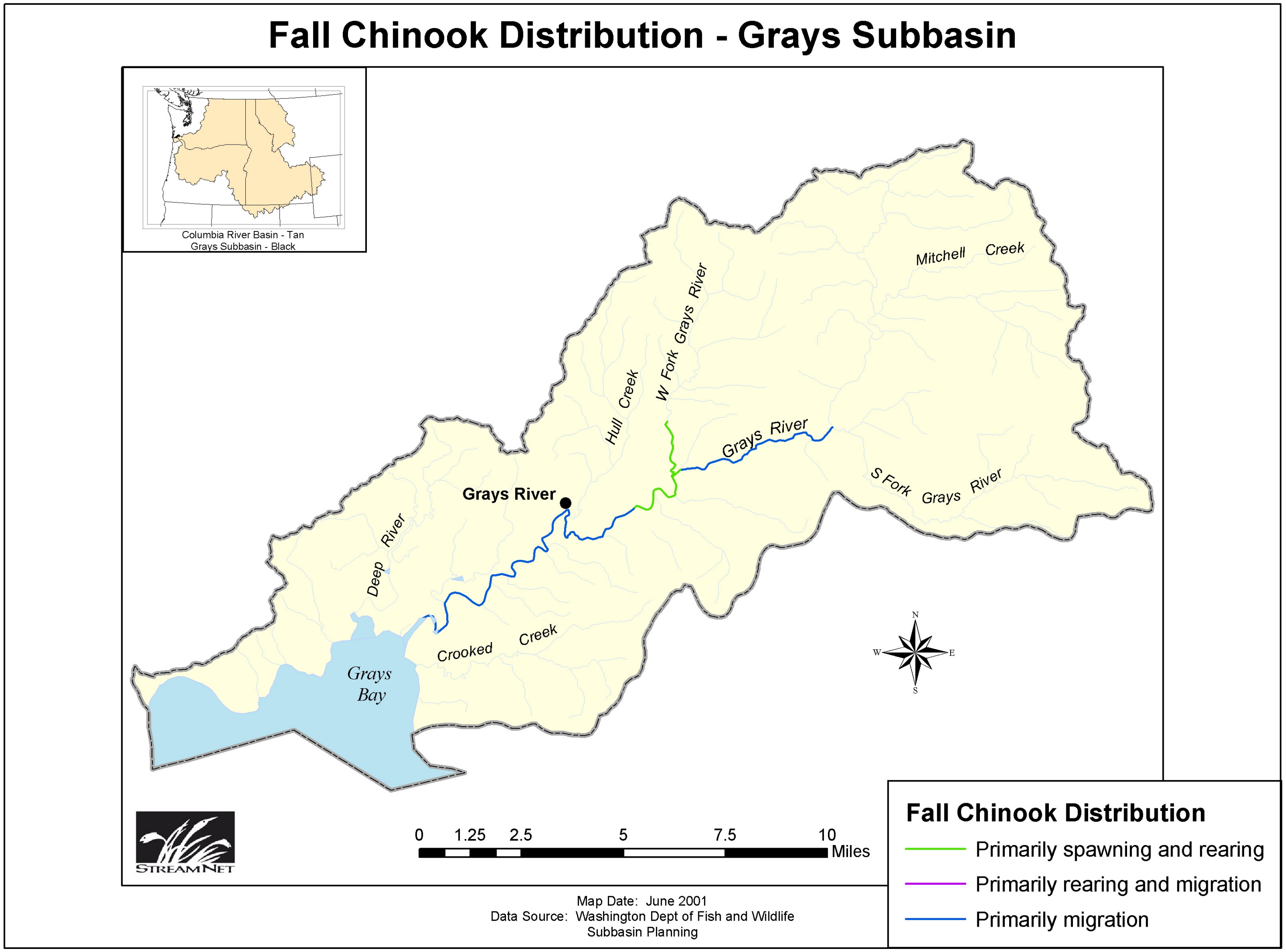
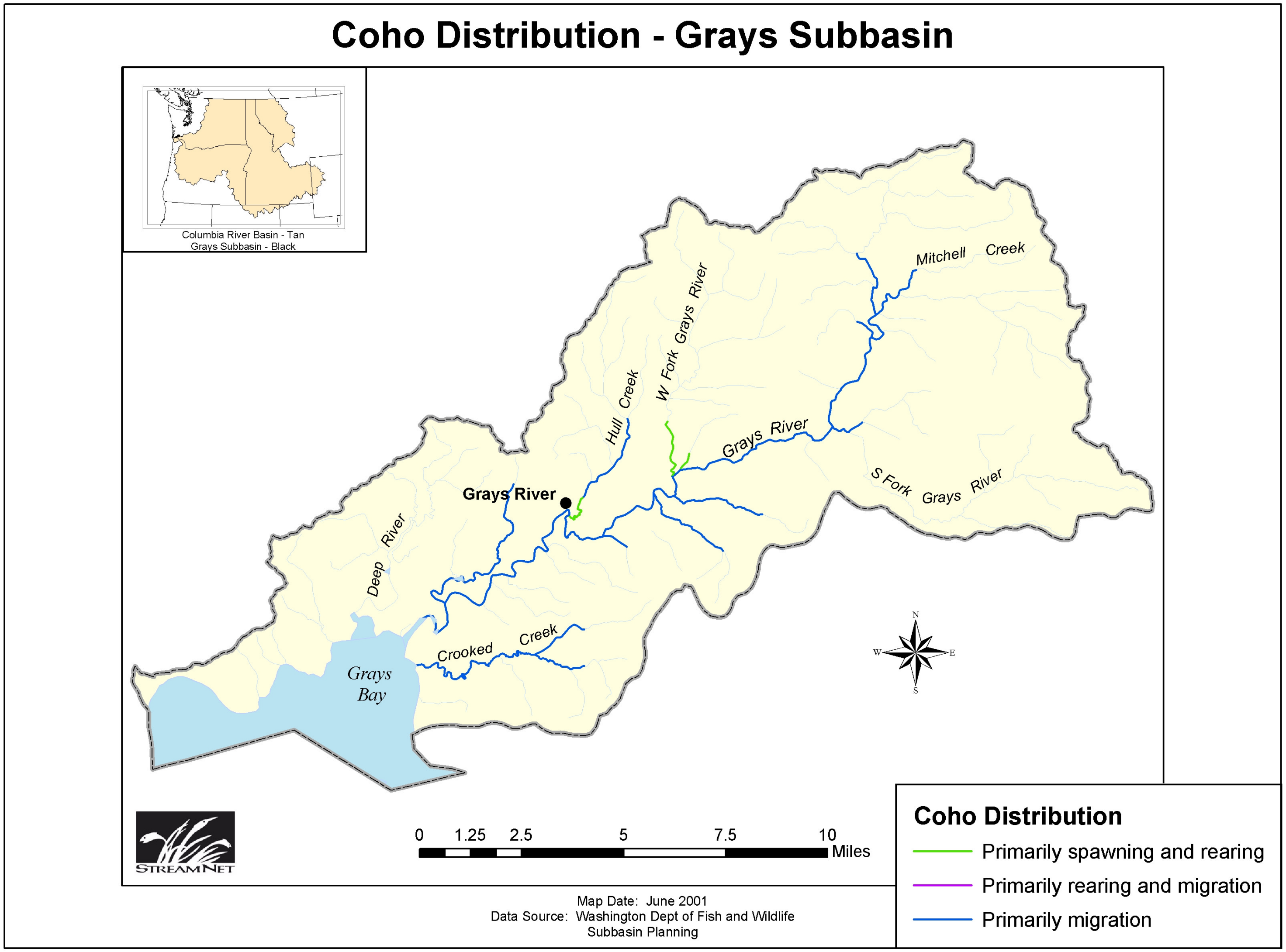
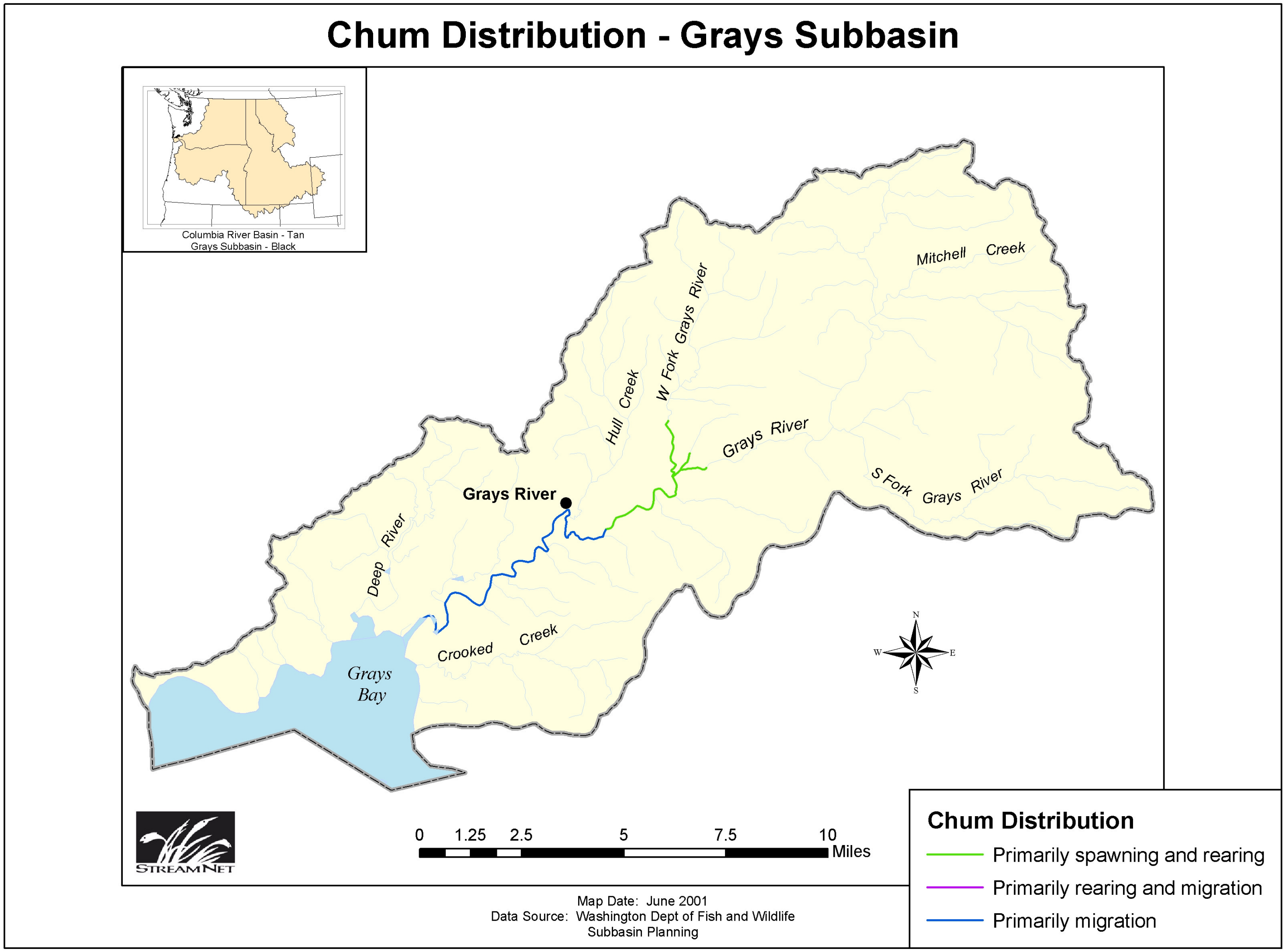
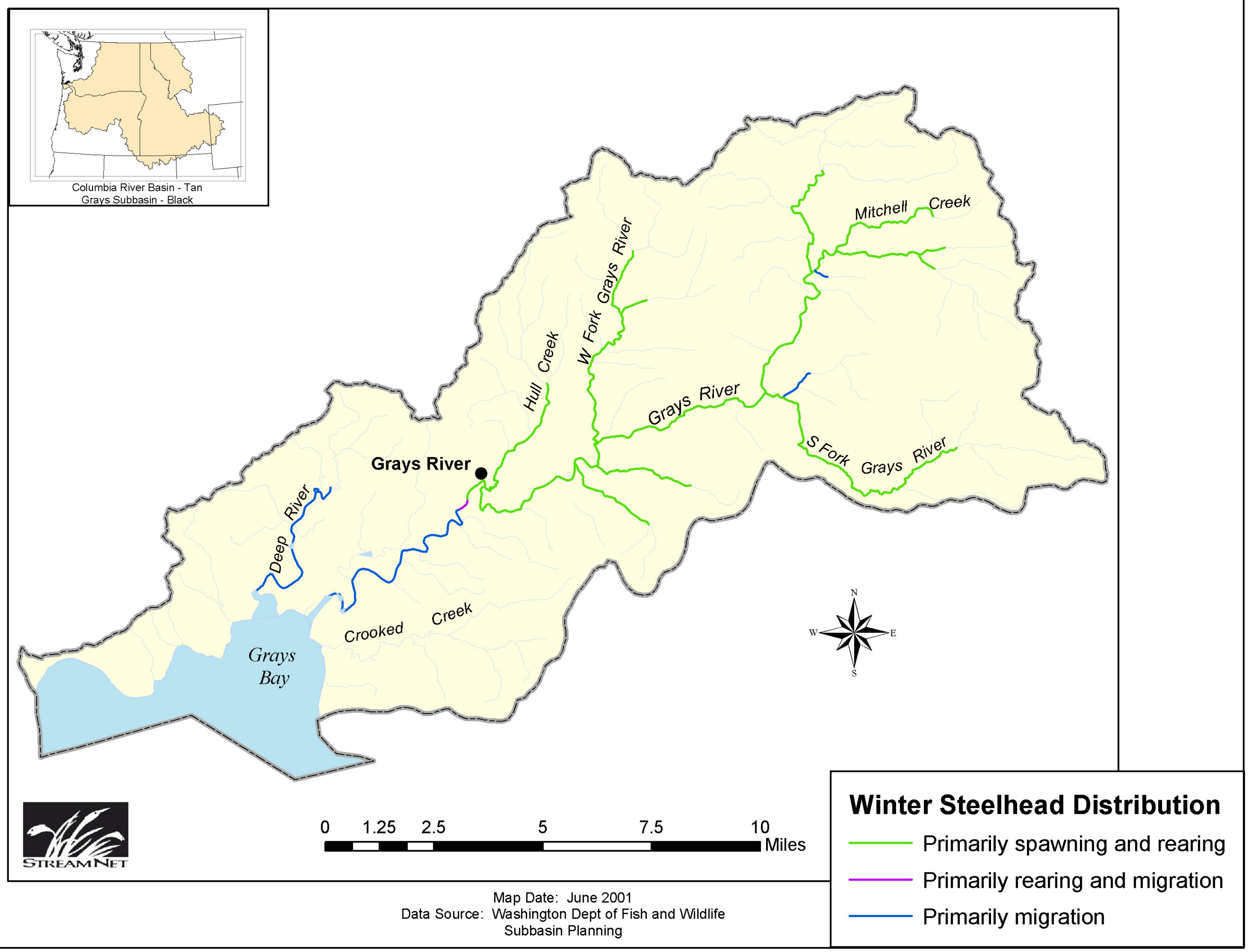
Appendix A. Streamnet Maps


Fall Chinook Distribution - Grays Subbasin
Columbia River Basin - Tan
Grays Subbasin - Black
Mitchell Creek
W Fork Grays River
Hull Creek
Grays River
S Fork Grays River
Grays River
Deep River
Crooked Creek
Grays Bay
N
S
E
W
0 1.25 2.5 5 7.5 10
Miles
STREAMNET
Map Date: June 2001
Data Source: Washington Dept of Fish and Wildlife
Subbasin Planning
Fall Chinook Distribution
Primarily spawning and rearing
Primarily rearing and migration
Primarily migration


Coho Distribution - Grays Subbasin
Columbia River Basin - Tan
Grays Subbasin - Black
Mitchell Creek
W Fork Grays River
Hull Creek
Grays River
S Fork Grays River
Grays River
Deep River
Crooked Creek
Grays Bay
N
W
E
S
StreamNet
0 1.25 2.5 5 7.5 10 Miles
Coho Distribution
Primarily spawning and rearing
Primarily rearing and migration
Primarily migration
Map Date: June 2001
Data Source: Washington Dept of Fish and Wildlife
Subbasin Planning


Chum Distribution - Grays Subbasin
Columbia River Basin - Tan
Grays Subbasin - Black
Mitchell Creek
W Fork Grays River
Hull Creek
Grays River
S Fork Grays River
Grays River
Deep River
Crooked Creek
Grays Bay
N
W
E
S
0 1.25 2.5 5 7.5 10
Miles
STREAMNET
Chum Distribution
Primarily spawning and rearing
Primarily rearing and migration
Primarily migration
Map Date: June 2001
Data Source: Washington Dept of Fish and Wildlife
Subbasin Planning

Winter Steelhead Distribution - Grays Subbasin



Appendix B. Fisheries Management and Evaluation Plan

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.

<u>Chinook</u>

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	<u>2001</u>	<u>2002</u> and on.
Cowlitz		≤25%	≤10%
Kalama		≤60%	≤10%
Lewis		≤60%	≤10%

<u>Steelhead</u>

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

<u>Chum</u>

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
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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

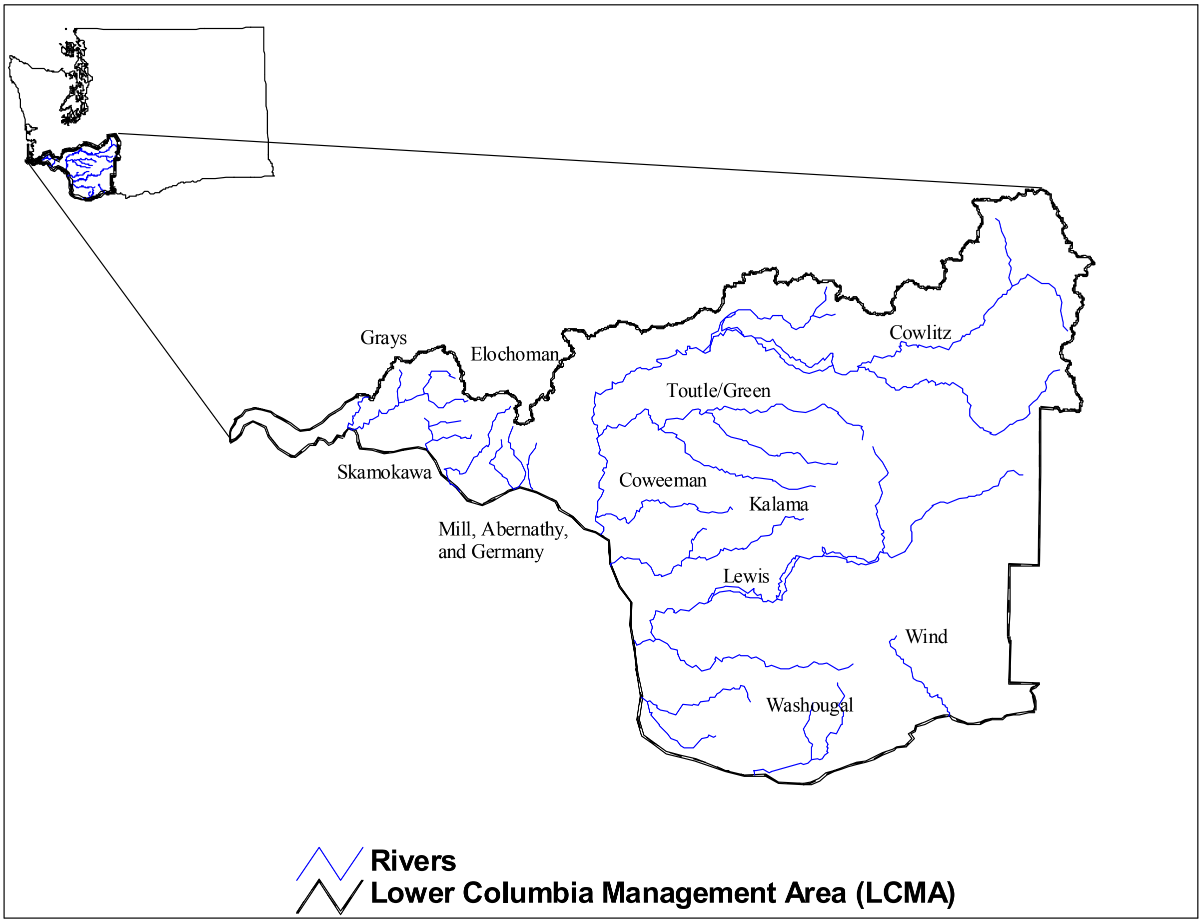


Figure 1. The Lower Columbia River Management Area**.**

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 B

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

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

Natural Populations (or Management Units)	Associated hatchery stock(s)	Recovery Categories	Hatchery stock essential for Recovery? (Y or N)
Kalama Spring Chinook	Kalama	2	N
EF Lewis Fall Chinook	None	1	N
Lewis Fall Chinook	None	1	N
Lewis Spring Chinook	Lewis	3	N
Washougal Fall Chinook	Washougal	2	N
Wind River Tule Fall Chinook	None	1	N
Wind River Bright Fall Chinook	None	2	N
Wind River Spring Chinook	Carson	3	N
Grays River Fall Chum	Grays	1	N
Hardy Creek Fall Chum	None	1	N
Hamilton Creek Fall Chum	None	1	N

Dam. It is unclear if the spawners in these other basins are a separate population, due to the lack of genetic and population data. Hatchery chum salmon are currently being raised at Grays River Hatchery as part of a recovery plan for tributaries in the LCMA.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Fall Chum Return Year	Grays Fish/mile	Hamilton Fish/mile	Hardy Fish/mile	Average Fish/mile
1944	453	500		476
1945	333	2,090		1,212
1946	295			295
1947	170	1,660		915
1948				
1949				
1950		950		950
1951	2,027	1,316		1,671
1952	1,624	1,512		1,568
1953	656	410		533
1954		1,166		1,166
1955	52	100		76
1956		222		222
1957	319	460	40	273
1958	6		119	62
1959	521	754	205	493
1960	323	374	83	260
1961	217	612	154	328
1962	51	391	327	257
1963	127	892	73	364
1964	24	606	179	270
1965	43	574	22	213
1966	206	374	217	266
1967	138	496	91	242
1968	98	90	24	71
1969	95	298	74	156
1970	40	316	123	160
1971	81	213	88	127
1972	156	563	42	254
1973	56	106	130	97
1974	14	167	86	89
1975	43	117	14	58
1976	60	68	6	45
1977	105	80	137	107
1978	77	127	42	82
1979	33	4	1	13
1980	29	67	131	76
1981	9	50	7	22
1982	184	230	210	208
1983	31	66	112	69
1984	86	67	76	76
1985	89	119	67	91
1986	180	274	58	171
1987	149	100	193	147
1988	269	189	436	298
1989	65	36	9	37
1990	132	73	116	107
1991	104	27	125	85
1992	461	213	635	436
1993	199	29	324	184
1994	42	99	264	135
1995	140	29	130	100
1996	242	123	125	163
1997	146	207	105	153
1998	171	400	443	338
1999	316	260	157	244

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

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

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).

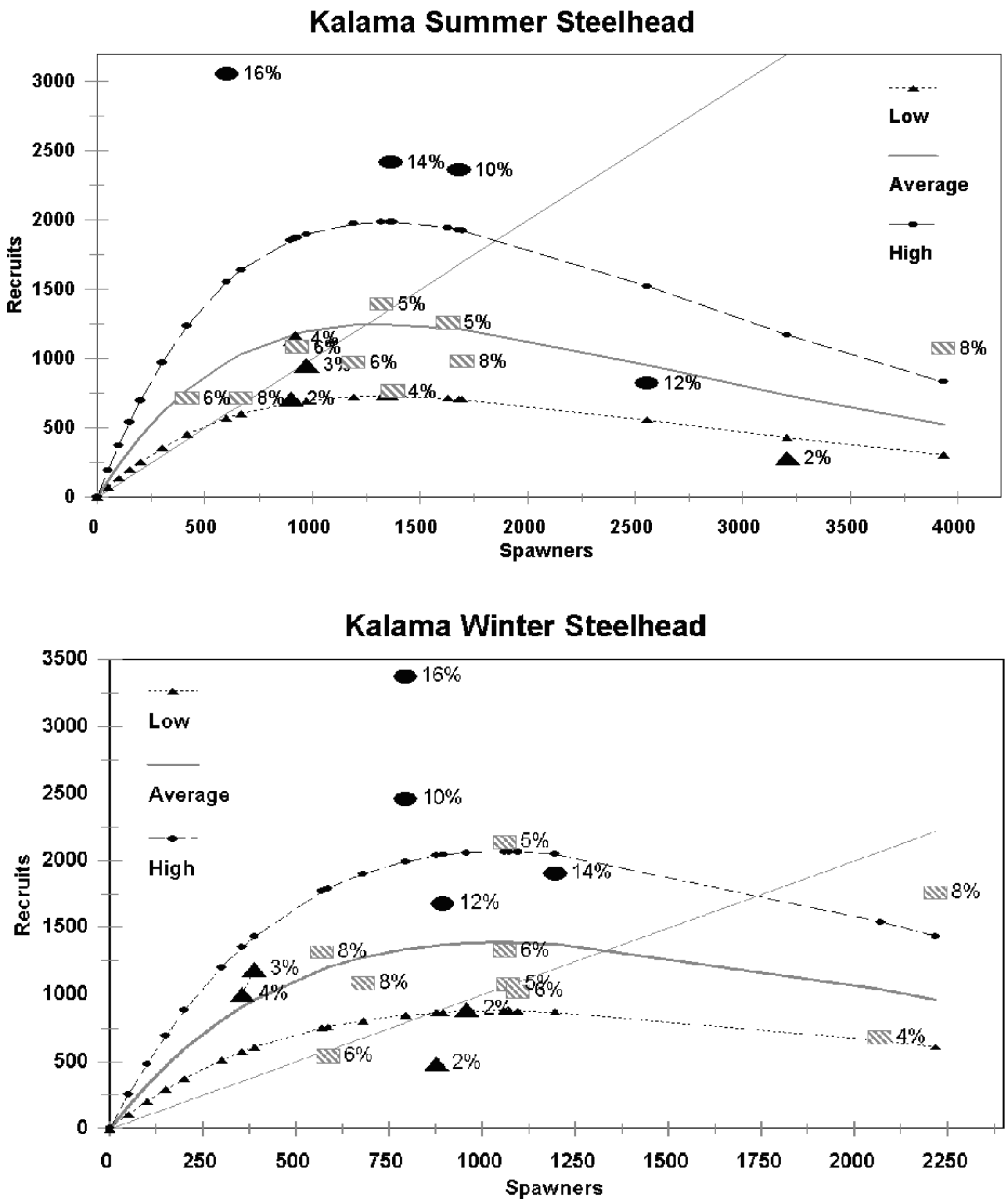


Figure 2. Spawner recruit model for wild winter and summer steelhead under low, average, and high ocean productivity, brood years 1977-93.

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

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

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

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

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

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

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

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

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

Steelhead fisheries -
Statewide rules for steelhead fisheries have been developed to protect wild salmon and steelhead populations while providing recreational angling. Only wild steelhead release fisheries are permitted in the LCMA and all anglers are required to release all non-adipose clipped steelhead. To protect juvenile steelhead, a minimum size restriction is imposed.

Steelhead less than 20 inches must be released. There is a two-fish daily limit for retaining hatchery steelhead and an annual limit of 30 fish.

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

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

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

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

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

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

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

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

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

Resident Trout -
The WDFW has established statewide rules for trout fisheries designed to provide recreational angling while at the same time protecting wild salmon and steelhead

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

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

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

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

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

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

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

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

Other anadromous species -

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

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

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

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

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

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

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

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

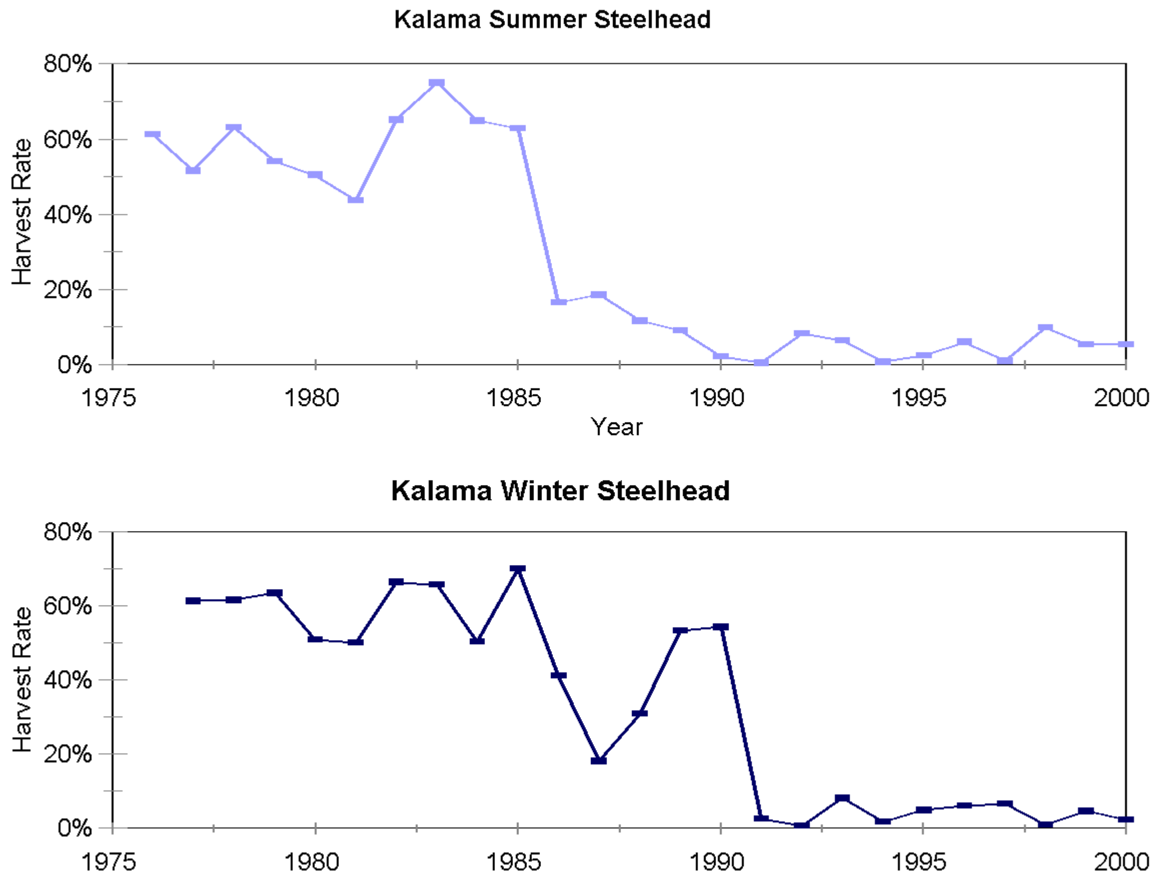


Figure 3. Wild steelhead harvest rates for winter and summer steelhead, 1976-1999. Harvest for winter steelhead after 1991 and summer steelhead after 1985 is adult morality due to hooking mortality in the wild steelhead release fisheries.

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.

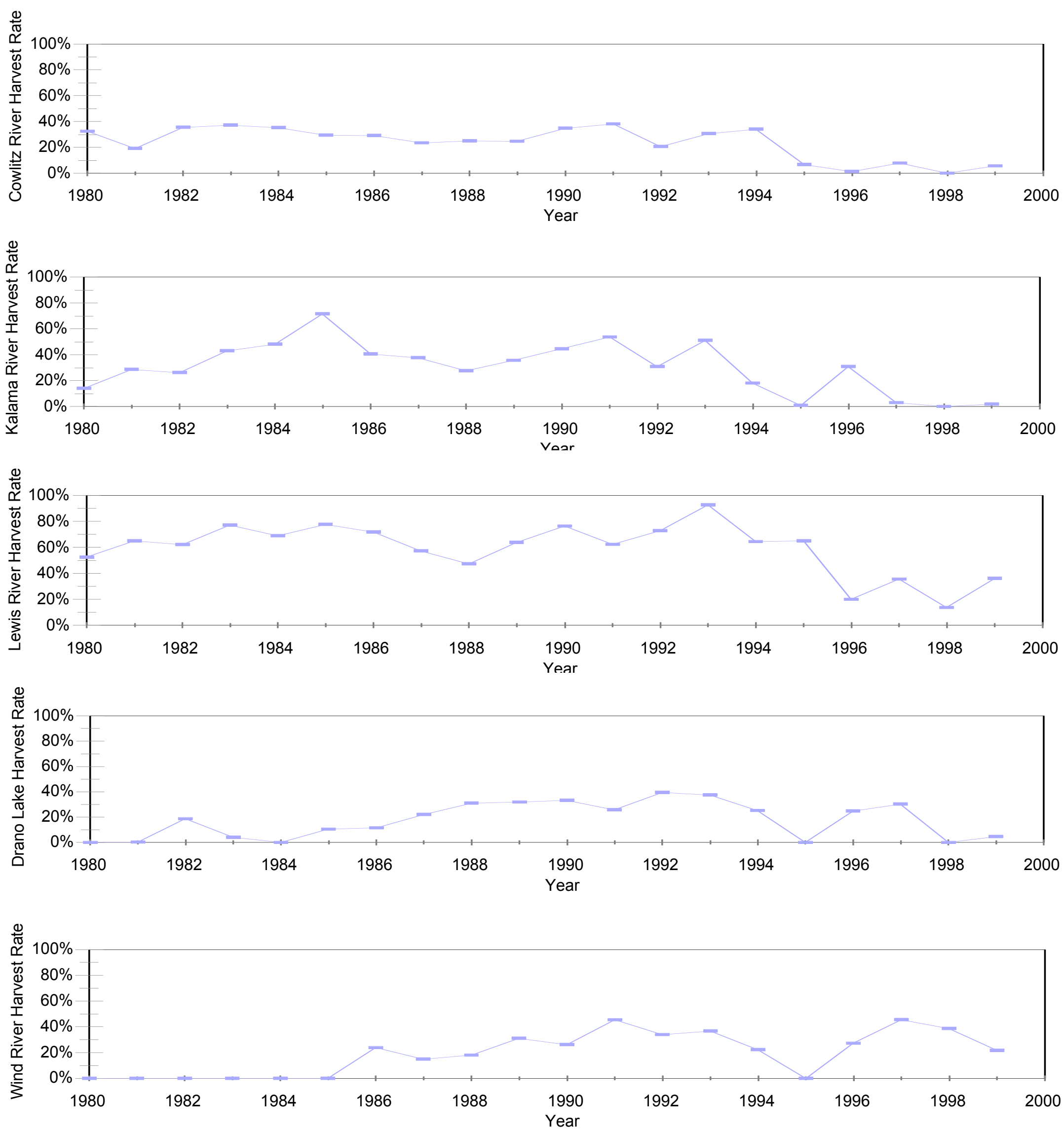


Figure 4. Spring chinook tributary harvest rate 1980-99. Harvest rate equals sport catch divided by run size at tributary mouth.

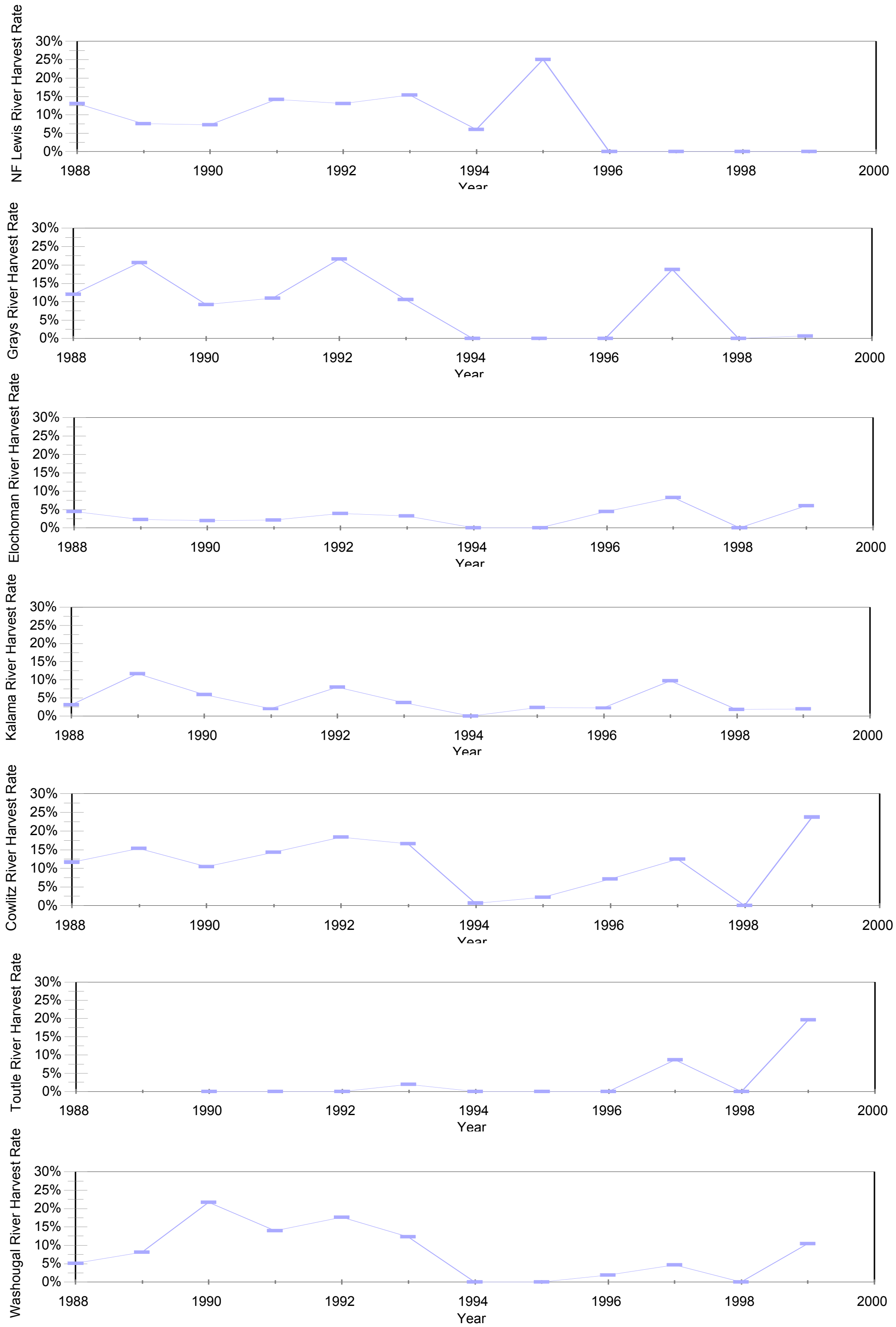


Figure 5. Fall chinook tributary harvest rate, 1988-99. Harvest rate equals sport catch divided by size at tributary mouth.

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%

[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)			
	AE[1]	EM[2]	AE	EM	AE	EM	AE	EM	Harvest[3]	Total take[4]
Fall chinook Green River	0	0	0	0	0	0	0	0	20%	20%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Columbia River chinook	NA									
Cowlitz River										
Winter steelhead	70%	4%	0	0	17%	3%	0	0	0	6%
Fall chinook	0	0	0	0	0	0	0	0	24%	24%
Spring chinook	0	0	77%	7%	0	0	0	0	0	7%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Kalama River										
Winter steelhead	70%	4%	0	0	17%	3%	0	0	0	6%
Summer Steelhead	60%	5%	0	0	<3%	<1%	0	0	0	6%
Fall chinook	0	0	0	0	0	0	0	0	12%	12%
Spring chinook	0	0	77%	7%	0	0	0	0	0	7%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Lewis River										
Winter steelhead Mainstem/NF	70%	4%	0	0	17%	3%	0	0	0	6%
Winter steelhead EF	40%	2%	0	0	17%	3%	0	0	0	5%
Summer steelhead NF	NA									
Summer steelhead EF	40%	3%	0	0	<3%	<1%	0	0	0	4%
Fall chinook EF	0	0	0	0	0	0	0	0	10%	10%
Fall chinook	0	0	0	0	0	0	0	0	25%	25%
Spring chinook	0	0	77%	7%	0	0	0	0	0	7%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Washougal River										
Winter steelhead	40%	2%	0	0	17%	3%	0	0	0	5%

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]
Summer steelhead Mainstem	40%	3%	0	0	<3%	<1%	0	0	0	4%
Fall chinook	0	0	0	0	0	0	0	0	22%	22%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Wind River										
Winter steelhead	30%	1%	40%	3%	17%	2%	0	0	0	6%
Summer steelhead	<10%	1%	<10%	1%	<3%	<1%	0	0	0	3%
Fall tule chinook	0	0	0	0	0	0	0	0	NA%	NA%
Fall bright chinook	0	0	0	0	0	0	0	0	NA%	NA%
Spring chinook	0	0	0	0	0	0	0	0	46%	46%
Columbia River chum	<2%	<1%	<2%	<1%	0	0	0	0	0	1%
Little White Salmon River										
Winter steelhead	NA									
Summer steelhead	NA									
Fall tule chinook	0	0	0	0	0	0	0	0	NA%	NA%
Fall bright chinook	0	0	0	0	0	0	0	0	NA%	NA%
Spring chinook	0	0	0	0	0	0	0	0	40%	40%
Columbia River chum	NA									
Other Tributaries										
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%

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

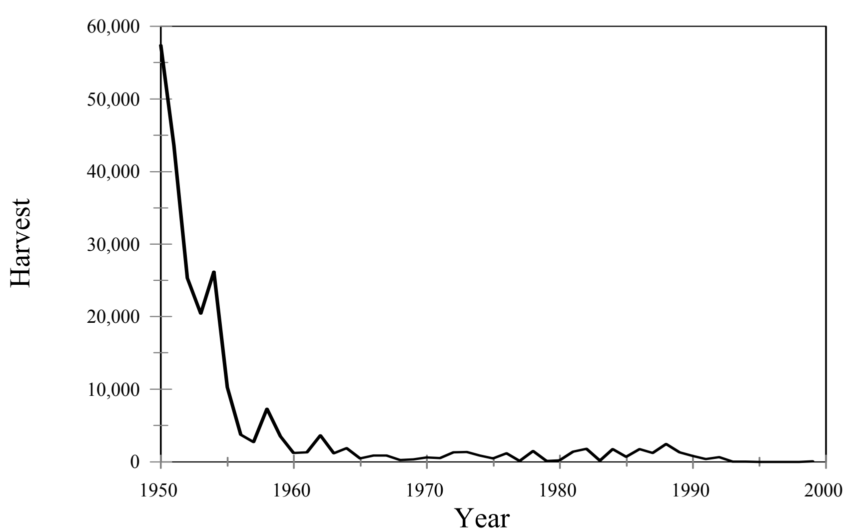
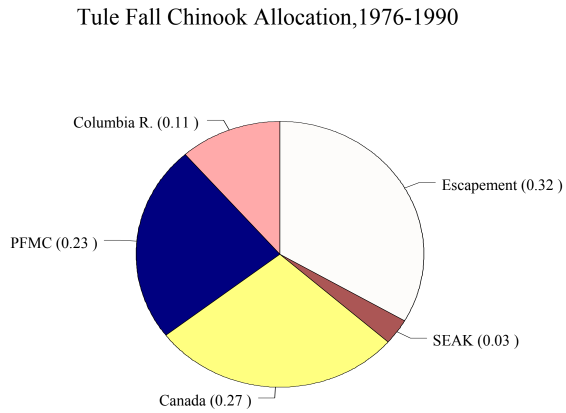


Figure 6. Commercial landings of chum salmon from the Columbia River, 1950-99.



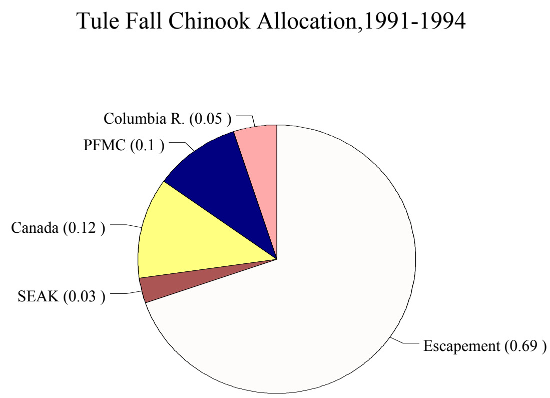
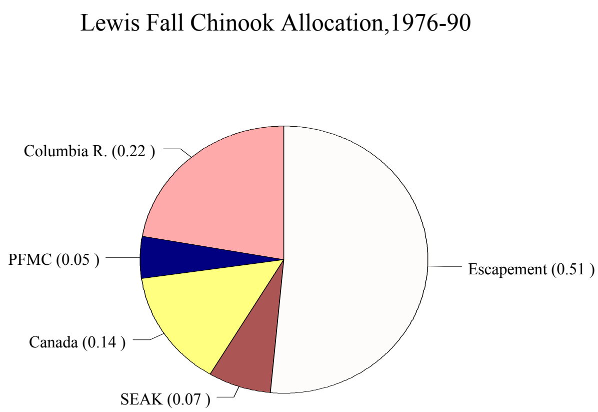


Figure 7. Tule fall chinook allocation pre and post 1991.



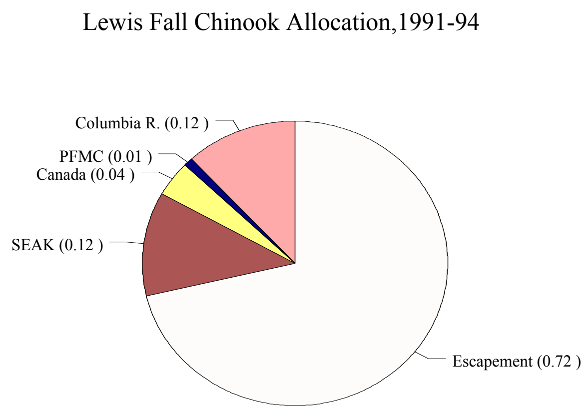


Figure 8. Lewis River chinook allocation pre and post 1991.

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	

Basin	Stock	Other Species	Adult Monitoring	Smolt Monitoring	Adult Esc. Method	Comments
Hardy Creek	Chum	Coho Winter Steelhead	V-Weir Trap	V-Weir Trap	Mark-Recapture	USFWS providing data
Hamilton Creek	Chum	Coho Winter Steelhead	V-Weir Trap	V-Weir Trap	Mark-Recapture	USFWS providing data
NF Lewis River	Fall Chinook	Coho, Chum Steelhead	Live & Carcass Counts	CWT Seining	Carcass Tagging	

Table 14. Other wild steelhead monitoring sites with current funding.

Basin	Stock	Method	Comments
L. Cowlitz	Winter	Redd	Intermittent tributary surveys for abundance
Coweeman	Winter	Redd	Redd surveys for population estimate
SF Toutle	Winter	Redd	Redd surveys for population estimate
Green	Winter	Redd	Index redd surveys on tributaries for abundance
EF Lewis	Winter	Redd	Index redd surveys for abundance
EF Lewis	Summer	Snorkel	Index abundance snorkel surveys
Washougal	Winter	Redd	Index redd surveys for abundance
Washougal	Summer	Snorkel	Index abundance snorkel surveys
Gorge Tribs	Winter	Redd	Intermittent redd surveys for presence/absence

Table 15. Other chum salmon monitoring sites.

Basin	Method	Comments
Skamokawa	AUC	Intermittent surveys will continue if outside funding secured.
Elochoman	AUC	Intermittent surveys will continue if outside funding secured.
Mill	AUC	Intermittent surveys will continue if outside funding secured.
Abernathy	AUC	Intermittent surveys will continue if outside funding secured.
Germany	AUC	Intermittent surveys will continue if outside funding secured.
Cowlitz	AUC	Intermittent surveys will continue if outside funding secured.
Toutle	AUC	Intermittent surveys will continue if outside funding secured.
Kalama	AUC	Intermittent surveys will continue if outside funding secured.
Lewis	AUC	Intermittent surveys will continue if outside funding secured.
Washougal	AUC	Intermittent surveys will continue if outside funding secured.
Gorge tribs	AUC	Intermittent surveys will continue if outside funding secured.
BON	Count	COE fish counting program

Table 16. Chinook abundance data for streams with PSMFC funding

Basin	Method	Comments
Grays	Carcass Tagging	PSMFC CWT recovery program
Skamokawa	Carcass Tagging	PSMFC CWT recovery program
Elochoman	Carcass Tagging	PSMFC CWT recovery program
Mill	Carcass Tagging	PSMFC CWT recovery program
Abernathy	Carcass Tagging	PSMFC CWT recovery program
Germany	Carcass Tagging	PSMFC CWT recovery program
Cowlitz	Carcass Tagging	PSMFC CWT recovery program
Coweeman	Carcass Tagging	PSMFC CWT recovery program
SF Toutle	Carcass Tagging	PSMFC CWT recovery program
Green	Carcass Tagging	PSMFC CWT recovery program
Toutle	Carcass Tagging	PSMFC CWT recovery program
Kalama	Carcass Tagging	PSMFC CWT recovery program
EF Lewis	Carcass Tagging	PSMFC CWT recovery program
Washougal	Carcass Tagging	PSMFC CWT recovery program
Wind	Carcass Tagging	PSMFC CWT recovery program
Drano	Carcass Tagging	PSMFC CWT recovery program

Currently, a sufficient data set is only available from the Kalama River for steelhead and the NF Lewis for fall chinook salmon to develop a fishery management approach based on measurement of management parameters. Data from other systems (Toutle, Washougal, and Wind rivers for steelhead, and EF Lewis and Coweeman for fall chinook) are currently being prepared for data analysis. We are currently working on an approach to develop the parameters for chum salmon for populations in Grays River, Hamilton/Hardy creeks, and above Bonneville Dam. However, this chum data is not complete for this analysis. Our goal is to develop data sets from all the locations listed above to complete fishery and extinction risks analyses but it may take another decade to collect enough information due to the variation in the data, and the extended and complex life history of anadromous salmonids.

Redd surveys -

Steelhead and salmon escapements are estimated annually using redd surveys, mark recapture studies, carcass tagging, snorkel surveys, Area-Under-the Curve (AUC), and trap counts. WDFW began collecting wild winter and summer steelhead abundance data in 1976 on the Kalama River at the Kalama Falls trap. By the 1980s, abundance was estimated for other wild winter steelhead populations by redd surveys. In the 1980s, WDFW also incorporated snorkel surveys to estimate wild summer steelhead abundance. Estimates from steelhead redd surveys were calculated using the standard WDFW methodology (Freymond and Foley, 1984). Index tributaries were surveyed every two weeks from March 1 to May 31. A peak survey was done outside of index areas and was used to estimate redds in these areas based on the percent of redds visible in index areas at the time of the peak survey. Average redd densities were used to estimate redds in unsurveyed tributaries. The lower mainstems of large tributaries are flown every two weeks and redd life was used to calculate the total number of redds using an AUC methodology. A peak flight is conducted on the upper mainstem to calculate redds. Expansion is similar to that described for tributaries. Escapement estimates based on redd surveys are calculated for winter steelhead in the Coweeman, and SF Toutle rivers. Index redd surveys are not complete escapement estimates and track trends in the LCMA tributaries. Index counts are conducted in the Green, EF Lewis, and Washougal rivers due to limited funding. WDFW uses peak redd count expansion factors for spring and fall chinook estimates in the Cowlitz River.

Mark-recapture -
Summer steelhead escapement estimates in the Wind and Kalama rivers are based on mark recapture estimates. Wild summer steelhead are tagged at the Shipherd Falls and Kalama Falls traps, since summer steelhead can bypass the trap by jumping the falls. Snorkel surveys are conducted in September to count tagged and untagged wild steelhead. A Petersen estimator is used to determine wild steelhead run size. Index snorkel surveys are conducted annually on the EF Lewis and Washougal rivers to track wild summer steelhead abundance. A Petersen estimate is also used to estimate fall chinook populations above the Cedar Creek trap. The only difference between the steelhead and chinook estimates is that tags are recovered by carcass surveys for chinook salmon.

Mark-recapture carcass tagging experiments are used to estimate the abundance of chinook salmon in Grays, Skamokawa, Elochoman, Mill, Abernathy, Germany, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis, Washougal, Wind, and Little White Salmon basins. Population estimates can be determined by a model developed by G. Paulik (prepared by D. Worlund) of the University of Washington. This model is an application of the open model release and recapture techniques presented by Seber (1982). This is the same method used in the previous Lewis River carcass tagging study in 1976 (McIsaac, 1990). Field crews conduct counts of live salmon and carcasses. Crews staple unique shaped and colored plastic carcass tags under the operculum of any chinook. Each week, different colored and shaped carcass tags will be used. After collecting biological and mark sampling data and tagging the carcasses, the fish will be put back as close as possible to their original location. The color and shape of the carcass tags will be noted on all previously tagged carcasses recovered. When previously carcass-tagged fish are recovered, the carcass tags are removed and the tail of the fish is removed to prevent re-sampling. In years when there is no carcass tagging, population estimates are based on the expansion factor that compares the total population estimate divided by the peak live and dead counts.

Barrier trap counts -
For winter steelhead, Kalama and Shipherd falls are total barriers and the trap count is the wild winter steelhead escapement in these basins. Wild winter steelhead counts in the NF Toutle River at the Fish Collection Facility and for the reintroduction effort in the Cowlitz River above the Barrier Dam also equate to the total escapement. An index of wild winter steelhead escapement in Cedar Creek is the trap count. Wild winter steelhead can jump the falls at Cedar Creek but no mark recapture studies have been conducted to estimate the total population.

Coded-Wire-Tags -
All carcasses and trapped salmon and steelhead are examined for fin clips (mark sampling) and snouts taken from fish with missing adipose and ventral fins collected in carcass surveys. Lengths, sex, and scales will be randomly (biological sampling) taken from trapped adults and carcasses with the adipose fin intact and from all adipose-clipped fish recovered. Snouts from the adipose-clipped carcasses will be dissected at the WDFW Olympia office. Scale samples and CWTs will also be read in Olympia. This is standard procedure for all Columbia River samples collected by WDFW. Spring and fall chinook stock composition is determined by removing any stray hatchery stocks from the natural spawning population based on the expansion of CWTs recovered divided by their respective adult or juvenile tagged to untagged ratios.

Area-Under-the-Curve -
Chum salmon population estimates are made either from the mark recapture described for fall chinook in Cedar Creek, the carcass tagging method used for fall chinook salmon, or the AUC method. The USFWS operates traps in Hamilton Springs and Hardy Creek and will use mark-recapture as the primary method to estimate chum salmon escapements. In Hamilton Creek, Grays River, and the mainstem Columbia River, carcass tagging or AUC will be used. In the AUC, live counts of chum salmon are made every seven days. The escapement of chum salmon is estimated using AUC / RT, where AUC is the area under the observed escapement curve obtained by plotting the number of live fish observed by survey day throughout the spawning season. The total number of spawner days, which is the area under the curve, can be calculated with a polar planimeter, computer software, or using a trapazoidal approximation. The RT, residence time, will be determined from carcass recovery of marked fish or based on the literature.

Outmigration studies -
Juvenile outmigrants are monitored in the Kalama River, NF Lewis River, Cedar Creek, and Wind River. Fall chinook are seined and 100,000 migrants are CWT on the Lewis River. Tag adults are recovered in fisheries and during spawning ground surveys. A Petersen mark recapture estimate is used to estimate the number of fall chinook juveniles based on the recovery of tagged and untagged carcasses. Rotary screw traps are located in the Kalama, Cedar, and Wind basins. Outmigrant estimates are developed using a Petersen estimator based on the trap efficiency method. Wild steelhead are estimated in the Wind River, Kalama River, and Cedar Creek. In addition, spring chinook are estimated in the Kalama and sea-run cutthroat and coho estimates are made for Cedar Creek. Juvenile steelhead, chinook, and cutthroat production is also monitored at Mayfield and Cowlitz Falls dams. Intermittent juvenile production monitoring has been conducted in the NF Toutle and EF Lewis basins. However, annual funding for these is not available.

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

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

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

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

3.3) Public Outreach

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

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

3.4) Enforcement

Sport fishing regulations in Washington are enforced by the Enforcement Program of the WDFW. The Fish Management and Enforcement programs work together to develop enforceable regulations to achieve fish and wildlife resource management goals. The Region 5 Enforcement program for the LCR includes one captain, three sergeants, and 13 enforcement officers. Although Klickitat County is within Region 5, it is outside the coverage of this plan. Enforcement activities in the LCR are conducted from offices in Vancouver and Cook, and are responsible for enforcement of state fish, wildlife, and habitat regulations in the area covered by this plan. The highest enforcement priority for fish is protection of endangered species, which includes monitoring LCR tributary and mainstem Columbia River fisheries for compliance.

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

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

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

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

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

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

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

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

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

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

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

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