximum recruitment. Barrowman and Myers (2000) found that the Beverton-Holt model generally produced a maximum productivity at low spawning densities that is higher than the Ricker model. If the Beverton-Holt model does overestimate the slope at origin, this may leave managers with a dangerously high impression of resiliency. The Kalama steelhead data sets, like many other salmon and steelhead data sets, have few data points at a low escapement that are critical in defining the slope at origin in either the Beverton-Holt or Ricker model. Since wild steelhead stocks in this FMEP are listed under ESA, it is critical that we not overestimate the intrinsic productivity of the stocks. Therefore, given the similar goodness of fit, we chose the Ricker model because it provided a more conservative estimate of resiliency.

The initial Ricker model fit for summer and winter steelhead was average to good, with R^2 of 0.43 for winter steelhead and 0.65 for summer steelhead. However, we noticed the Pearsons Product Moment Correlation between smolt to adult survival and the number of maiden steelhead recruits produced was 0.83 and 0.66 for summer and winter steelhead. Based on this, we added a marine survival parameter to the Ricker model and the improved the R^2 to 0.66 for winter steelhead and 0.83 for summer steelhead. Next, spawner recruit relationship was examined under the low, average, and high levels of smolt to adult return in the data set. These are surrogates for the different levels of ocean productivity. Based on this analysis, Ricker α and β parameters were calculated for the different ocean conditions. Next, extinction and MSY fishery harvest rates were estimated under various ocean conditions.

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

WDFW desires to establish harvest rates on Kalama wild steelhead that promote recovery. Since μ_{ext} is defined as the harvest rate that will lead to extinction, harvest rates for

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

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

Since WDFW does not currently forecast wild steelhead runs, we have chosen to use a maximum exploitation rate set that does not jeopardize survival or recovery of steelhead under the lowest ocean conditions observed in the data set. This is a very conservative estimate. For summer and winter steelhead below Bonneville Dam and for winter steelhead stocks above Bonneville Dam, we estimate a maximum harvest rate of 10%. However, this level of take in the tributary fishery may jeopardize recovery of summer steelhead populations above Bonneville Dam given the impacts from the operation of Bonneville Dam, fisheries research, and mainstem harvest. Therefore, we estimate 4% impact for summer steelhead in the Wind River during tributary fisheries. For winter steelhead stocks above Bonneville Dam, tributary fisheries impacts are estimated to be less than 10%.

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

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

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

Summer	Trib Winter	Trib	Trib	Trib Fall	Trib	Trib

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

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

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

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

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

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

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

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

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

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

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

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

steelhead anglers as both are present at the same time. Beginning in 2002, wild spring chinook will be protected in these fisheries under wild fish release regulations.

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

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

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

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

Tributary fall chinook fisheries occur from August through January. Tule chinook stocks are present in most LCMA tributaries with fisheries peaking in September. The Lewis River fall chinook are a later-timed stock, with peak fishing occurring in October. Due to recent low run sizes, tributary fall chinook fisheries have been reduced to ensure hatchery

and wild fall chinook escapement goals are met. Steelhead impacts during targeted fall chinook fisheries are believed to be low because most wild summer steelhead have passed into the upper watershed sanctuary areas where it is closed to chinook fishing and significant numbers of wild winter steelhead have yet to arrive. Wild winter and summer steelhead and chum salmon are protected in these fisheries by wild steelhead and chum salmon release regulations.

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

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

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

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

Fisheries for resident trout take place in tributaries and standing waters throughout the LCMA. Plants of hatchery-reared trout for put-and-take fisheries have been restricted to standing waters, streams above the anadromous zone, and streams above dams on the

Lewis and Cowlitz rivers to minimize impacts on steelhead and salmon smolts. These plants and fisheries now occur above or in the same reservoirs whose dams block historic salmon migrations. In addition, hatchery-reared sea-run cutthroat trout are released in the Cowlitz River to mitigate for the construction of Mayfield and Mossyrock dams.

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

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

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

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

Other Resident Fish Species -
Fisheries for other species may occur year-round within the LCMA or concurrent with salmon and steelhead seasons. Many of these fisheries, however, are concentrated after the spring runoff when flows and warm water temperatures permit successful angling. Targeted species includes whitefish, walleye, and other warm water species, such as largemouth and smallmouth bass. Selective gear requirements are imposed on some tributaries within the LCR, while angling for any fish species.
Fisheries occur in the lower sections of some LCR tributaries for warm water game species including largemouth bass, smallmouth bass, channel catfish, crappie, bluegill, carp, and northern pikeminnow. The whitefish fishery is not significant in the LCR and no specific regulations or special seasons are implemented. Warmwater fisheries also occur in standing waters throughout the basin. Chinook, chum, and steelhead impacts in warm water fisheries are nil. In the LCR tributaries, warm water fisheries are concentrated in backwaters and sloughs, which are not hospitable rearing areas for juvenile salmonids. Chinook, chum, and steelhead are not present in standing waters where warm water fisheries occur. Fisheries are also most active during warm summer months after spring migrant juvenile chinook and chum have left the system and before fall migrant juvenile chinook disperse downstream from rearing areas. Since warm water species potentially prey on and compete with juvenile salmonids, warm water fisheries could actually provide some marginal benefit for listed salmon and steelhead if the warmwater catch were significant.

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

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

In the absence of an actual interception rate, WDFW used harvest rates calculated in fisheries when wild steelhead harvest was allowed or where WDFW measured interception

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

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

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

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

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

Summer steelhead harvest fisheries have been restricted to wild steelhead release fisheries since 1986. Some winter steelhead fisheries went to wild steelhead release in 1986 as well. The remaining fisheries went to wild steelhead release in 1992, with the exception of the SF Toutle, which went to wild steelhead release in 1994. It was not possible to estimate

wild steelhead harvest rates for most streams in the basin because wild steelhead escapement and harvest estimates were not available for most basins when steelhead harvest fisheries were permitted. The exception is the Kalama River, where an ongoing research program collected these data. The Kalama River is representative of the changes in wild steelhead harvest rates. Harvest rates for winter and summer steelhead declined from more than 50% under harvest fisheries to less than 6% in wild steelhead release fisheries (Figure 3).

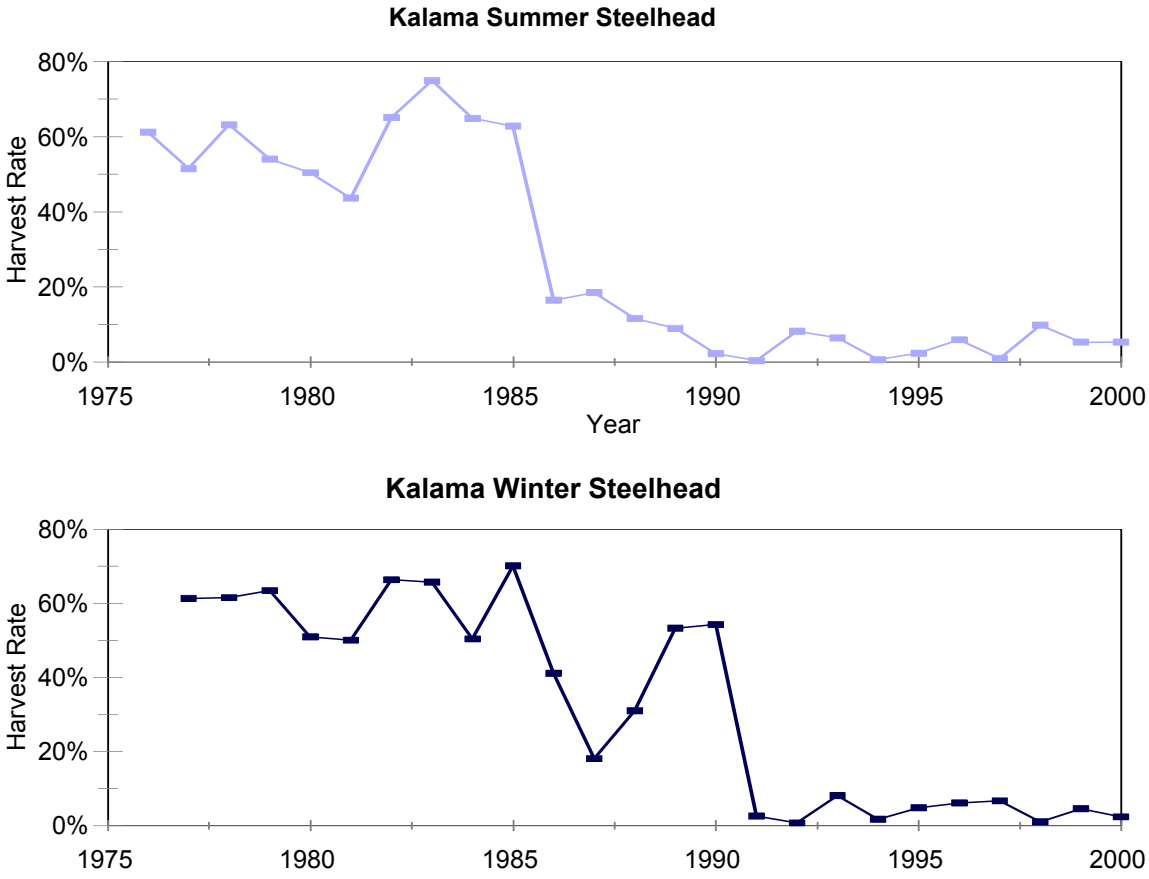


Figure 3. Wild steelhead harvest rates for winter and summer steelhead, 1976-1999. Harvest for winter steelhead after 1991 and summer steelhead after 1985 is adult morality due to hooking mortality in the wild steelhead release fisheries.

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.

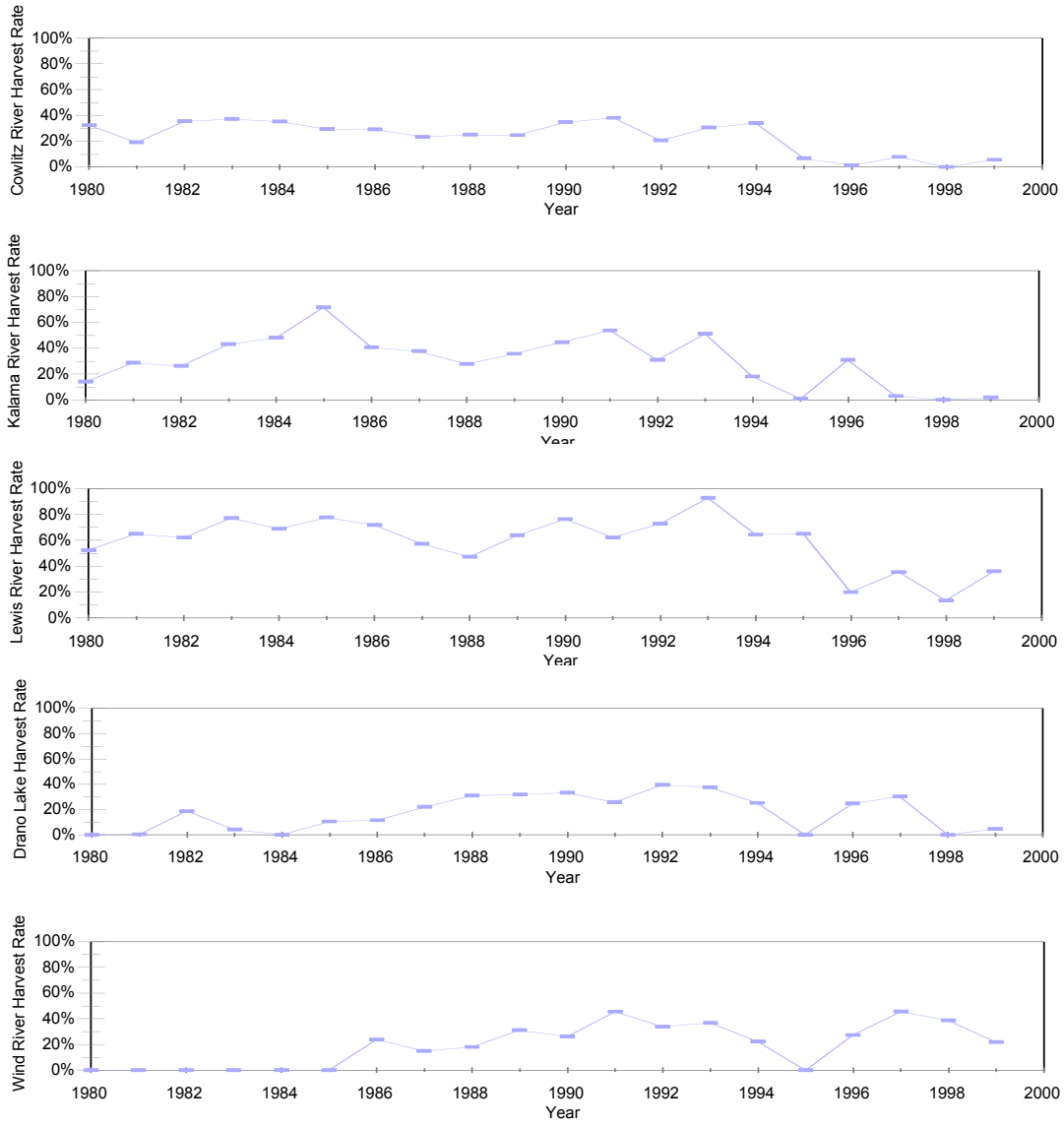


Figure 4. Spring chinook tributary harvest rate 1980-99. Harvest rate equals sport catch divided by run size at tributary mouth.

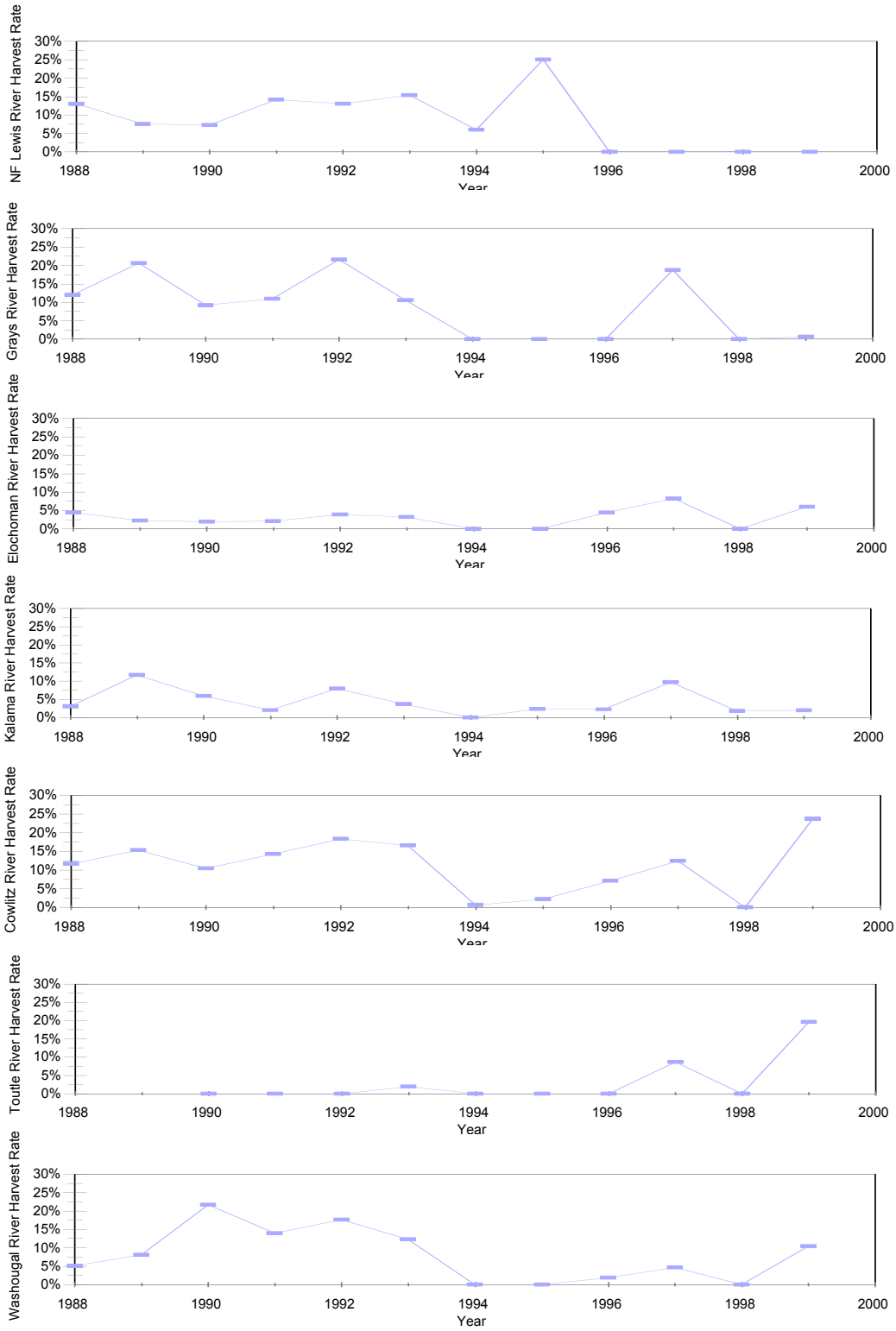


Figure 5. Fall chinook tributary harvest rate, 1988-99. Harvest rate equals sport catch divided by size at tributary mouth.

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

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

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

[2]Expected Mortality (EM) is the hooking mortality of incidentally caught fish, based on (WDFW 2000). Expected mortalities are included in Anticipated Encounters in terms of take.

[3]Harvest is the expected recreational harvest based on historic recreational catch and future run size projections.

[4]Total take encompasses Anticipated Encounters and expected recreational harvest. This can be construed as the **exploitation rate**.

Affected stock	Fisheries									
	Steelhead		Salmon		Res. Trout		Others (eg. Whitefish, warmwater)		Harvest [3]	Total take [4]
	AE [1]	EM [2]	AE	EM	AE	EM	AE	EM		
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										
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									

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]
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 2000b). Lewis River fall chinook are harvested in the ocean fishery at a lower rate than tule chinook but harvested at a higher rate than tule chinook in the Columbia River mainstem and tributary fisheries (Figure 8). The average fisheries exploitation rate on Lewis River fall chinook has been reduced from 49% to 28% from 1977-90 to 1991-94. This is significantly lower than the 65% Recovery Exploitation Rate.

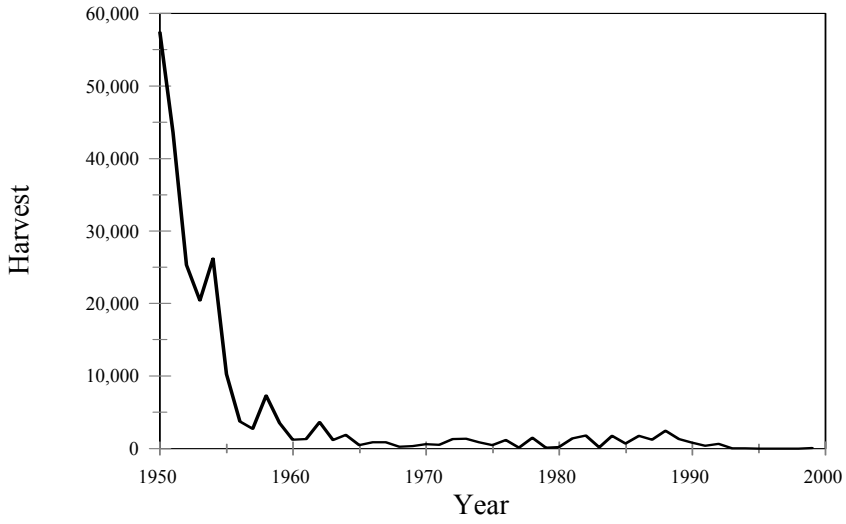


Figure 6. Commercial landings of chum salmon from the Columbia River, 1950-99.

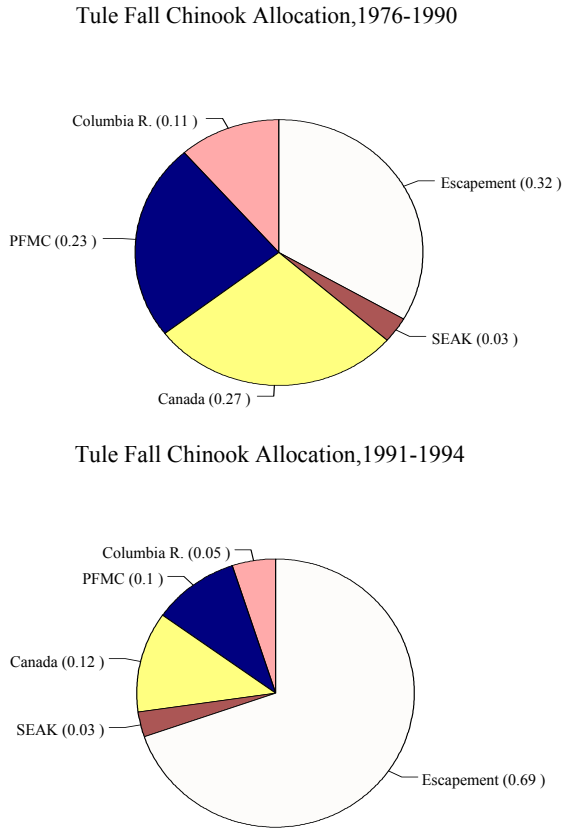


Figure 7. Tule fall chinook allocation pre and post 1991.

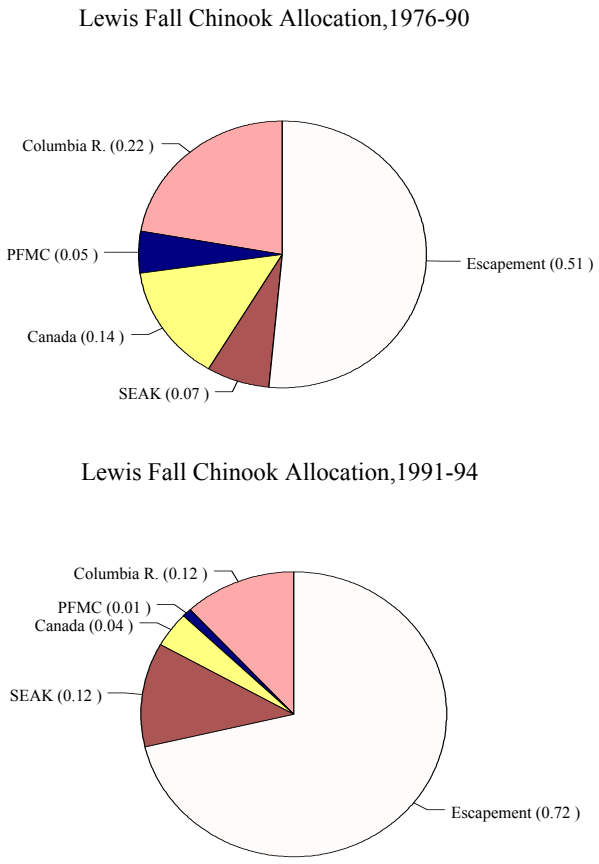


Figure 8. Lewis River chinook allocation pre and post 1991.

SECTION 3 MONITORING AND EVALUATION

3.1) Description of the specific monitoring of the "Performance Indicators" listed in section

Performance indicators for wild LCMA salmon and steelhead include fish population indicators and fishery indicators. Since the objective of this FMEP is to provide fishing opportunity consistent with the recovery of listed species and at rates that do not jeopardize their survival or recovery, the primary indicators for this FMEP are the abundance and productivity of wild salmon and steelhead stocks.

Abundance and productivity

Index streams -

The primary fish population indicators for wild salmon and steelhead are spawning escapement estimates for 3 chum salmon populations, 3 spring chinook populations, 4 summer steelhead populations, 9 winter steelhead populations and 16 fall chinook salmon populations. Our first priority is to choose streams that have a weir and trap so that

observation or measurement error can be minimized and/or quantified. Stream indexes include a variety of salmonid populations, are representative of the habitat within the ESU, and dispersed across the ESU. The steelhead index basins above weirs include the Cowlitz River above Barrier Dam, the North Fork Toutle River above the Sediment Retention Structure, Kalama River above Kalama Falls Hatchery, Cedar Creek tributary of the NF Lewis River above the Grist Mill fish ladder, and the Wind River above Shipherd Falls including the primary tributary of Trout Creek above Hemlock Dam (Table 13). In addition, index snorkel reaches are established for summer steelhead in the EF Lewis and Washougal rivers, and redd survey reaches for winter steelhead have been established in the SF Toutle River, Coweeman River, EF Lewis River, and Washougal River (Tables 14). For chum salmon, index streams include the two population centers for this species in the Grays River, and Hamilton/Hardy creeks and other sites are shown in Table 15. For fall chinook, index streams include, the Grays, Skamokawa, Elochoman, Mill, Abernathy, Germany, Lower Cowlitz, Coweeman, Kalama, NF & EF Lewis, Washougal, Wind River, and Drano Lake (Table 16).

Table 13. Key steelhead & salmon monitoring sites in the Lower Columbia River ESU with current funding.

Basin	Stock	Other Species	Adult Monitoring	Smolt Monitoring	Adult Esc. Method	Comments
Cowlitz above Cowlitz Falls	Winter Steelhead/ Spring Chinook	Cutthroat Coho	Barrier Dam	Cowlitz Falls Dam	Total Fence Count	Population in upper watershed extirpated, reintroduction effort
NF Toutle River	Winter Steelhead	Coho Cutthroat	Fish Collection Facility	intermittent	Total Fence Count	Population recovering after eruption of Mt. St. Helens
Kalama River	Winter/ Summer Steelhead	Cutthroat Chinook	Kalama F. Hatchery	Kalama F. Hatchery	Fence Count with Mark-Recapture	Located in the center of ESU, average habitat, mix of steelhead and spring chinook
Cedar Creek	Winter Steelhead	Chinook Cutthroat Coho	Grist Mill Ladder	Grist Mill Ladder	Fish Ladder Index	Historically, a coho stream with a small fall chinook, steelhead & cutthroat run
Wind River	Summer/ Winter Steelhead	Sp Chinook	Shipherd Falls Ladder	Mouth	Fence Count with Mark-Recapture	Steelhead stream with a hatchery spring chinook run
Trout Creek	Summer Steelhead	none	Hemlock Dam	Hemlock Dam	Total Fence Count	Only streams with no other anadromous salmonids
Grays River	Chum Chinook	Winter Steelhead F.Chinook 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 method. Wild steelhead are estimated in the Wind River, Kalama River, and Cedar Creek. In addition, spring chinook are estimated in the Kalama and sea-run cutthroat and coho estimates are made for Cedar Creek. Juvenile steelhead, chinook, and cutthroat production is also monitored at Mayfield and Cowlitz Falls dams. Intermittent juvenile production monitoring has been conducted in the NF Toutle and EF Lewis basins. However, annual funding for these is not available.

Fisheries monitoring
Performance indicators for fisheries typically include estimates for the catch, catch rates, harvest, harvest rates, hooking mortality for fish caught and released, effort of the fishery, and catch per unit effort (CPUE) for the fishery. WDFW makes statistically based estimates of hatchery steelhead and salmon catch from the WDFW catch record card (CRC) and follow-up phone surveys. No harvest estimates are made for wild steelhead, since WDFW requires wild steelhead and chum salmon release for all LCR basins. However, WDFW is concerned about the indirect mortality that can occur from wild steelhead and salmon release. Based on a literature search, WDFW estimated the hooking mortality for steelhead (Rawding 1998), and salmon (Bendock and Alexandersdottir 1993, and Schroeder et al. 1999). In the absence of an actual interception rate, WDFW used harvest rates calculated in fisheries when wild steelhead harvested was allowed or where WDFW measured interception rates in wild steelhead or salmon release fisheries. Creel surveys are being conducted on the NF Lewis and Cowlitz rivers for steelhead and salmon to assess hatchery programs. In conjunction with CRC estimates, these can be used to determine the hatchery harvest rate, interception rate for wild fish, and catch per unit effort (CPUE). Chinook and coho fisheries in major tributaries including the Grays, Elochoman, Cowlitz, Toutle, Kalama, Lewis, Washougal, Wind, and Little White Salmon Rivers are sampled to collect CWT, CPUE, and interception rate for wild fish. Due to lack of funds, these estimates are not available for steelhead fisheries outside of the Lewis and Cowlitz rivers.

Other monitoring programs that occur outside the LCMA will provide information that may be applicable to these fisheries in this ESU. For example, it is not possible to monitor the survival of each released wild salmon and steelhead. The results from studies outside the LCR could be very useful in this area. Other studies on gear selectivity and hooking mortality rates by gear, reproductive success of caught and released steelhead and salmon, effectiveness of sanctuary areas, and others would also have application in the LCMA.

WDFW will make an effort to include this new information when the FMEP is updated or before if the information is significant enough to warrant it.

3.2) Description of other monitoring and evaluation not included in the Performance Indicators (section 3.1) which provides additional information useful for fisheries management.

In addition to routine monitoring and evaluation activities described above, WDFW also collects or uses information from other sources related to the status of listed salmon and steelhead and the implementation of fisheries which might affect them. Since freshwater habitats are linked to wild steelhead and salmon production, WDFW monitors habitats through the Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) and through checks on hydraulic permits. These data may be useful in forecasting salmon and steelhead runs, because they may quantify changes in habitat productivity, such as, habitat improvement projects that open historic habitats or document nature depensatory processes. Finally, extensive monitoring and evaluation are conducted for chum salmon, chinook salmon, and steelhead at local hatcheries. This program inventories production and returns, tracks straying, monitors fish health, and relates return rates to hatchery practices.

3.3) Public Outreach

The popularity of the steelhead and salmon fisheries result in intense public interest and participation in the annual management processes for these species. WDFW conducts extensive public involvement and outreach activities related to salmon and steelhead fishery management and recovery. The annual fishery regulation process involving a series of public meetings, information mailouts, press releases, and public hearings was described in detail in section 1.5. Anglers are keenly aware of and accustomed to abrupt inseason management changes including closures and reopenings with short notice. Permanent regulations are detailed in published pamphlets of fishing regulations. Annual regulation and inseason changes are widely publicized with press releases, phone calls or faxes of action notices to key constituents, and signs posted at fishery access points. WDFW also operates an information line, a recorded hotline, and an Internet web page where timely information is available.

In addition to fishery-related outreach efforts, the state of Washington is conducting a broad-based watershed recovery effort coordinated through the Lower Columbia River Fish Recovery Board (LCRFRB). The LCRFRB is developing a salmon and steelhead recovery plan for the LCR region in conjunction with federal, state, and local governments and concerned citizens.

3.4) Enforcement

Sport fishing regulations in Washington are enforced by the Enforcement Program of the WDFW. The Fish Management and Enforcement programs work together to develop enforceable regulations to achieve fish and wildlife resource management goals. The

Region 5 Enforcement program for the LCR includes one captain, three sergeants, and 13 enforcement officers. Although Klickitat County is within Region 5, it is outside the coverage of this plan. Enforcement activities in the LCR are conducted from offices in Vancouver and Cook, and are responsible for enforcement of state fish, wildlife, and habitat regulations in the area covered by this plan. The highest enforcement priority for fish is protection of endangered species, which includes monitoring LCR tributary and mainstem Columbia River fisheries for compliance.

The WDFW Enforcement and Fish programs work together to facilitate enforcement of resource management goals through a monthly cooperative enforcement planning process where local sergeants and officers meet monthly with local biologists at the district to set enforcement priorities by fish species. Sergeants then develop 28-day plans to address priority issues and gain desired compliance levels to protect resources and meet management goals. The results of each 28-day plan are quantified and compared to the compliance level considered necessary to meet management goals. Compliance is typically estimated based on the percentage of angler contacts where no violations are noted. The 28-day plans are adjusted if necessary based on compliance assessments to make the best use of limited resources in manpower and equipment to achieve the goals.

Fisheries are assigned a high priority for enforcement and are intensively monitored. Officers are assigned to work during open fishing days and restrictive seasons, with additional checks during closed periods. Officers conduct bank and boat patrols to check and assist anglers. Covert surveillance is also made in locations where complaints on violators have been received.
The current enforcement database tracks hours worked, angler contacts, warnings, and citations by officer by fishery. The database differentiates fisheries by location (mainstem Columbia versus tributary, or within tributaries Cowlitz versus Lewis), or salmon (chinook versus coho versus chum). Summary compliance reports are available for these fishery activities but have not been compiled except for a draft compliance report to measure how well anglers were complying with Wild steelhead release fisheries.

WDFW enforcement staff conducted a statewide angler compliance survey in 1992 and 1993 in waters that were open to fishing under wild steelhead release or catch and release regulations. A total of 4,879 anglers was contacted. The anglers had retained 351 steelhead. A total of six wild steelhead were retained, providing a compliance estimate of 98.6% (Hahn 1997). To improve compliance monitoring, WDFW is designing a study, which will focus on particular sites over time. This program will include enforcement and non-enforcement components.

3.5) Schedule and process for reviewing and modifying fisheries management.

3.5.1) Description of the process and schedule that will be used on a regular basis (e.g. annually) to evaluate the fisheries, and revise management assumptions and targets if necessary.

Wild population status and fishery performance will be assessed annually by WDFW. The

annual fishery review process described in detail in Section 1.5 will continue to be employed to evaluate fisheries and revise management assumptions and targets as needed. To ensure that fish populations and fishery management is meeting the goals described in this plan, annual monitoring will include wild fish escapement numbers and/or indices, cohort replacement rates, projected future wild and hatchery numbers based on age composition of recent returns, fishery harvest of hatchery fish and handle of wild fish, fishery effort, fishery catch per unit effort, mark rates in the fishery and escapement areas, and projected fishery impacts on wild fish.

WDFW used Recovery Exploitation Rates for index populations because sufficient data was not available to estimate Recovery Exploitation Rates for each population. With the monitoring program outlined in this FMEP, WDFW will collect the data required to develop additional population specific Recovery Exploitation Rates. Critical and viable thresholds for each population have not yet been established, and instead WDFW used Recovery Exploitation Rates in this FMEP. Over the next year, WDFW will work with the TRT to develop estimates of critical and viable thresholds and incorporate these thresholds into this fishery analysis. WDFW will produce a report annually on the status of chum, chinook, and steelhead in the LCR.

3.5.2) Description of the process and schedule that will occur every 5 years to evaluate whether the FMEP is accomplishing the stated objectives. The conditions under which revisions to the FMEP will be made and how the revisions will likely be accomplished should be included.

The mean age of maturation for most steelhead and salmon population is five years and it makes little sense to evaluate this FMEP sooner than that period of time. Therefore, comprehensive reviews will be repeated by WDFW at five-year intervals thereafter until such time as the wild stocks are recovered and delisted. Consultations between WDFW and NMFS regarding management of these fisheries will be reinitiated only if there are significant changes in the status of listed chinook, chum or steelhead populations or their habitat.

SECTION 4 CONSISTENCY OF FMEP WITH PLANS AND CONDITIONS SET WITHIN ANY FEDERAL COURT PROCEEDINGS

Tribal fisheries below Bonneville Dam do not currently exist. It is unclear whether any tribes have treaty rights in the LCR tributaries. If the tribes are found to have treaty rights below Bonneville Dam, then WDFW will work with the tribes to develop tributary fisheries consistent with protection of listed species and harvest sharing. Treaty Indian fisheries promulgated by the member Tribes of the Columbia River Inter-Tribal Fish Commission may be conducted in the tributaries above Bonneville Dam. The Yakama Nation currently has fisheries in the Wind River watershed. This fishery is not regulated by WDFW. Each tribe has retained its authority to regulate its fisheries and issues fishery regulations through its respective governing bodies. The tribes are represented by their staff on the Technical Advisory Committee and participate in monitoring activities and data sharing with other parties. The tribes have policy and technical representation in the

U.S. v. Oregon and PFMC/North-of-Falcon harvest management processes, and coordinate fisheries with the State managers and Columbia River Compact as necessary.

REFERENCES

Andersen, J.J. 1998. Decadal climate cycles and declining Columbia River salmon. In Proceedings of the Sustainable Fisheries Conference. Victoria BC, Canada. 1996. Eric Knudsen editor. Special Pub. American fisheries Society.

Barrowman, N.J., R.A. Myers. 2000. Still more spawner-recruit curves: the hockey stick and its generalizations. Can. J. Fish. Aquat. Sci. 57:665-676
.

Bradford, R.H., S. A. Leider, P.L. Hulett, and C.W. Wagemann. 1996. Differential leaping success by adult summer and winter steelhead at Kalama Falls: implication for estimation of steeelhead spawner escapement. Fish Management Program, Resources Assessment Division Technical Report RAD 96-02. Wash. Dept. of Fish and Wild., Olympia, WA. 56pp.

Bendock, T. and M. Alexandersdottir. 1993. Hooking mortality of chinook salmon released in the Kenai River, Alaska. North American Journal of Fish Management 13: 540-549.

Chilcote, M. W., S. A. Leider, and J. J. Loch. 1986. Differential reproductive success of hatchery and wild summer-run steelhead under natural conditions. Transactions of the American fisheries Society 115:726-735.

Freymond W., and S. Foley. 1986. Wild steelhead: spawning escapements for Boldt Case Area Rivers. Fisheries Management Division. Washington Department of Game. Report No. 86-12. Olympia, Wa.

Gibbons, R. G., P.K. Hahn, and T. Johnson. 1985. Methodology for determining MSH steelhead escapement requirements. Report No. 85-11. Fish Management Division. Washington Department of Game, Olympia, WA.

Hahn, P. Angler compliance for wild steelhead trout release regulations in Washington State, 1992-93. Washington Department of Fish and Wildlife, Olympia WA, Unpublished draft, 7pp

Hare, S.R., and R.C. Francis. 1995. Climate change and salmon production in the northeast Pacific Ocean, p. 357-372. In R.J. Beamish [ed.] Climate change and Northern Fish Populations. Can. Spec. Publ. Fish. Aquat. Sci. 121.

Hooton, R. 1987. Catch and release as a management strategy for steelhead in British Columbia. In R. Barnhart and T. Roelofs, editors, Proceedings of catch and release fishing, a decade of experience. Sept 30-Oct 1, 1987. Humboldt State University, Arcata, CA.

IHOT (Integrated Hatchery Operations Team), 1995. Operations Plans for Anadromous Fish Production Facilities in the Columbia River Basin. Volume III-Washington. Annual

Report 1995. Bonneville Power Administration, Portland, Oregon. Project Number 92-043. 536 pp.

James, B. 1997. Addendum tables to Columbia River Progress Report 95-11. Washington Department of Fish and Wildlife Memorandum. July 27, 1997.

Johnson, O.W., W.S. Grant, R.G. Kope, K. Neely, F.W. Waknitz, and R.S. Waples. 1997. Status review of chum salmon from Washington, Oregon, and California. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-32, 280 p.

Leider, S. A., P. L. Hulett, J. J. Loch, and M. W. Chilcote. 1990. Electrophoretic comparison of the reproductive success of naturally spawning transplanted and wild steelhead trout through the returning adult stage. Aquaculture 88:239-252.

Lirette, M. 1989. Monitoring of tagged hatchery summer steelhead in the Campbell River, 1988-89. Ministry of Environment, Lands, and Parks, Fisheries Program. Fisheries Report No. VI892, June 1989.

McElhany, P., M. H. Rucklelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. NOAA Technical Memorandum NMFS-NWFSC-42. Seattle, Washington.

McGie, A.M. 1994. Stock-recruitment in summer-run steelhead of the North Umpqua River, Oregon. Oregon Department of Fish and Wildlife. Report No. 94-5. Portland, OR. 30pp.

McIsaac, D.M. 1990. Factors affecting the abundance of 1977-79 brood wild fall chinook salmon in the North Fork Lewis River, Washington. University of Washington, dissertaion.

Myers, R.A., K.G. Bowen, and N.J. Barrowman. 1999. Maximum reproductive rate of fish at low population sizes. Can. J. Fish. Aquat. Sci. 56:2404-2419.

NMFS (National Marine Fisheries Service). 2000a. Biological opinion on effects of Pacific Coast ocean and Puget Sound fisheries during the 2000-2001 annual regulatory cycle. Seattle, Washington.

NMFS (National Marine Fisheries Service). 2000b. Biological opinion and incidental take statement on 2000 Treaty Indian and non-Indian fall season fisheries in the Columbia River Basin. Seattle, Washington.

NMFS (National Marine Fisheries Service). 2000c. Biological opinion on impacts of Treaty Indian and non-Indian year 2000 winter, spring, and summer season fisheries in the Columbia River basin, on salmon and steelhead listed under the Endangered Species Act. Seattle, Washington.

ODFW (Oregon Department of Fish and Wildlife) 2000. Fisheries Management and Evaluation Plan. Upper Willamette River Spring Chinook in Freshwater Fisheries of the Willamette Basin and Lower Columbia River Mainstem. Portland Oregon.

Peters, C. N., D. R. Marmorek, and I. Parnell (eds.). 1999. PATH Decision analysis report of t Snake River Fall Chinook. Prepared by ESSA Technologies Ltd. Vancouver, B.C.

Pettit, S. 1977. Comparative reproductive success of caught and released and unplayed hatchery female steelhead (Salmo gairdneri) from the Clearwater River, Idaho. Trans. Amer. Fish. Soc. 106:431-35.

Rawding, D. 1998. A methodology for estimating the adult winter steelhead sportfishing mortality in tributaries to the Lower Columbia River. Wash. Depart. of Fish and Wild. Vancouver, WA. Unpublished draft, 16pp.

Rawding D. 2001. Stock-recruitment of wild winter and summer steelhead in the Kalama River, Washington. Wash. Depart. of Fish and Wild. Vancouver, WA. Unpublished draft.

Schill, D.S. 1996. Hooking mortality of bait caught rainbow trout in an Idaho trout stream and a hatchery: implications for special-regulation management. North American Journal of Fisheries Management 16: 348-356.

Schill, D.J., J.S. Griffith, and R.E. Gresswell. 1986. Hooking mortality of cutthroat trout in a catch-and-release segment of the Yellowstone River, Yellowstone National Park. North American Journal of Fisheries Management 6; 226-232.

Schroeder, R. K., K. R. Kenaston, and R. B. Lindsay. 1999. Spring chinook salmon in the Willamette and Sandy Rivers. Fish Research Project Annual Progress Report. Oregon Department of Fish and Wildlife. Portland, Oregon.

Seber, G.A.F. 1982. Estimation of Animal Abundance, 2nd Edition. Griffen, London. 654 p.

Ward, B.R. 1996. Population dynamics of steelhead trout in a coastal stream, the Keogh River, British Columbia. Pp. 308-323 In I.Cowx [ed.] Stock Assessment in Inland Fisheries. Fishing News Books, Blackwell Scientific Publications, Oxford.

Washington Department of Fisheries (WDF), 1993. 1992 Washington State Salmon and Steelhead Stock Inventory. Appendix Three Columbia River Stocks. Olympia, Washington.

Washington Department of Fish and Wildlife (WDFW). 1997a. Wild Salmonid Policy, draft environmental impact statement. Wash. Depart. of Fish and Wild. Olympia, WA.

Washington Department of Fish and Wildlife (WDFW). 1997b. Preliminary stock status update for steelhead in the Lower Columbia River, Washington. Wash. Depart. of Fish and Wild. Vancouver, WA, 15pp.

Washington Department of Fish and Wildlife/Oregon Department of Fish and Wildlife (WDFW/ODFW). 2000. ESA Section 7/10 application for the Incidental Take of Listed Species in Washington and Oregon Mainstem Fisheries of the Columbia River January Through July, 2001. Olympia WA. Portland OR.

KALAMA RIVER SUB BASIN STOCK SUMMARY AND HABITAT PRIORITIES

Stocks and Priorities

SASSI and LCSCI Stocks	Priority	Other Anadromous Salmonids Present in the Sub-basin (LFA)
Kalama River Summer Steelhead (LCSCI)	Tier 1	Chum Salmon
Kalama River Winter Steelhead (LCSCI)	Tier 1	
Kalama River Fall Chinook (SASSI)	Tier 2	
Kalama River Spring Chinook (SASSI)	Tier 2	
Kalama River Coastal Cutthroat (SaSI)	Tier 3	
Kalama River Coho Salmon (SASSI)	Tier 3	

Not all stocks are present in all parts of the subbasin. Use LFA maps or contact Gary Wade at the LCFRB for specific site information.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Fish Passage	**Medium:** 5.5% of the historic habitat in the subbasin is blocked (5.1miles).	• Assess and if possible address potential low flow passage problems at the mouth of the Kalama that have been exacerbated by various alterations in channel characteristics. • Look for solutions to excessive sediment deposition at the mouth of Langdon, North Fork Kalama, and Jacks Creeks that leads to subsurface flows during summer months. • Address passage problems	None

		during low flow periods at the hatchery on Hatchery Creek. • Schoolhouse and Bybee Creeks have culverts that block passage to 3.2 miles and 1 mile of habitat respectively. The quality of the habitat above these blockages is unknown. • Culverts also block passage to portions of Bear Creek, upper Wildhorse Creek, and an unnamed tributary to Wildhorse Creek.	
Floodplain Conditions	**High:** Very limited floodplain habitat available with numerous modifications.	• Reconnect and enhance off-channel and floodplain habitats along the reaches of the lower Kalama River (below RM 10) and its tributaries to help increase rearing habitat for juvenile salmonids.	Preserve off-channel and side channel habitat and associated wetlands wherever they occur in the Kalama and its tributaries. The lower reaches of the Kalama below RM 10 are especially important.

Sediment	**High:** Data is lacking for most streams. However, LFA TAG members considered excessive sediment fines a major problem in many of the streams within the subbasin.	• ***Identify and repair roads that are contributing excessive fine sediments to streams in the subbasin. The Kalama Subbasin has very high road densities and numerous stream crossings that increase fine sediment inputs to streams.*** • ***Assess and, if possible, stabilize mass wasting and bank erosion problems on the North Fork Kalama, and Spencer, Hatchery, Wildhorse, Gobar, Lakeview Peak, and Langdon Creeks.*** • ***Restore native riparian vegetation along the tributaries to the upper Kalama that have been logged down to the stream channel. Riparian areas with mostly deciduous vegetation may require thinning and under planting to restore a high percentage of conifers.***	Protect existing quality riparian corridors from additional development along all anadromous streams within the subbasin. Protect critical spawning habitat for fall chinook, chum and, coho between RM 10 and RM 2.4 on the mainstem Kalama, and for winter steelhead in from RM 10 upstream. The North Fork Kalama, and Gobar, Wildhorse, Langdon, and Lakeview Peak Creeks provide critical spawning habitat for summer steelhead. Preserve vegetation and limit development in areas with steep, unstable slopes.
LWD	**Medium:** LWD supplies are very limited in the sub-basin.	• Increase functional LWD structures, or similar natural structures, in appropriate stream reaches through LWD placement projects and/or through recruitment. Very limited mature riparian vegetation is left for recruitment of LWD along some of the most productive steelhead streams (North Fork Kalama, and Wildhorse, Gobar, Lakeview Peak, and Arnold Creeks). • Speed recruitment of conifers within degraded riparian corridors to provide a future supply of LWD.	Protect existing mature riparian vegetation wherever found within the subbasin for LWD recruitment. Maintain current appropriate pieces of LWD, and other natural structures, through increased education and enforcement.
Riparian	**High:** Riparian conditions are	• Target riparian restoration efforts along the most	Preserve healthy riparian corridors in the headwaters of

	"poor" almost throughout the sub-basin and some of the most productive tribs. have almost no mature conifers.	productive and/or degraded streams including the anadromous reaches of the North Fork Kalama, and Wildhorse, Gobar, Lakeview Peak, and Arnold Creeks.	all the sub-basin's tributaries, focusing first on productive areas like the North Fork Kalama, and Wildhorse, Gobar, Lakeview Peak, and Arnold Creeks.
Water Quality	**Medium:** Data is lacking for most streams in the basin. The lower River and Hatchery Creek are on 303d list.	• Restore degraded riparian cover for all streams within the sub-basin, especially along degraded reaches of tributaries to the upper Kalama. • Protect and restore wetlands, springs, and seeps in the subbasin. • Reduce direct runoff from roads to streams, especially from heavily traveled gravel roads in the upper watershed. • Enhance pool habitat to provide thermal refuge for salmonids rearing or holding in the watersheds.	Protect riparian corridors in all headwaters areas to maintain the supply of cool, clean water to critical downstream spawning and rearing areas. Protect and enhance wetlands and spring fed sources of cool water.
Water Quantity	**Medium:** Both elevated peak and low flows present problems in the sub-basin.	• Reduce impervious surfaces, road densities, and the direct connections between road drainage ditches and streams to reduce peak flows, promote groundwater recharge, and potentially enhance low summer flows. • Look for solutions to excessive coarse sediment deposits in the lower reaches of the North Fork Kalama, and Langdon, Jacks, and Wold Creeks that result in subsurface flow during summer months.	Protect fully forested and unroaded areas in the upper watershed from further development to reduce peak flows to downstream habitats, and the mass-wasting potential, and to provide refuge for salmonids from elevated stream temperatures. Preserve floodplain connections and associated wetlands to provide off-channel refuge during high flows and additional flood capacity.
Biological Processes	**Medium:** Escapement is well below historic levels and a lack of nutrients may	• Assess the need to increase the contribution of marine–derived nutrients through increased use of carcasses or pass additional spawning fish above the falls.	None

	be limiting.		

* Restoration and Preservation Actions by Limiting Factor were prioritized based upon the Limiting Factors Report and will be circulated to TAG members for their approval.

"Poor", "Fair" and "Good" comments refer to habitat criteria developed by the Conservation Commission for the Habitat Limiting Factors Analysis Reports.

Appendix E. Approved Lower Columbia Fish Recovery Board

INTERIM REGIONAL HABITAT STRATEGY

INTERIM REGIONAL HABITAT STRATEGY

August 3, 2001

SECTION 1. Introduction

This document outlines the goals and strategies the Lower Columbia Fish Recovery Board and its Technical Advisory Committee will use to:

A. Identify and rank habitat restoration and protection needs; and
B. Evaluate and rank habitat project proposals.

It should be noted that this document is an ***interim*** habitat strategy. The adequacy and sophistication of available information on fish stocks, watershed functions, and habitat conditions varies significantly across the lower Columbia region. The strategy will be refined, as better information and analytical tools become available. It is anticipated that this strategy will evolve over the next several years to become an integral element in a comprehensive salmonid recovery plan for the lower Columbia.

In the near-term, this strategy will assist the Board and project sponsors to better target limiting factors and habitat protection needs in a way that will help maximize benefits for fish recovery and ensure the most effective use of limited resources.

The strategy provides fish recovery and habitat recovery goals. It prioritizes fish stocks and habitat recovery and protection needs. And, finally, it sets forth the means the Board and TAC will use to evaluate and rank project proposals.

SECTION 2. Goals

The Lower Columbia Fish Recovery Board (LCFRB) was established by RCW 77.85.200 to coordinate fish recovery activities in the lower Columbia region of Washington State. The Board's key activities include recovery planning, watershed planning and habitat restoration and protection.

It is the overall habitat goal of the Lower Columbia Fish Recovery Board to provide the habitat necessary to support healthy, harvestable populations of ESA listed fish species in the lower Columbia region of Washington. Specific goals for fish recovery and habitat restoration and protection are:

A. Fish Recovery Goals

1. Support Recovery of ESA listed stocks.

First priority in achieving this objective will be given to stocks that are listed under the federal Endangered Species Act (ESA). Four of six lower Columbia salmonid species are currently listed as threatened. These are chinook and chum salmon, steelhead, and bull trout. The ESA defines species as threatened when it is "likely to become endangered within the foreseeable future throughout all or a significant portion of its range." A species is considered endangered when it is "in danger of extinction throughout all or a significant portion of its range."

Second priority will be given to species that are candidates or are proposed for listing under the ESA. Currently coho salmon are a candidate for listing. Sea-run cutthroat are proposed for listing as a threatened species.

2. Support biodiversity through recovery of native wild stocks.

The maintenance of genetic and life-cycle diversity across the region is critical to the recovery of listed fish species. To help preserve this diversity, priority will be given to habitat projects benefiting naturally spawning, locally adapted fish stocks with minimal hatchery influence. The stock origin and production type classifications used for identifying and prioritizing stocks to achieve this objective are those provided in:

a. The 1993 Washington Department of Fish and Wildlife (WDFW) Salmon and Steelhead Stock Inventory (SASSI);
b. The 1998 Salmonid Stock Inventory for bull trout (SaSI);
c. The 2000 Salmonid Stock Inventory for coho (SaSI); and
d. The Lower Columbia Steelhead Conservation Initiative (LCSCI, 1997).

SASSI notes that its stock origin designations should be considered as preliminary until such time as more detailed information confirms or refutes the current origin designations. For this reason, the SASSI data will be augmented by more recent information where and when it becomes available. In developing project proposals, sponsors are encouraged to bring forward any additional information available regarding stock identification, origin, production and status.

Based on the SASSI information, first priority under this objective will be given to stocks that are designated as being of **native** origin and **wild** production. Second priority will be given to stocks of **mixed** or **unknown** origin and **wild** production. Third priority will be given to stocks of **mixed** origin and **cultured** or **composite** production.

SASSI defines a **native** as "an indigenous stock of fish that has not been substantially impacted by genetic interactions with non-native stocks, or by other factors, and is still present in all or part of its original range." **Mixed** stocks are defined as those whose individuals originated from commingled native and non-native parents, and/or by mating between native and non-native fish; or a previously native stock that has undergone substantial genetic alteration." Stocks of **unknown** origin are those "where there is insufficient information to identify stock origin with confidence."

SASSI defines a **wild** production stock as one that "is sustained by natural spawning and rearing in natural habitat, regardless of parentage." A **cultured** stock is defined as one that "depends upon spawning, incubation, hatching, or rearing in a hatchery or other artificial production facility." A **composite** stock is a stock "sustained by both wild and artificial production."

3. Restore or sustain geographic distribution of stocks.

Maintaining multiple stocks across the region is necessary to reduce the risk that changes in environmental conditions, catastrophic events, and disease will result in an unacceptable risk of species extinction. Priority will be given to restore or sustaining the historic geographic distribution of stocks. Noteworthy in this regard are listed chum stocks. Currently only three relatively small stocks of chum exist in the region. They are located in the Grays River, Hardy Creek and Hamilton Creek. Other stocks with limited geographic distribution are summer steelhead and bull trout. Efforts should be made to increase the number and distribution of these stocks throughout their historic range within the region through habitat restoration activities.

4. Maintain healthy stocks of a listed species.

Maintaining healthy stocks of listed salmonid species can substantially reduce the biological risk and costs of species recovery. Rather than allowing habitat conditions to deteriorate to the point that healthy stocks are reduced to depressed or critical levels, priority will be given to projects that protect or restore habitat conditions and habitat –forming processes upon which existing healthy stocks of listed salmonid species depend.

Healthy stocks in the lower Columbia region are identified in Attachment 1. Of the 46 stocks of listed salmonid species in the lower Columbia, 17 are identified as healthy (13 fall chinook, 2 spring chinook, 1 winter steelhead, and 1 chum). The list is based on the WDFW SASSI and SaSI, LCSCI, and Limiting Factor Analysis (LFA, 1999-2001) reports for WRIAs 26 through 29. The information contained in Attachment 1 will be updated and augmented by more recent data when available.

5. Support recovery of critical stocks of listed species

SASSI classifies a stock as "critical" if it is "experiencing production levels that

are so low that permanent damage to the stock is likely or has already occurred." SASSI further states that these stocks are "in need of immediate restoration efforts to ensure their continued existence and to return them to a productive state."

The loss of a critical stock can reduce genetic and life-cycle diversity within the region. For this reason habitat restoration and protection actions needed to support the recovery of critical stocks will be given priority. The SASSI report did not identify any critical stocks in the lower Columbia. However, the LCSCI classified Wind River summer steelhead stocks (Mainstem, Panther Creek, Trout Creek) as being in critical condition. (See Attachment 1.) Accordingly, habitat projects benefiting these stocks will be a high priority.

Habitat Protection and Restoration Goals

Recovery of salmonid species requires the restoration and protection of the habitat conditions and processes upon which the fish depend. The following goals are listed in priority order.

Restore access to habitat

Removal of man-made barriers to substantial reaches of good quality habitat provides important benefits to fish in both the near and long term. Actions to improve access can include removal or replacement of blocking culverts and reconnecting isolated habitats, such as side channel areas. Protecting or restoring properly functioning habitat conditions are only beneficial if fish have the necessary access to the habitat. In assessing the need to remove a barrier consideration must be given to the stocks and life-history stages affected and the type, quality and quantity of habitat that would be made accessible. LFA reports, barrier inventories, and other watershed and habitat assessments will be used in assessing the need to remove or correct a barrier.

Protect existing properly functioning habitat conditions.

Existing high quality habitat is critical to sustaining current fish abundance and productivity. Habitat restoration can be expensive and technically difficult, if not impossible. For this reason, protecting properly functioning habitat from degradation and loss is an important priority. LFA reports, other watershed and habitat assessments, and stock priorities will be used to identify and rank habitats for protection.

The quality and quantity habitat, the potentially affected stocks, and the nature and urgency of the threat to habitat values are key considerations in determining habitat protection needs. Priority will be given to protection of high quality habitat facing serious near-term threats.

Restore degraded watershed processes needed to sustain properly functioning habitat conditions.

Habitat projects should focus on the restoration of watershed functions that will sustain habitat conditions upon which salmon stocks depend over the long-term. Projects that address a habitat need on a temporary or near-term basis may be

justified as a critical interim step in a comprehensive effort to restore natural habitat forming processes over the long-term.
LFA reports and other technical assessments will be used to help identify and prioritize key watershed functions requiring restoration or protection in each basin.

Support of critical salmonid life-history stages.

Projects may target habitat conditions needed to support critical life-history stage needs. LFA information and other technical assessments should be used to help identify the key habitat needs for each species in a given basin. Sponsors should provide adequate supporting information linking:

- The habitat requirements of target species and life-history stages.
- The availability of those habitat conditions relative to historic conditions.
- The likelihood that the lack of suitable habitat is restricting population abundance.

Consideration will also be given to a project's contribution to critical life-history stages on a regional level. Some basins, such as the Chinook River, play an important role in the life history of fish stocks from outside the lower Columbia region. (Dewberry, 1997)

Project proposals should clearly identify each species and its life-history stages that will benefit from the proposed action.

Secure near and long-term benefits

Addressing habitat protection and restoration needs that will provide both near-term and sustainable long-term benefits for fish should receive a higher priority than addressing conditions that will provide benefits to fish only in the long-term. Projects that provide only short-term benefits may be justified if they are:

a. Part of a comprehensive effort to restore natural habitat processes over the long-term, and

b. Designed to sustain or protect a stock(s) until natural habitat processes are restored.

SECTION 3. Fish Stock Priorities

Stocks for each salmonid species have been categorized into four tiered priority groupings to assist setting habitat priorities within each watershed and across the lower Columbia region. Stocks for each watershed, except the Chinook River, were identified using SASSI. SASSI defines a stock as "the fish spawning in a particular lake or stream(s) at a particular season, which fish to a substantial degree do not interbreed with

any group spawning in a different place, or in the same place at a different season."

Since SASSI stock information is not available for the Chinook River, stocks for this watershed were identified using information from Sea Resources (Dewberry, 1997), WDFW, and the WRIA 24/25 LFA.

The tiered breakdown integrates goals 1 through 5 discussed in Section 2.A above. It uses stock information taken from SASSI, LFA reports, and LCSCI. SASSI definitions of stock origin, production type, and status are outlined in Section 1.A. Attachment 1 provides a list of stocks by watershed or basin. Attachment 2 provides a listing of stocks by tier. The criteria for each of the four tiers is provided below:

A. Tier 1 (Highest Priority)

This Tier includes stocks that are (1) listed as threatened pursuant to the ESA and are (2) classified by SASSI as native, mixed, or unknown in origin and wild in production. It also includes all chum, summer steelhead, and bull trout stocks due to their limited geographic distribution. It may include stocks designated by SASSI as healthy, depressed, or critical if the stocks satisfy the ESA, origin, and production type designations for this Tier.

B. Tier 2

This Tier includes stocks that are (1) listed as threatened pursuant to the ESA and are (2) classified by SASSI as mixed, non-native, or unknown in origin and composite in production. It includes all stocks designated by SASSI as healthy or critical and not included in Tier 1. It may also include a stock designated as depressed if the stock satisfies the ESA, origin, and production type designations for this Tier.

C. Tier 3

Tier 3 includes all stocks that are proposed or are candidates for listing under the ESA. They may be of any stock origin, production type, or status designation.

D. Tier 4 (Lowest Priority)

Tier 4 includes all stocks that are not listed or proposed for listing under the ESA. They may be of any stock origin, production type, or status designation.

SECTION 4. Habitat Protection and Restoration Priorities

The number of affected stocks and their importance along with the degree to which correction of a limiting factor or protection of habitat would help achieve or sustain properly functioning habitat conditions are key considerations in determining habitat priorities.

As discussed in Section 3, Attachment 1 identifies fish stocks by basin and their priority rating, tiers 1 through 4. It should be noted that not all stocks will be present throughout the basin. Stocks likely to be present in a given river reach can be determined using the LFA fish presence information and maps.

Attachment 3 provides a ranked list of limiting factors. Limiting factors have been identified using LFA reports. The importance of each limiting factor is ranked as high, medium, or low based on the habitat goals set forth in Section 2.B. Attachment 3 presents this ranking information in matrix form. It is organized by basin using the LFA sub-basin designations. In addition to ranking limiting factors within a basin, potential restoration and protection actions have been identified for each limiting factor. Finally, fish stocks and their priorities are also listed for each basin.

In general, limiting factors rated as high and affecting multiple high priority (Tier 1 or 2) stocks are a higher priority than limiting factors rated moderate or low and affecting few or lower priority (Tier 3 or 4) stocks.

This information is provided to assist project sponsors in identifying and developing projects that will address the most important habitat protection and restoration needs. It is intended to serve as guidance. It will be refined as additional information on fish stocks and habitat conditions becomes available. It should be further noted that basing a project on a limiting factor that is rated as high and affects high priority fish stocks substantially enhances the likelihood, but does not ensure, that a project will receive a high priority for funding. As discussed in Section 5 below, a project's priority for funding is based on both its benefit to fish and certainty of success. Certainty of success takes into consideration a project's relationship to other limiting factors and restoration efforts as well as project design, cost, and management elements.

SECTION 5. Evaluation and Ranking of Habitat Projects

The ranking of habitat project proposals will be done using the same basic approach

outlined for establishing habitat priorities but also takes into consideration the degree to which a project addresses an identified habitat priority and factors affecting the level of certainty that a project will produce its intended benefits for fish.

A. Evaluation Criteria

Each proposed habitat project will be evaluated using the following criteria:

1. Benefits to Fish

a. The number of stocks that will be affected and their priorities.

The number of stocks that would benefit from a project and their priority will be determined using the tiered stock listing discussed in Section 3 and the fish presence information contained in the applicable LFA report or other comparable source.

b. The nature and significance of the benefit's the project will have for the affected stocks.

While the benefit for all affected stocks will be considered, greatest weight will be given to the project's potential value to ESA listed species or unique stocks essential for recovery.

c. The degree to which the proposed correction of a limiting factor or protection of habitat would help to achieve and sustain properly functioning habitat conditions.

Factors to be considered include the extent to which a project addresses:

(1) An identified habitat priority as discussed in Section 4 or limiting factors identified in an LFA report or other technical assessment.
(2) Section 2.B habitat goals. These include the value of the project in:
    (a) The importance of the project in restoring access to habitat;
    (b) Achieving and sustaining properly functioning habitat conditions; and
    (c) Providing for critical salmonid life history stages in the reach or basin.

2. Certainty of Success

The level of certainty that the project would produce its intended benefit for fish will be assessed based on the extent to which the proposed project:

a. Complements other habitat protection and restoration programs and projects within a basin.

Habitat projects should be designed, coordinated, and sequenced in concert with other salmon recovery activities with a watershed or basin. This can help to achieve the greatest benefit to fish in the shortest possible time and with the most efficient use of resources.

Specific consideration will be given to whether a project is:

(1) An element of a comprehensive watershed or basin restoration and protection strategy;
(2) Well coordinated and logically sequenced with other habitat projects completed, underway, and planned for a watershed or basin; and/or
(3) Complements and supports other local and state salmon recovery regulations and programs, including land use and development regulations, critical area ordinances, storm water management programs, shoreline master plans, forest management regulations, etc.

b. Has a sound technical basis in addressing habitat forming processes and limiting factors.

The success of a project requires a solid understanding of conditions and watershed processes that cause or contribute to the problem or limiting factor being addressed. For some projects, existing LFA information may be sufficient. More complex problems may require a more thorough assessment of conditions and watershed processes. This information may be available through existing studies and evaluations. In some cases, site-specific assessments and design work may be required. In order to assess whether a project has an adequate supporting technical basis, it will be important that the project proposal addresses considerations listed for its project type contained in the Guidance on Watershed Assessment for Salmon, Part 3 (Joint Natural Resources Cabinet, State of Washington, May 2001).

c. Demonstrates that sponsor experience and capabilities are commensurate with project requirements.

The success of a habitat project is dependent on the project sponsor's ability to design, plan, implement and monitor a project. Ideally, project sponsors should have experience in successfully completing project of similar nature, scope, and complexity. At a minimum, sponsors should indicate how they would acquire needed experience and expertise that they do not possess.

Options for doing so could include partnerships with other agencies or organizations, or contracting for needed services.

d. Applies proven methods and technologies.

The certainty of a projects success can be enhanced through the use of proven and accepted methods and technologies. Projects should utilize approaches and technologies that are commensurate with the nature, scope, and complexity of the problem being addressed.

Innovative or experimental approaches may be acceptable if no proven method exists or it can be shown that they will reasonably extend knowledge of restoration methodologies.

e. Has community support

The long-term success of habitat restoration and protection efforts depends on the acceptance and support of local communities. Projects should be designed and implemented in a manner that accommodates local values and concerns.

f. Demonstrates that costs are reasonable for the work proposed and the benefit to be derived.

Given that resources for habitat protection and restoration are limited, projects should be designed and implemented in the most efficient and effective manner possible. Project costs should be commensurate with those for projects of similar nature, scope, and complexity. A project's chance of success can also be enhanced through the use of partnerships that can leverage expertise, contributions of materials and labor, and funding.

g. Demonstrates an effective maintenance and monitoring element.

Monitoring the effectiveness of the project is critical to determining the success of the project in meeting its objectives. Maintenance of a completed project may be critical to the project's performance and long-term effectiveness.

B. Scoring and Ranking of Habitat Project Proposals

Habitat projects will be scored by the TAC using a score sheet that is based on the evaluation criteria discussed in section 4.A. above. A sample score sheet is provided as Attachment 4.

Each project will be scored on both its benefits for fish and certainty for success. As discussed above a project's benefit to fish is determined by the affected stocks and their priority and the degree to which the proposed correction of a limiting factor or protection of habitat would help to achieve and sustain properly functioning habitat conditions. Certainty of success is the level confidence that a project will achieve its goals.

The scores for each project will be used to rate its benefit for fish and certainty of success as high, medium, or low. Based on these designations a project will be assigned to a priority using the matrix below. Within each priority category projects will be ranked based on their combined benefit and certainty scores. Projects in categories 1, 2 and 3 will be recommended for funding.

		Benefit To Fish		
		High	**Medium**	**Low**
Certainty Of Success	**High**	**Group 1**	**Group 2**	**Group 4**
	Medium	**Group 2**	**Group 3**	**Group 4**
	Low	**Group 4**	**Group 4**	**Group 4**

Appendix F. Kalama River Sub Basin Stock Summary and Habitat Priorities

KALAMA RIVER SUB BASIN STOCK SUMMARY AND HABITAT PRIORITIES

Stocks and Priorities

SASSI and LCSCI Stocks	Priority	Other Anadromous Salmonids Present in the Sub-basin (LFA)
Kalama River Summer Steelhead (LCSCI)	Tier 1	Chum Salmon
Kalama River Winter Steelhead (LCSCI)	Tier 1	
Kalama River Fall Chinook (SASSI)	Tier 2	
Kalama River Spring Chinook (SASSI)	Tier 2	
Kalama River Coastal Cutthroat (SaSI)	Tier 3	
Kalama River Coho Salmon (SASSI)	Tier 3	

Not all stocks are present in all parts of the subbasin. Use LFA maps or contact Gary Wade at the LCFRB for specific site information.

Prioritization of Limiting Factors and Identification of Potential Restoration and Preservation Needs*

Limiting Factor	Priority Rating	Potential Restoration Actions	Preservation Actions
Fish Passage	**Medium:** 5.5% of the historic habitat in the subbasin is blocked (5.1miles).	• Assess and if possible address potential low flow passage problems at the mouth of the Kalama that have been exacerbated by various alterations in channel characteristics. • Look for solutions to	None

		excessive sediment deposition at the mouth of Langdon, North Fork Kalama, and Jacks Creeks that leads to subsurface flows during summer months. • Address passage problems during low flow periods at the hatchery on Hatchery Creek. • Schoolhouse and Bybee Creeks have culverts that block passage to 3.2 miles and 1 mile of habitat respectively. The quality of the habitat above these blockages is unknown. • Culverts also block passage to portions of Bear Creek, upper Wildhorse Creek, and an unnamed tributary to Wildhorse Creek.	
Floodplain Conditions	**High:** Very limited floodplain habitat available with numerous modifications.	• Reconnect and enhance off-channel and floodplain habitats along the reaches of the lower Kalama River (below RM 10) and its tributaries to help increase rearing habitat for juvenile salmonids.	Preserve off-channel and side channel habitat and associated wetlands wherever they occur in the Kalama and its tributaries. The lower reaches of the Kalama below RM 10 are especially important.

Sediment	**High:** Data is lacking for most streams. However, LFA TAG members considered excessive sediment fines a major problem in many of the streams within the subbasin.	• ***Identify and repair roads that are contributing excessive fine sediments to streams in the subbasin. The Kalama Subbasin has very high road densities and numerous stream crossings that increase fine sediment inputs to streams.*** • ***Assess and, if possible, stabilize mass wasting and bank erosion problems on the North Fork Kalama, and Spencer, Hatchery, Wildhorse, Gobar, Lakeview Peak, and Langdon Creeks.*** • ***Restore native riparian vegetation along the tributaries to the upper Kalama that have been logged down to the stream channel. Riparian areas with mostly deciduous vegetation may require thinning and under planting to restore a high percentage of conifers.***	Protect existing quality riparian corridors from additional development along all anadromous streams within the subbasin. Protect critical spawning habitat for fall chinook, chum and, coho between RM 10 and RM 2.4 on the mainstem Kalama, and for winter steelhead in from RM 10 upstream. The North Fork Kalama, and Gobar, Wildhorse, Langdon, and Lakeview Peak Creeks provide critical spawning habitat for summer steelhead. Preserve vegetation and limit development in areas with steep, unstable slopes.
LWD	**Medium:** LWD supplies are very limited in the sub-basin.	• Increase functional LWD structures, or similar natural structures, in appropriate stream reaches through LWD placement projects and/or through recruitment. Very limited mature riparian vegetation is left for recruitment of LWD along some of the most productive steelhead streams (North Fork Kalama, and Wildhorse, Gobar, Lakeview Peak, and Arnold Creeks). • Speed recruitment of conifers within degraded riparian corridors to provide a future supply of LWD.	Protect existing mature riparian vegetation wherever found within the subbasin for LWD recruitment. Maintain current appropriate pieces of LWD, and other natural structures, through increased education and enforcement.
Riparian	**High:** Riparian conditions are	• Target riparian restoration efforts along the most	Preserve healthy riparian corridors in the headwaters of

	"poor" almost throughout the sub-basin and some of the most productive tribs. have almost no mature conifers.	productive and/or degraded streams including the anadromous reaches of the North Fork Kalama, and Wildhorse, Gobar, Lakeview Peak, and Arnold Creeks.	all the sub-basin's tributaries, focusing first on productive areas like the North Fork Kalama, and Wildhorse, Gobar, Lakeview Peak, and Arnold Creeks.
Water Quality	**Medium:** Data is lacking for most streams in the basin. The lower River and Hatchery Creek are on 303d list.	• Restore degraded riparian cover for all streams within the sub-basin, especially along degraded reaches of tributaries to the upper Kalama. • Protect and restore wetlands, springs, and seeps in the subbasin. • Reduce direct runoff from roads to streams, especially from heavily traveled gravel roads in the upper watershed. • Enhance pool habitat to provide thermal refuge for salmonids rearing or holding in the watersheds.	Protect riparian corridors in all headwaters areas to maintain the supply of cool, clean water to critical downstream spawning and rearing areas. Protect and enhance wetlands and spring fed sources of cool water.
Water Quantity	**Medium:** Both elevated peak and low flows present problems in the sub-basin.	• Reduce impervious surfaces, road densities, and the direct connections between road drainage ditches and streams to reduce peak flows, promote groundwater recharge, and potentially enhance low summer flows. • Look for solutions to excessive coarse sediment deposits in the lower reaches of the North Fork Kalama, and Langdon, Jacks, and Wold Creeks that result in subsurface flow during summer months.	Protect fully forested and unroaded areas in the upper watershed from further development to reduce peak flows to downstream habitats, and the mass-wasting potential, and to provide refuge for salmonids from elevated stream temperatures. Preserve floodplain connections and associated wetlands to provide off-channel refuge during high flows and additional flood capacity.
Biological Processes	**Medium:** Escapement is well below historic levels and a lack of nutrients may	• Assess the need to increase the contribution of marine–derived nutrients through increased use of carcasses or pass additional spawning fish above the falls.	None

	be limiting.		

* Restoration and Preservation Actions by Limiting Factor were prioritized based upon the Limiting Factors Report and will be circulated to TAG members for their approval.

"Poor", "Fair" and "Good" comments refer to habitat criteria developed by the Conservation Commission for the Habitat Limiting Factors Analysis Reports.