Draft

Lewis River
Subbasin Summary

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Northwest Power Planning Council

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Lewis River Subbasin Summary

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General Description

PART I. DESCRIPTION OF SUBBASIN

Subbasin Location

Located along the Columbia River in Southwest Washington, the Lewis River contains portions of three counties (Clark, Cowlitz, and Skamania) The Lewis River flow into the Columbia River at RM 87. The Lewis River watershed includes two large drainages, the North Fork and East Fork, which converge approximately 3.5 miles upriver from the confluence with the Columbia River.

Drainage Area

The Lewis River watershed is approximately 93 miles long, has a total fall of approximately 12,000 feet, and drains an area of about 1,050 square miles (EA Engineering 1999, Figure 1). The headwaters arise on the southern flanks of Mt. Saint Helens and Mt. Adams. The mainstem of the Lewis, also known as the North Fork, flows southwesterly from its source in Skamania County through three impoundments, Swift Reservoir (River Mile 47.9), Yale Reservoir (34.2), and Merwin Lake (RM 19.5). The middle and lower sections of the North Fork Lewis form the boundary between Clark and Cowlitz Counties. A major tributary, the East Fork Lewis River, enters the mainstem at RM 3.5. From this point the mainstem Lewis flows westerly, entering the Columbia River at RM 88. The average annual streamflow for the entire Lewis River system is approximately 6,125 cubic feet per second (cfs). For analysis purposes, this report divides the watershed into the North Fork (mainstem) Lewis River and East Fork Lewis River.

The North Fork Lewis River headwaters arise from the southern flanks of Mt. Adams and Mt. Saint Helens in the Cascade Range. The lower 12 miles of the mainstem and North Fork Lewis River flows through a wide flat valley, much of which is under cultivation and protected from flooding by dikes. The lower 11 miles are a tidally influenced backwater of the Columbia River. Within this area, the flow is sluggish and the sediments are generally composed of sand, silts, and clays typical of lower floodplains.

The valley begins to narrow for the next 8 miles, eventually forming a canyon from the confluence of Cedar Creek (RM 15.7) to Merwin Dam (WDF, 1990). The 240 foot high Merwin Dam (RM 20) is a major feature on the river, blocking all upstream passage to 80% of the historical anadromous habitat. This is the first of three dams blocking passage on the Lewis River

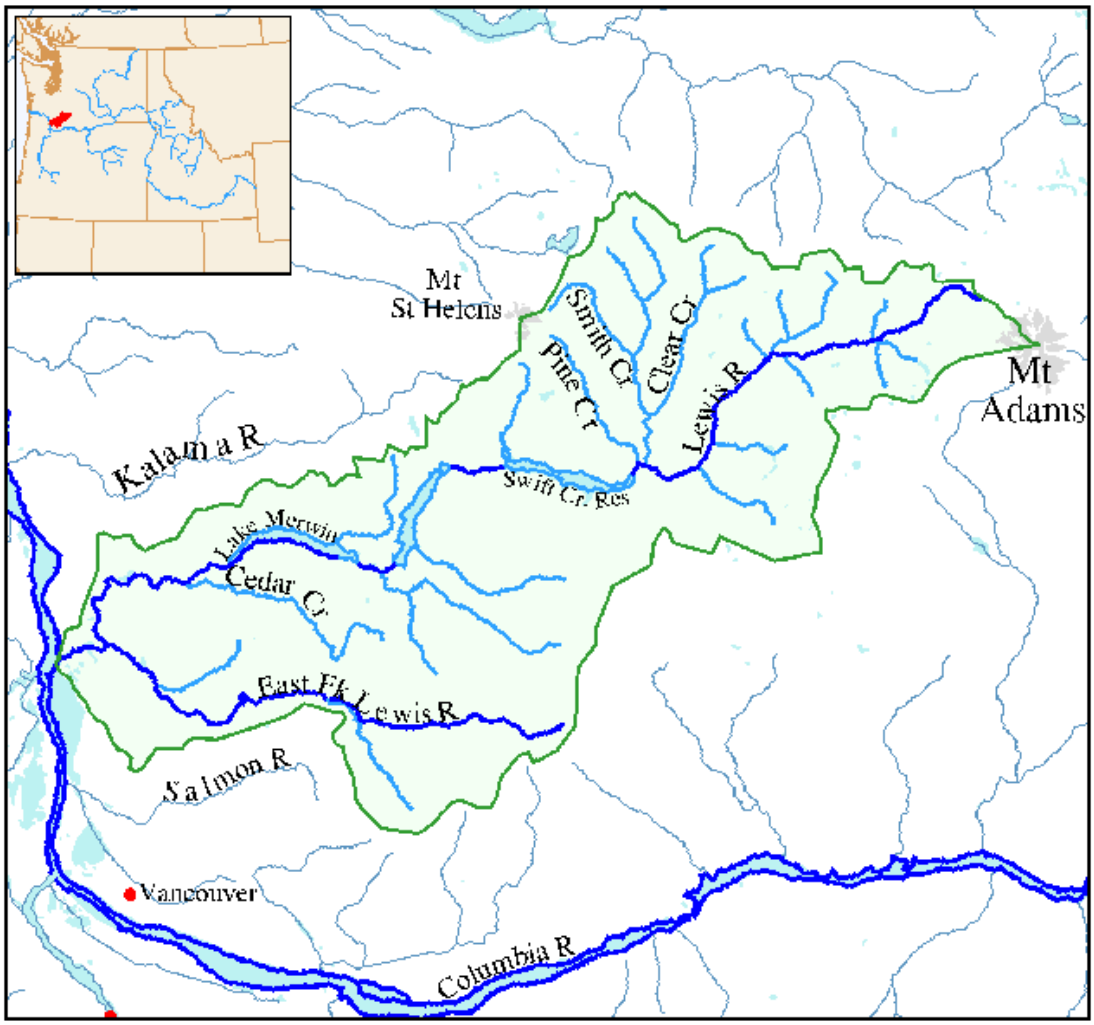

Figure 1 Lewis Subbasin Base Map. Courtesy of Pacific States Marine Fisheries Commission

Before these dams were completed, salmon and steelhead production was the result of natural spawning, with major production of coho, spring chinook, fall chinook, and winter and summer steelhead. Mitigation programs have attempted to reestablish these runs, but pre-dam productivity of the Lewis River is unknown (WDF 1990).

The majority of the Lewis River basin is forested, typical of the southern Washington Cascade Mountains. However, an area of approximately 30 square miles within the upper basin was denuded by the May 18, 1980 eruption of Mt. Saint Helens (EA Engineering 1999). Most of the basin is within the western hemlock vegetation zone (Franklin and Dyrness, 1973).

The major tributaries within the Lewis River system below Merwin Dam include the East Fork Lewis River, Johnson Creek, and Cedar Creek. Now that the dams block anadromous passage to the upper river, Cedar Creek provides most of the productive tributary habitat for anadromous salmonids within the North Fork basin. Cedar Creek has a number of tributaries with productive anadromous salmonid habitat including Pup Creek, Bitter Creek, Beaver Creek, and North and South Forks of Chelatchie Creek.

The mainstem of the North Fork, from RM 15 to the Merwin Dam (RM 20) provides an extremely productive spawning area for fall chinook. All three reservoirs (Merwin, Yale, and Swift) have populations of bull trout/Dolly Varden. Three streams provide rearing and spawning habitat for bull trout in the upper river including Pine and Rush Creeks that flow into Swift Reservoir, and Cougar Creek that flows into Yale Reservoir (see Bull Trout/Dolly Varden Distribution Map, Figure 10).

The East Fork watershed extends approximately 11 miles into Skamania County and the Gifford Pinchot National Forest near Green Lookout Mountain, and reaches an elevation of approximately 4442 feet above sea level. It joins the North Fork of the Lewis River approximately 4000 feet downstream from the Interstate 5 Bridge (Figure 1).

At its headwaters, the East Fork Lewis River generally flows through steep, mountainous terrain, restricted by narrow valley walls. Tributary streams in the headwaters are steep channels dominated by bedrock and boulders. The two largest tributaries in the upper East Fork Lewis River basin are Copper and upper Rock creeks (R2 Resources, 1999).

Lucia Falls (RM 21.3) is thought to block upstream migration for all anadromous species other than steelhead and an occasional coho (WDF, 1990). From Lucia Falls downstream to river mile 17 near the mouth of Rock Creek (lower), the East Fork is within a narrow ravine where water velocities are such that the stream is slowly down cutting. Upstream from Lewisville Park at river mile 14, the river cuts through volcanic ash, pyroclastic layers, and basalt lava flows creating waterfalls, small gorges, and cliffs. Downstream from river mile 17 and especially below river mile 11, the valley floor begins to broaden out into a well-defined flood plain. The East Fork's gradient declines from approximately 20 feet per mile, at RM 11, to less than 2 feet per mile at RM 6. Bedload deposition occurs in this section in the form of gravel bars where declining gradient and loss of energy releases gravel, causing bar formation, channel shifting, and increased susceptibility to flooding. Most of the remaining six miles of river is less than ten feet above mean sea level, has minimal slope, and is subject to backwater effects from the Columbia (Hutton 1995b).

The East Fork of the Lewis River contributes, on average, approximately 1000 cubic feet per second to the flow of the Columbia River (Hutton 1995b). Rainfall provides the most significant contribution to streamflow in the basin (USFS 1995a). Therefore, streamflows are substantially higher during the rainy season, from November to April than from May through October. Overbank flooding can be severe in the lower sections of the East Fork (Hutton 1995b).

Repeated large-scale stand-replacement fires burned large portions of the eastern portions of Clark County between 1902 and 1952, and these disturbances have had

significant impacts on the hydrology, the structure, composition, and age-class distribution of the plant communities, as well as riparian and instream habitats along the East Fork system.

The largest fire, the Yacolt Burn, occurred in 1902 and covered an estimated 238,900 acres of state, private, and federal lands extending from the foothills of the Cascades. Fires repeatedly burned over the portions of the same area, including the Rock Creek Fire of 1927 (48,000 acres), and the Dole Fire of 1929 (227,500 acres). Some areas have burned over five times, with the last major fires occurring in 1952 (USFS 1995a). Besides destroying most if not all of the vegetation within the burned areas, these fires were especially hot. Portions of the higher peaks and ridges burned so hot that shrub/forb seral stages still predominate (USFS 1995a).

Sediment loading, high stream temperatures, insufficient canopy cover, large peak flows, and soil productivity were probably at their worst soon after the large fires. The major flood events occurring in 1931 and 1934 were probably associated with rain-on-snow precipitation events that coincided with major fires (USFS 1995a). Natural processes are slowly healing the landscape, and many of the associated problems have decreased in severity. However, snag habitat, number of pieces of large woody debris per mile of stream, and the vegetation structure, composition, and age-class distribution remain well outside of historic conditions today, and are projected to remain outside historic conditions well into the future.

Climate

The climate of the subbasin is typical of western Washington. The maritime air moderates the seasonal extremes, producing mild, wet winters and cool summers. Average annual rainfall in the subbasin varies with elevation, but ranges from 45 inches near Woodland, at the mouth of the river, to 140 inches at the peak of Mount St. Helens (WDF, 1990).

Topography

The topography of the subbasin is a result of geological uplifting, volcanic activity and river flooding. Mount Adams is the highest peak in the subbasin at 12,307 feet. Mount St. Helens is an active volcano, last erupting in May 1980. The Chelatchie Prairie and the Yacolt Basin are high benches that are relatively level (WDF, 1990).

Geology

The basin has a complex geologic history, having undergone Tertiary volcanism, several glaciations, and interglacial erosion and deposition. Bedrock surrounding the reservoirs is predominately comprised of younger Eocene to older Oligocene volcanic lava flows Oligocene volcaniclastic rocks, and Quaternary volcaniclastic deposits. The volcanic rocks have undergone regional compressional deformation; rock strata are folded by a major southeast plunging anticline and a southeast plunging syncline.

Hydrology

Streamflow on the lower section of the North Fork is regulated by Merwin Dam. Average annual flow, measured below Merwin (1924-1986), is 4,849 cubic feet per second (cfs). Average annual flow on the East Fork, measured at the confluence with the North

Fork, is 1,000 cfs. Average annual flow for the entire watershed, measured at the river's mouth, is 6,125 cfs (WDF, 1990).

The average annual stream discharge for the North Fork Lewis is 4,900 cubic feet per second. Glacial runoff contributes to the flow in the Lewis River, but rainfall provides the most significant contribution (WDF, 1973). Management of the flow in the Lewis is largely controlled through the Merwin Project licensing agreement with the operator of the dam, PacifiCorp. Since 1985, PacifiCorp and the Washington Departments of Fisheries (WDF) and of Wildlife (WDW) have studied the relationship between spring flows and chinook rearing habitat on the North Fork and evaluated the need to modify spring flow provisions in Article 49 of the licensing agreement. In 1995, Article 49 was amended to provide for increased minimum flows of 2700 cfs in April, May, and June (WDFW Vol. 1 Appendices, 1998). The need for additional modifications of flow regimes and ramping rates to protect other ESA listed or proposed for listing species (steelhead, chum salmon, coho salmon, and cutthroat trout) will be assessed as part of the ongoing relicensing studies (Lesko 1999, personal communication; Wade, 2001).

Soils

Soils in the subbasin derive from recent alluvial deposits, overlaying an older alluvial fan known as the Troutdale Formation, which consists of clays, sands and deposits of gravel. Underlying materials of the upper watershed include volcanic and basaltic formations of the Cascade Range (WDF, 1990).

Land Uses

A large portion of the North Fork Lewis River basin is managed as commercial forest and, as such, is undeveloped except for logging roads. However, recreational use and residential development demand has increased significantly (EA Engineering 1999; WDFW 1998, vol. 1). Road densities in the basin range from 4.96 miles/square mile in the lower North Fork below Merwin Dam (Lewis County GIS 1999) to as low as 2.01 miles/square mile in the upper portions of the watershed on Forest Service lands (USFS 1995c). Population densities are generally low within the basin. There is scattered residential development with only a few small communities (Cougar, Chelatchie, and Amboy) in the upper basin. The largest urban population center, the City of Woodland, lies near the mouth of the river.

Despite extensive residential development, forestry and farming are still the predominate land-use even in the lower portions of the watershed. In general, the upper portions of the watershed contain mainly large private and public holdings actively managed for timber production. Approximately 56 percent of the upper East Fork Watershed is owned and managed by private timber companies, 23 percent by the Washington State Department of Natural Resources (DNR), and 23 percent by the U.S. Forest Service (USFS 1995a).

Just below Daybreak Park (RM 10) are a number of abandoned gravel mining pits. During November 1995, the East Fork avulsed (abruptly changed channels) through a gravel pit pond at RM 9 and abandoned about 1,700 ft of channel. In November of 1996, the river again avulsed through 6 closely spaced gravel pit ponds called the Ridgefield Pits from RM 8.3 to RM 7.6 (Norman et al. 1998). The avulsion into these ponds has created highly dynamic and unstable conditions within the lower reaches of the East Fork.

Wetlands and open-water also covers large areas of the floodplains within this lower stretch of the river. La Center, Washington is the only heavily urbanized area on the main stem of the East Fork.

Impoundments and Irrigation Projects

There are three major hydrodams on the Lewis River. From downstream they are: Merwin Dam (RM20), Yale Dam (RM35) and Swift No.1 (RM 45). Each dam forms its own reservoir with lengths of 14.5, 10.5 and11.5 miles respectively. Additionally there is a smaller project Swift 2, which channels the flow from the tailrace of Swift 1, down a 3.2 mile canal and into a powerhouse.
Colvin Creek (RM 16.2) has a dam that at one time provided water to the hatchery. The water intake is no longer in use and the dam forms a complete passage barrier for all species.

Protected Areas

The United States Forest Service operates the Gifford Pinchot National Forest and the Mount St. Helens National Volcanic Monument. Fish species are protected under the North West Forest Plan.

There is a series of PacifiCorp recreation areas and campgrounds along each of the reservoirs: Merwin Park, Speelyai Bay Park, Cresap Bay Campground, Saddle Dam park, Cougar Campground, Beaver Bay Campground, Swift Campground and Eagle Cliff Park. Additionally, there is a series of County parks along the East Fork Lewis: La Center Bottoms, Daybreak Park, Lewisville Park, Lucia Falls Park, Moulton Falls Park. South of Yale Lake is the undeveloped Siouxon County Park.

Fish and Wildlife Resources

Fish and Wildlife Status

Fish

Spring Chinook (Oncorhynchus tshawytscha)

Spring and fall chinook are indigenous to the Lewis and Kalama systems. Historically, spring chinook were predominant in the Lewis River and fall chinook in the Kalama basin. By the early 1900's, Columbia river salmon populations were declining from overfishing and a combination of land use practices that proved detrimental to salmon habitat (WDFW, 1998 vol. 1). The construction of Merwin Dam in 1931 blocked all anadromous passage at RM 20 and virtually eliminated the natural run of spring Chinook in the Lewis system. Approximately 80% of the available anadromous fish habitat was blocked by the construction of Merwin Dam (WDF/WDW 1993).

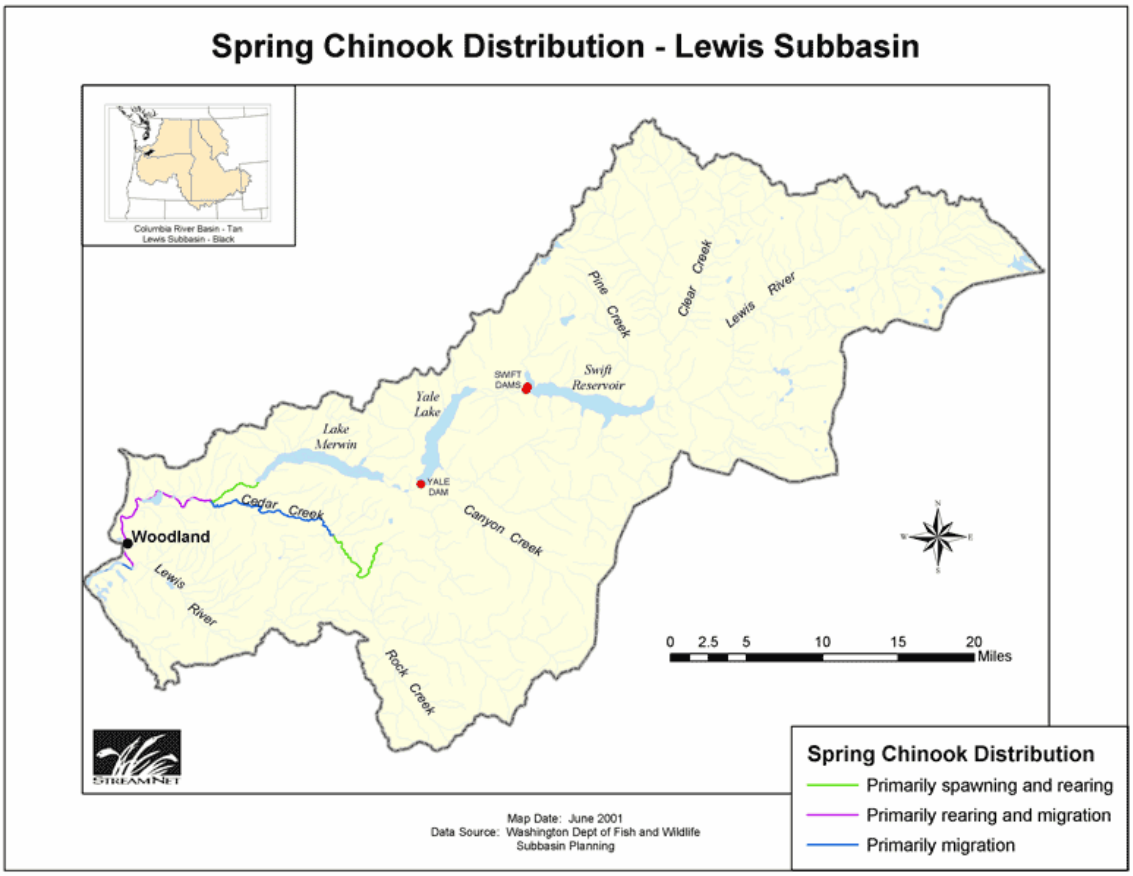

Figure 2. Spring Chinook Distribution.

Early attempts to save the native population through hatchery production failed, and by the 1950's spring chinook runs in both the Lewis and Kalama rivers had been reduced to only remnant populations. In 1951, Washington Department of Fisheries estimated the escapement of spring chinook in the Lewis River at only 100 fish (WDF 1951). Nearly all of the spawning on the Lewis River occurs in a 4-mile reach from Merwin Dam downstream to the Lewis River hatchery (WDF/WDW 1993). Hatchery programs for spring chinook were established at Kalama Falls Hatchery after its completion in 1959 and at Speelyai and Lewis River hatcheries beginning in 1971.

The Lewis River naturally spawning spring chinook population was considered healthy based on escapement trend (WDF/WDW 1993). However, Myers et al. (1998) indicate the possibility that the native Lewis River spring chinook run is extinct, and the observed stock has undergone extensive hybridization. This information conflicts with the 1993 SASSI report (WDF/WDW 1993) that lists the Lewis River spring Chinook stock as native (Table 1). Additional information is needed to determine the stock origin and recent stock status for Lewis River spring chinook (Rawding 1999, personal communication). Natural spawn escapement from 1980-1991 has averaged 2,194 with a low of 345 in 1981 and a peak of 6,939 in 1987. Only occasional stray spring chinook return to the East Fork Lewis (WDF/WDW 1993).

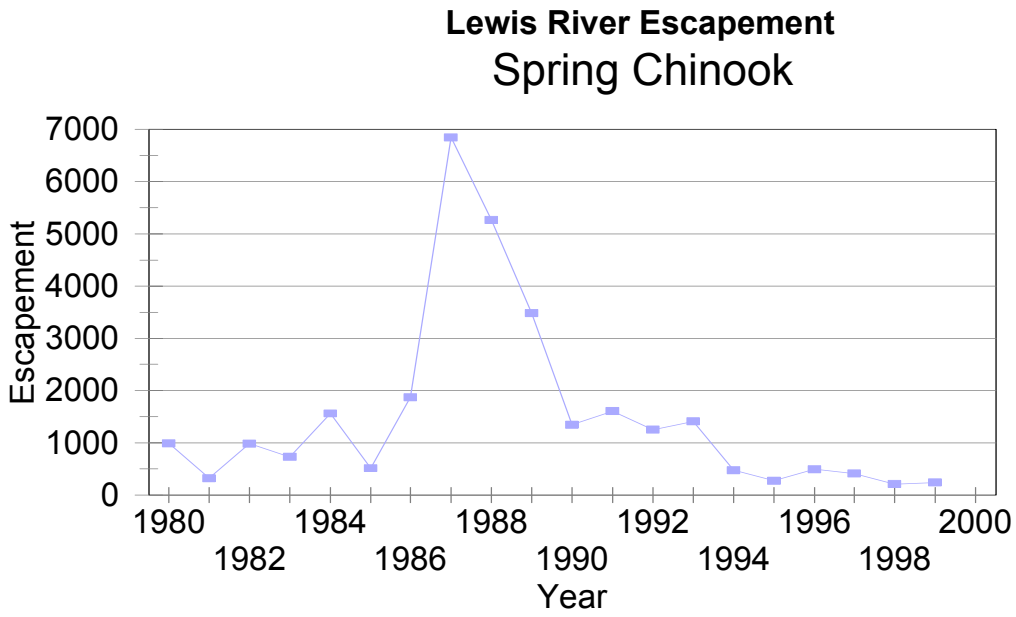

Figure 3. Lewis River adult escapement 1980-1999.

Table 1. Lewis River spring chinook stock status.

Table 1a. WRIA 27 Spring Chinook Stock Status

Stock	Screening Criteria	1992 SASSI Stock Status	Status (ESA Listing)
Kalama	Escapement Trend	Healthy	Federal "Threatened"
NF Lewis	Escapement Trend	Healthy	Federal "Threatened"
EF Lewis	None	None	Federal "Threatened"

Adopted from WDF/WDW 1993

Table 1b. WRIA 27 Spring Chinook Stocks

Stock	Stock Origin	Production Type
Kalama	Mixed	Composite
NF Lewis	Native	Wild
EF Lewis		

Adopted from WDF/WDW 1993

Fall Chinook (Oncorhynchus tshawytscha)

Since the early 1900's natural fall chinook populations have been stable or increasing in the Lewis River (WDFW 1998, vol. 1 appendices). The North Fork Lewis River fall chinook represent about 80% to 85 % of the wild fall chinook returning to the Lower Columbia River (WDF, 1990). In 1951, Lewis River fall chinook escapement was

estimated at 5,000 fish. The Lewis River fall chinook natural spawners are a native stock of wild production (see Table 2). The stock has been supplemented from time to time by Kalama stock since 1940, but no fall chinook have been planted in the basin since 1986 (WDF/WDW 1993). The stock of wild fall chinook in the Lewis River system has maintained a significant population with negligible hatchery influences, unlike other lower Columbia River stocks (WDF/WDW, 1993). There is now a self-sustaining population with an escapement goal of 5,700 adults (Dammers 2000, personal comm.). North Fork Lewis River fall chinook spawn in the area from Merwin Dam down to Lewis River Salmon Hatchery, a distance of approximately 4 miles. McIssac (1990) states that construction of Merwin Dam eliminated approximately half the fall chinook spawning habitat, which would place the historical upper limits of fall chinook migration to approximately Yale dam (in PacifiCorp 1999). The North Fork Lewis River fall Chinook natural spawn stock status was considered healthy based on escapement trend (Figure 4). Natural spawn escapements from 1967-1991 averaged 12,976 with a low return of 4,199 in 1976 and a peak of 22,977 in 1989 (WDF/WDW 1993).

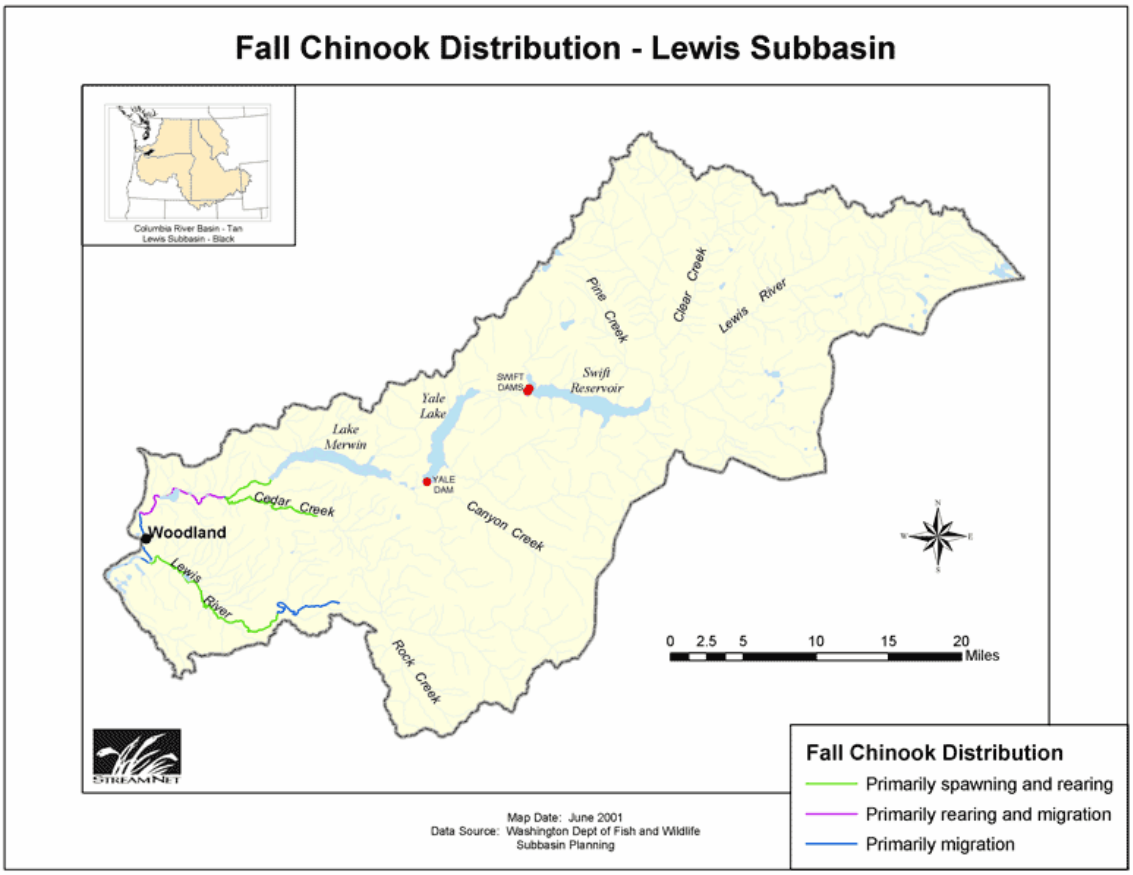

Figure 4. Lewis River Fall Chinook Distribution.

East Fork Lewis River fall chinook spawn in the area from Lucia Falls down to below Daybreak Park near RM 6.2 (Hawkins 1999, personal comm.). Spawning surveys

for fall chinook regularly occur between Lewisville Park (RM 15) and Daybreak Park (RM 10). The East Fork Lewis River fall chinook spawners are a native stock. The stock status was considered healthy based on escapement trend in 1992 (Table 2). However, the health of the stock status is unknown today (Hawkins 1999, personal communication.). Natural spawn escapements from 1967-1991 averaged 598 with a low return of 157 in 1987 and a peak return of 2,354 in 1971 (WDF/WDW, 1993).

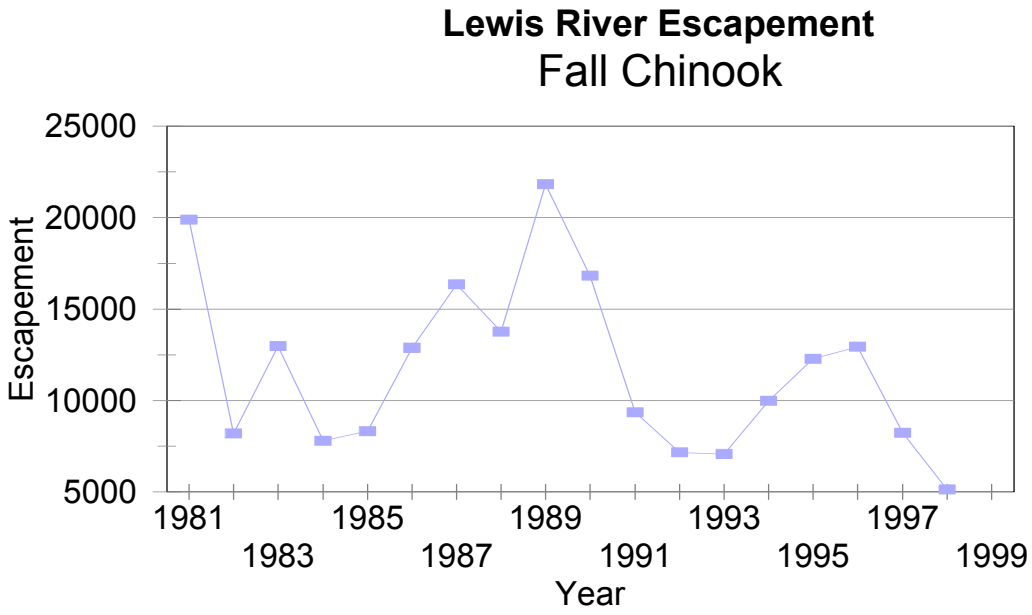

Figure 5. Lewis River adult fall chinook escapement 1980-1998.

Table 2. Lewis River adult fall chinook stock status.

Table 2a - WRIA 27 Fall Chinook Stock Status

Stock	Screening Criteria	1992 SASSI Stock Status	Status (ESA Listing)
Kalama	Escapement Trend	Healthy	Federal "Threatened"
NF Lewis	Escapement Trend	Healthy	Federal "Threatened"
EF Lewis	Escapement Trend	Healthy	Federal "Threatened"

Adopted from WDF and WDW, 1993

Table 2b - WRIA 27 Fall Chinook Stocks

Stock	Stock Origin	Production Type
Kalama	Mixed	Composite
NF Lewis	Native	Wild
EF Lewis	Native	Wild

Adopted from WDF and WDW, 1993

Coho Salmon (Oncorhynchus kisutch)

Historically, the Lewis River system had abundant wild coho. At one time coho were present in the Lewis River all the way to the headwater tributaries of Pine Creek at river mile (rm) 59.0 and the Muddy River (rm 60.0), including Clearwater and Clear Creeks (WDF/WDW 1993) (Figure 6.) In 1949, Bryant described the Lewis River as one of the most important coho producers in the Columbia Basin. In 1951, WDF estimated that 15,000 coho entered the Lewis River system to spawn, with 10,000 entering the North Fork and 5,000 the East Fork (WDF/WDW 1993). After construction of Merwin Dam in 1931, but before Yale Dam was built, coho were trapped and transported to the Merwin Reservoir to use upstream habitats. After Yale Dam was constructed, spawning and rearing habitats were flooded. Downstream passage for juveniles became impractical and transportation was discontinued (WDFW 1998, vol. 1 appendices). Lucia Falls (RM 21.3) is the upstream terminus for coho migrations in the East Fork Lewis (WDF/WDW 1993).

Coho in the Lewis watershed are managed for hatchery production, but some returning fish will successfully use natural habitat (WDFW 1998, vol. 1 appendices). Cedar Creek is the most extensively used stream on the North Fork Lewis; with coho traveling 15 miles into tributaries like the North and South Forks of Chelatchie Creek (WDF 1973). Coho stock status in the North Fork Lewis is considered depressed based on a long-term decline in escapement (see Table 3) (WDF/WDW 1993). Historically, mainly late returning coho utilized the East Fork, while both late and early returning coho were found in the North Fork. SASSI (WDF/WDW 1993) lists East Fork coho stock status as depressed. The recent status of coho within the East Fork Lewis is unknown because of incomplete and inconsistent survey data; however, the limited information that is available suggests that the population is depressed (Shane Hawkins 1999, personal communication).

Table 3. Lewis River Coho Salmon Distribution

Table 3 - WRIA 27 Coho Stock Status

Stock	Screening Criteria	1992 SASSI Stock Status	Status (ESA Listing)
Kalama	Chronically Low	Depressed	Federal "Candidate"
NF Lewis	Chronically Low	Depressed	Federal "Candidate"
EF Lewis	Chronically Low	Depressed	Federal "Candidate"

Adapted from WDF/WDW 1993

Chum Salmon (Oncorhynchus keta)

Chum salmon migrate to and spawn in the lower reaches of both the mainstem North Fork and East Fork Lewis River. WDF (1951) estimated escapement in 1951 as 3,000 adult spawners. In 1973, WDF estimated the spawning population in both the Lewis and Kalama Basins as only a few hundred fish. According to a 1973 report, the most dense observed chum spawning occurred in side channels and upwelling areas in the lower 6 miles of the East Fork Lewis River (WDF, 1973). However, TAG members stated that chum spawning habitat would extend to at least RM 10 today, and that available habitat would extend to Lucia Falls.

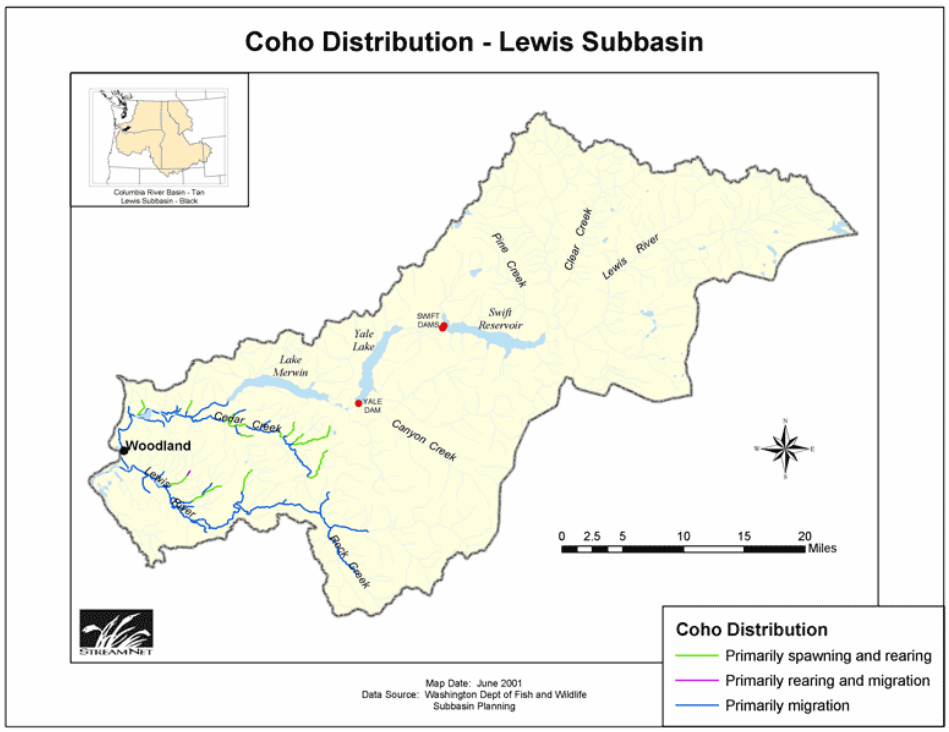

Figure 6. Lewis River Coho Distribution.

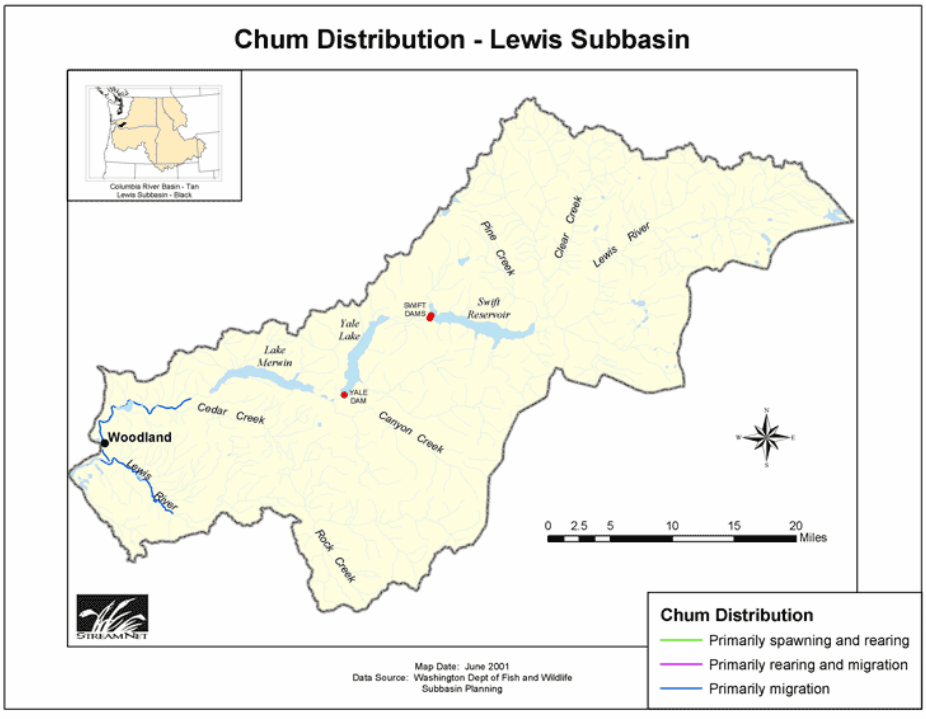

Figure 7. Lewis River Chum salmon distribution.

Very little is known about the life history of chum in the North Fork Lewis River. Smoker et al. (1951) confirmed the presence of chum in the North Fork Lewis River downstream of Merwin dam. Chambers (1957) reported 96 chum spawning just downstream of Merwin dam in mid-November of 1955. Chum were sighted occasionally during 1998 fall Chinook spawning surveys and 4 adult carcasses were observed in Cedar Creek. In addition, about 45 juvenile chum were captured during seining operations related to a smolt residual study in 1998 (R2 Resources). Annually, about 3 or 4 adult chum have also been captured at the Merwin fish trap (R2 Resources 1999).

Lewis River chum salmon are included in the Columbia River ESU and this population was listed by NMFS as "threatened" under the ESA on March 25, 1999. The current abundance of this ESU is estimated to be only 1% of historic levels (R2 Resources 1999).

The 1992 SASSI lists information on only the Grays River, Hardy Creek, and Hamilton Creek stocks for the lower Columbia. Chum salmon populations in the other river systems of the lower Columbia have not been monitored as populations are extremely low (Hawkins 1999 personal comm.). The Columbia River is considered the maximum southerly range of chum salmon.

Summer Steelhead (Oncorhynchus mykiss)

Summer steelhead are indigenous to the Lewis River watershed. Construction of Merwin Dam blocked anadromous fish passage to approximately 80% of the useable spawning and rearing habitat within the North Fork Lewis watershed (WDF/WDW, 1993). Passage was also blocked by a mill dam on Cedar Creek until the dam was removed in 1946. Spawning now occurs throughout most of Cedar Creek. Summer steelhead spawn throughout most of the East Fork Lewis River also. Few steelhead were reported to have ascended Sunset Falls on the East Fork Lewis (RM 32.7) before it was notched in 1982 to facilitate fish passage. Now approximately 12% of the observed spawning in the East Fork occurs in the headwaters above Sunset Falls and in the upper tributaries (WDFW 1998, vol. 1 appendices).

Total escapement of summer steelhead to the Lewis River between 1925 and 1933 was estimated to be 4,000 fish, while the average run size 1963-1967 was estimated to be 6,150 (WDF 1990). No total estimates are available for the historical wild component of summer steelhead with the exception of 1984 when the East Fork wild component was estimated to be about 600 fish while estimates of the North Fork were less than 50 fish (WDF 1990). More recent escapement data is displayed in Table 4 (LCSCI 1998).

The wild stock of North Fork summer steelhead is chronically low in abundance and rated as depressed due to loss of access to available habitat upstream of the dams (Table 4). Wild summer steelhead returns account for less than 7% of the total North Fork run size (WDFW 1998, vol. 1 appendices). Due to low return of wild summer steelhead to the North Fork, no escapement goal has been established (LCSCI 1998).

The East Fork summer steelhead stock status was classified as unknown in the 1992 SASSI (WDF/WDW, 1993). With more recent information, East Fork summer steelhead are now considered "depressed" due to chronically low escapements (Table 4). The East Fork Lewis River summer-run steelhead stock is primarily comprised of non-native

(Skamania) hatchery origin fish, with some natural spawning (WDF 1990). Historically, an average of approximately 90,000 summer-run steelhead smolts were released annually into the East Fork Lewis River system, although current stocking is around 40,000 smolts (R2 Resources 1999: Appendix A).

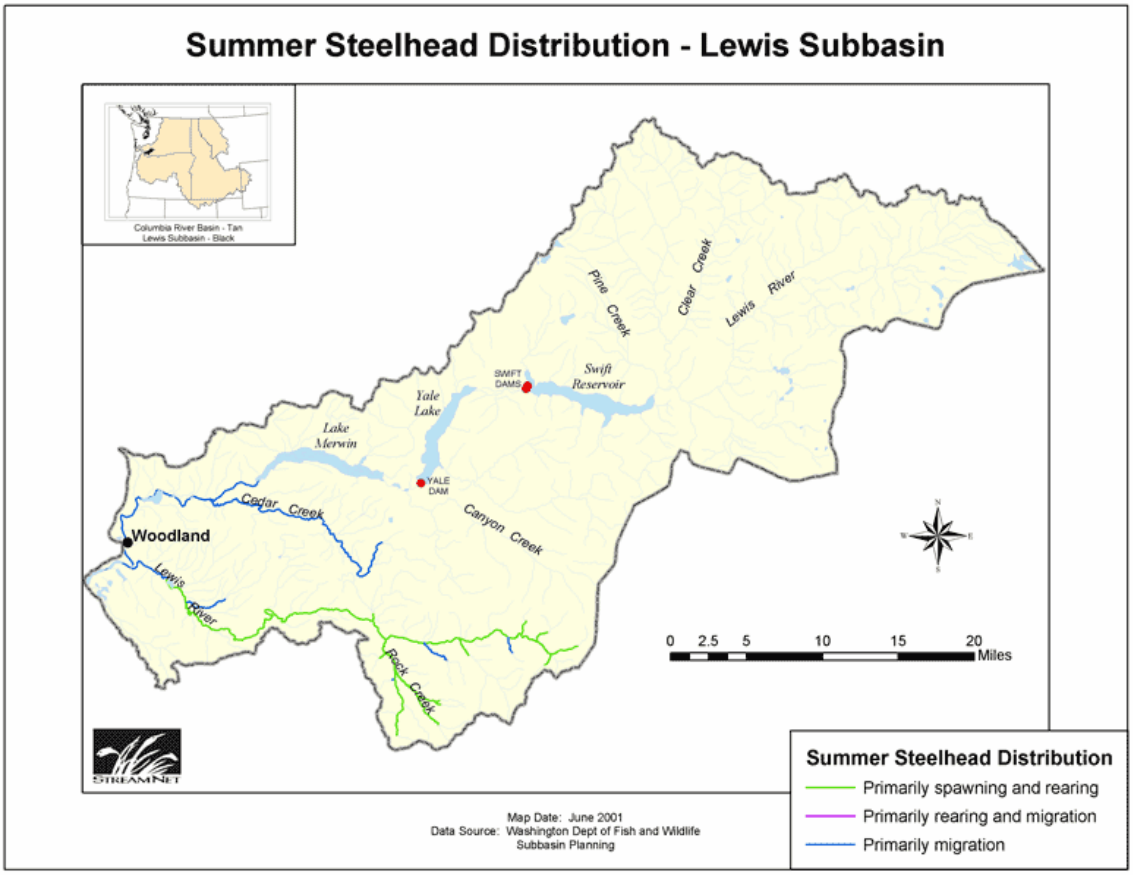

Figure 8. Lewis River summer steelhead distribution.

Winter Steelhead (Oncorhynchus mykiss)

Estimates of the historical spawning escapement of winter steelhead before Merwin Dam range from a low of 1,000 (Smoker et al. 1951) up to 11,000 (Lavoy 1983). Today, there is limited wild steelhead production in the North Fork, and the majority of the spawning and rearing habitat for winter steelhead in the Lewis River watershed is found in the East Fork basin (WDFW 1998, vol. 1 appendices).

Table 4. Lewis and Kalama River summer steelhead stock status and escapement.

Table 4a - WRIA 27 Summer Steelhead Stock Status

Stock	Screening Criteria	Proposed 1997 Stock Status	Status (ESA Listing)
Kalama	Short-Term Severe Decline	Depressed	Federal "Threatened"
EF Lewis	Chronically Low	Depressed	Federal "Threatened"
NF Lewis	Chronically Low	Depressed	Federal "Threatened"

Adapted from Lower Columbia Steelhead Conservation Initiative, 1998

Table 4b - WRIA 27 Summer Steelhead Stocks

Stock	Stock Origin	Production Type	Data Type	Escapement	Monitoring Period
Kalama	Native	Wild	Trap	Total	1977-1997
EF Lewis	Native	Wild	Snorkel	Index	1995-1997
NF Lewis	Native	Wild			Not Monitored

Adapted from Lower Columbia Steelhead Conservation Initiative, 1998

Table 4c - WRIA 27 Summer Steelhead Escapement Data

Stock	Wild Steelhead Escapement Goal	1991-1996 Average Wild Steelhead Escapement	Average % of Wild Escapement Goals	Average % of Hatchery Spawners
Kalama	1000	1170	117%	64%
EF Lewis	512	851	<30%	71%
NF Lewis	Not set	NA	NA	

Adapted from Lower Columbia Steelhead Conservation Initiative, 1998

As partial mitigation for the lost spawning and rearing habitat, state hatcheries began planting winter steelhead smolts in the Lewis in 1954 (WDFW 1998, vol. 1 appendices). The Lewis River winter steelhead stocks are now composed of both wild and hatchery stocks. Lucas (1985- in WDFW 1998, vol. 1 appendices) estimated that from 1973-1984, 56% of the winter steelhead returns to the East Fork Lewis were of wild origin. More recent data (LCSCI 1998) estimates that 51% of the spawning winter steelhead in the East Fork are of hatchery origin (see Table 5). WDF (1990) estimated that only 6% of the returning winter steelhead to the North Fork Lewis are wild fish. The East Fork Lewis

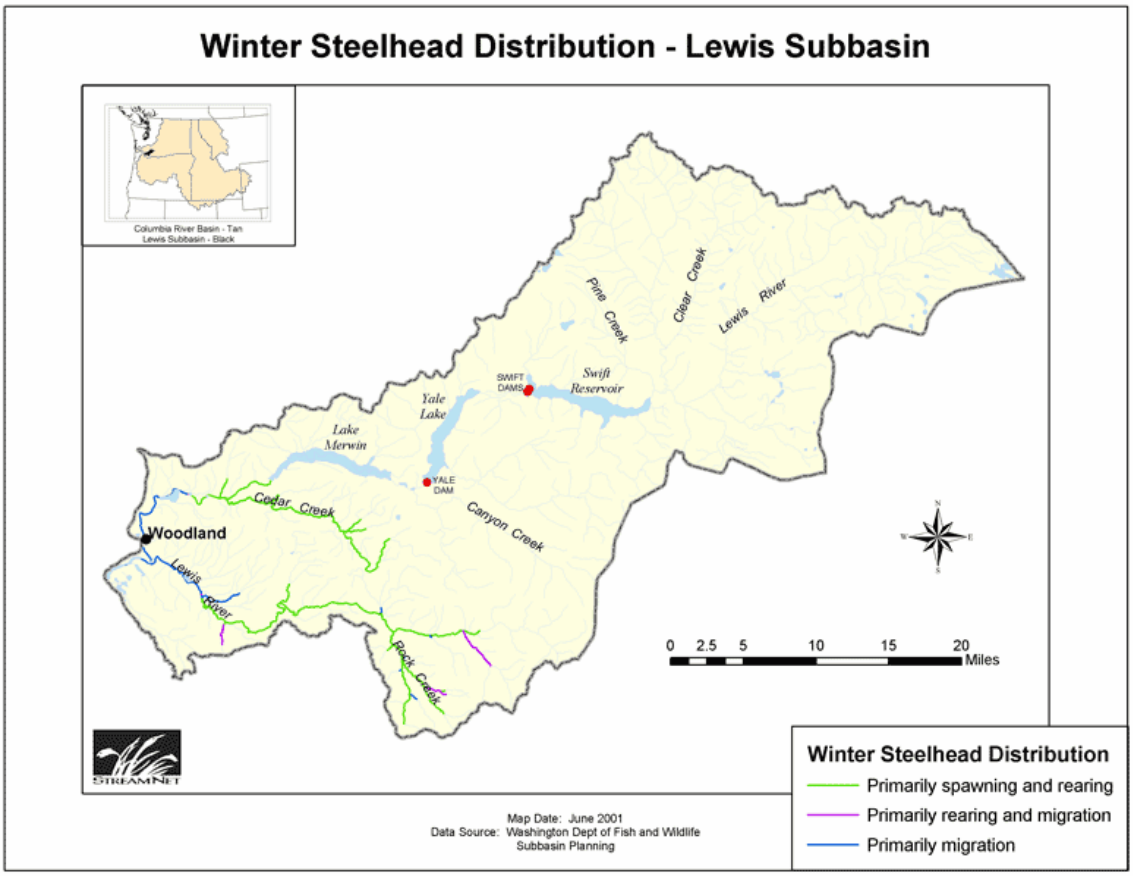

Figure 9. Lewis River winter steelhead distribution.

River winter-run steelhead is of mixed hatchery and native origin. To provide fishing opportunities, approximately 100,000 hatchery-origin smolts are planted annually. The winter-run steelhead stocks in both the East and North Lewis Rivers are identified as depressed by the WDFW (LCSCI 1998).

1973-1984, 56% of the winter steelhead returns to the East Fork Lewis were of wild origin. More recent data (LCSCI 1998) estimates that 51% of the spawning winter steelhead in the East Fork are of hatchery origin (see Table 5). WDF (1990) estimated that only 6% of the returning winter steelhead to the North Fork Lewis are wild fish. The East Fork Lewis River winter-run steelhead is of mixed hatchery and native origin. To provide fishing opportunities, approximately 100,000 hatchery-origin smolts are planted annually. The winter-run steelhead stocks in both the East and North Lewis Rivers are identified as depressed by the WDFW (LCSCI 1998) (Table 6).

Table 5. Lewis and Kalama River winter steelhead stocks and escapement.

Table 5a - WRIA 27 Winter Steelhead Stocks

Stock	Stock Origin	Production Type	Data Type	Escapement	Monitoring Period
Kalama	Native	Wild	Trap	Total	1977-1997
EF Lewis	Native	Wild	Redd	Index	1986-1997
NF Lewis (Cedar Creek)	Native	Wild	Redd	Index	1996-1997

Adapted from Lower Columbia Steelhead Conservation Initiative, 1998

Table 5b - WRIA 27 Winter Steelhead Escapement

Stock	Wild Steelhead Escapement Goal	1991-1996 Average Wild Steelhead Escapement	Average % of Wild Escapement Goals	Average % of Hatchery Spawners
NF Lewis	358 (I)	70 (I)	21%	93%
EF Lewis	204 (I)	76 (I)	37%	51%
Kalama	1000	1059	106%	31%

I = index escapement goals and counts
NF Lewis index is based on Cedar Creek data; Ph is for the entire NF Lewis
Adapted from Lower Columbia Steelhead Conservation Initiative, 1998

Table 6. Lewis and Kalama River winter steelhead stock status.

Table 6 - WRIA 27 Winter Steelhead Stock Status

Stock	Screening Criteria	Proposed 1997 Stock Status	Status (ESA Listing)
Kalama		Healthy	Federal "Threatened"
EF Lewis	Short-Term Severe Decline	Depressed	Federal "Threatened"
NF Lewis	Chronically Low	Depressed	Federal "Threatened"

Adapted from Lower Columbia Steelhead Conservation Initiative, 1998

Bull Trout (Salvelinus confluentus)

Populations of bull trout/Dolly Varden in the Lewis River have been identified as a distinct stock based on their geographic distribution (WDFW 1998, SASSI). The Lewis River system likely contained both anadromous and fluvial bull trout/Dolly Varden (native char) populations prior to construction of Merwin Dam (WDFW 1998, SASSI). The populations that now exist in Merwin, Yale, and Swift Reservoirs are adfluvial (a life-history type in which spawning and early rearing occurs in streams but most growth occurs in lakes or reservoirs). The populations of bull trout/Dolly Varden in Merwin Reservoir are thought to be fish that were spawned in the upper reservoirs and then spilled over Yale Dam. It is not believed that spawning occurs in Merwin Reservoir (WDFW 1998, SASSI).

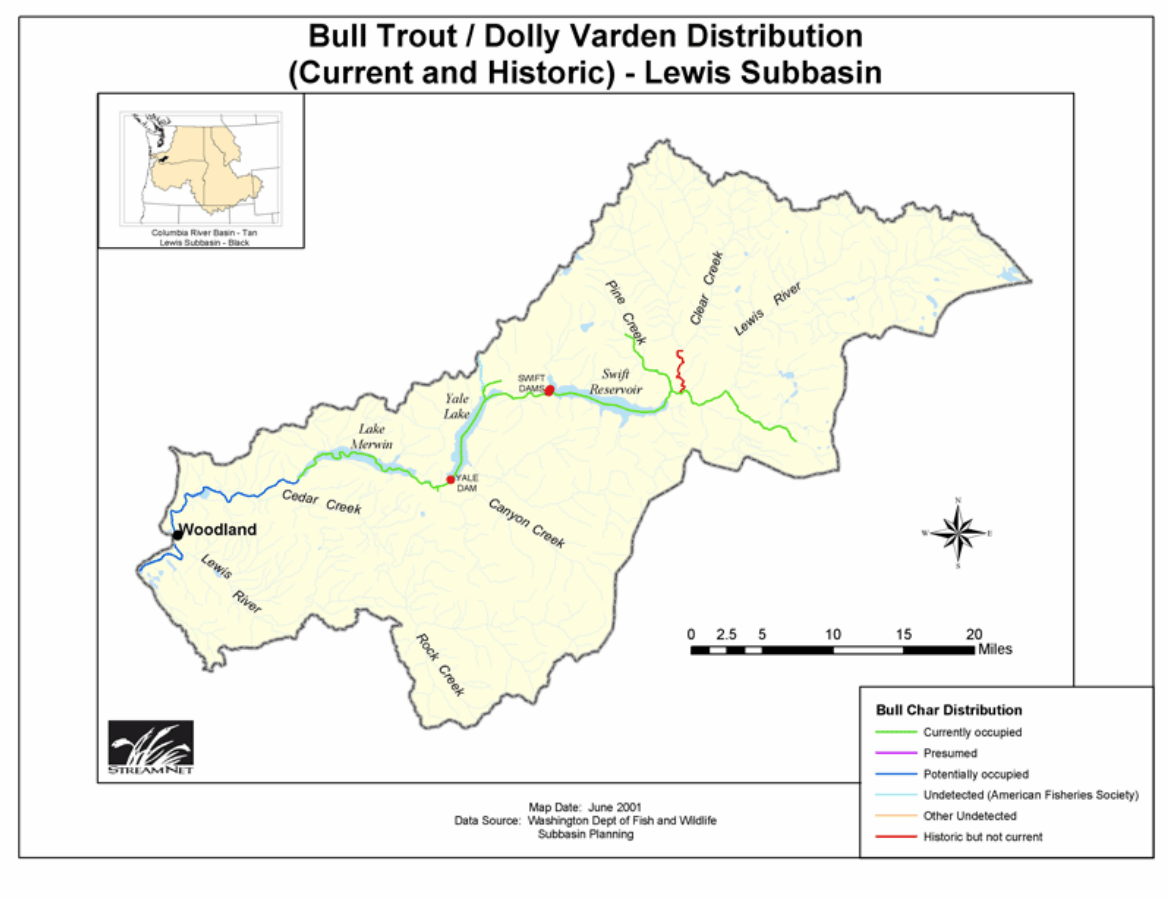

Figure 10. Lewis River bull trout distribution.

Cougar Creek is the only known spawning location for bull trout/Dolly Varden in the Yale Reservoir. Rush and Pine Creeks are the spawning and rearing areas for bull trout/Dolly Varden within Swift Reservoir and the upper Lewis River (Figure 10)

The bull trout/Dolly Varden stock is native and maintained by wild production. Stock status is "Depressed" due to chronically low abundance, and there exists a "moderate risk" of extinction for Lewis River bull trout/Dolly Varden (WDFW 1998, SASSI). Lewis River bull trout/Dolly Varden are part of the Columbia River bull trout distinct population segment (DPS). This DPS is a geographically isolated segment, encompassing the entire Columbia River basin and its tributaries, and the Lewis River supports a sub-population of this DPS. The Columbia River bull trout DPS was listed as "threatened" on June 10, 1998 by the USFWS under the ESA.

Spawner surveys in Cougar Creek since 1988 show an average peak count 22.5 (range seven to 37 fish). In 1991, a spawning population of 46 adults from Swift Reservoir was estimated. The population appears to be rebuilding from 1990 levels when monitoring began, and for the years 1994-1997 the average spawning population in Swift Reservoir tributaries was 240 fish (WDFW 1998, SASSI). This rebuilding coincides with the

recovery of such streams as Pine Creek that had been devastated by the eruption of Mt. Saint Helens in 1980.

A 1999 Swift Reservoir Creel Survey found that 7 bull trout were caught and one fish was caught and released in Swift Power Canal, and that three fish were released in Swift Reservoir during 1999 through the month of August (Lesko 1999, personal comm.).

The Swift Reservoir adult spawning population has been monitored since 1994. Adult fish are captured with drift nets and tagged with Floy tags yearly. A series of snorkel surveys slows determination of a population estimate based on the ratio of tagged and untagged adults seen in the snorkels. Results are presented in Figure 11.

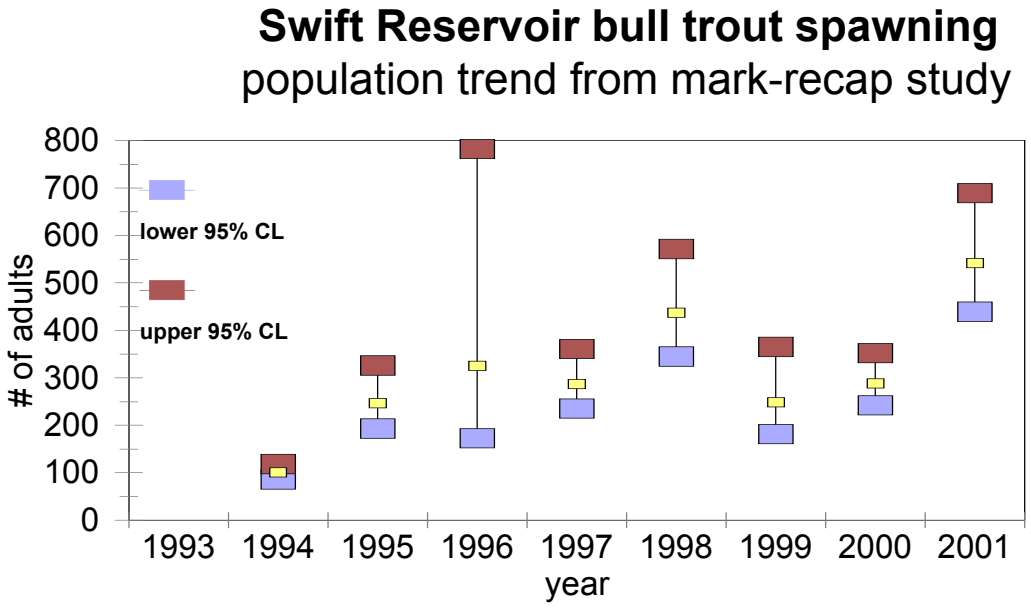

Figure 11. Bull trout spawner population trend 1994-2001.

Wildlife

Wildlife information in this document is derived primarily from the WDFW's Integrated Landscape Management (ILM) project (1998) as listed in the Goals, Objectives and Strategies section.

Wildlife habitat modeling for this process was based on meeting the requirements of four species the spotted owl, Larch Mountain salamander, bald eagle and elk. Species of concern are listed below:

Table 7. Priority wildlife species documented to have occurred in Kalama Lewis River Watersheds (WRIA #27).

(From ILM for Fish and Wildlife 1998)

Common Name	Federal Status	State Status
BIRDS		
Northern goshawk	FC2	SC
Golden eagle		SC
Great blue heron		SM
Cavity nesting ducks		
Band-tailed pigeon		
Pileated woodpecker		SC
Bald eagle	FT	ST
Harlequin duck	FC2	
Mountain quail	FC3	
Osprey		SM
Purple martin		SC
Northern spotted owl	FT	SE
Waterfowl		
AMPHIBIANS		
Larch Mountain salamander	FC2	SS
Van Dyke's salamander		SC
MAMMALS		
Grey Wolf	FE	SE
Elk		
Mule and Black-tailed deer		
Townsend's big-eared bat	FC2	SC
Grizzly Bear	FT	SE

Federal	Status
FE	Federal endangered
FT	Federal threatened
FCI	Federal candidate category I
FC2	Federal candidate category 2

State	Status
SE	State endangered
ST	State threatened
SC	State candidate
SM	State monitored
SS	State sensitive

Riparian Bird Guild

A great number of bird species are associated with or require riparian habitats along the Columbia River and its tributaries. As a subset of this guild, the neotropical migrants (e.g., willow flycatcher, yellow warbler, yellow-breasted chat, red-eyed vireo, Vaux's swift) continually exhibit declining population trends in this region. Lewis's woodpeckers are closely associated with large cottonwood stands. Historically, they were common in cottonwood habitats of the Columbia River but declines were noted after 1965 and they are now considered absent from Columbia River riparian habitat. The yellow-billed cuckoo is a riparian obligate species that was once found along the Columbia River but has not been

confirmed breeding in Washington for more than 20 years. Other species that are marsh obligates include the Virginia rail, sora rail, and marsh wren. Loss of riparian and riparian-marsh habitat for these birds resulted from the inundation and alteration of habitats in the Columbia River mainstem and tributaries.

Habitat Areas and Quality

History and Status of Habitat

Prior to any active state or federal regulation of forest practices, significant damage was done to the region's fisheries resources. Indiscriminate logging through streams, the use of splash dams to transport logs, and poor road construction and associated siltation problems, reduced or eliminated anadromous fish from many streams. Other kinds of problems, most notably destruction of riparian vegetation, land reclamation and non-point source pollution was caused by agricultural development. Urbanization, port development, and flood control works further impacted stream habitat. Today, numerous laws limit many major impacts, but the cumulative loss of habitat continues.

Habitat management for fish production embraces two elements that fish managers have varying degrees of control over --management of the water, and management of the physical habitat structure including the riparian edge. Management of flows in the North Fork Lewis River are largely controlled by discharges from Merwin Dam. Recent negotiations with Pacific Power and Light have alleviated some of the problems, particularly with fall chinook.

Physical modification of the aquatic habitat is controlled by federal and state statutes. This overlapping patchwork of regulation is designed to limit impacts to public stream and shoreline resources. Rules governing development are generally poorly understood by the public.

In many cases, important factors affecting the quantity and quality of stream habitat are outside the direct regulatory authority of the fish and wildlife management agencies. Interagency cooperation is one important way this difficult management situation can be counteracted. Better interagency communication of goals and objectives within watersheds, and then cooperative administration and enforcement of rules could improve habitat protection.

In spite of the best efforts of numerous state and federal agencies, and the imposition of regulatory programs some of the public deems onerous and excessive, there is a gradual loss of stream habitat. This cumulative loss is the result of routine development of natural resources and dedication of shoreline and water resources to other uses. These incremental losses have, and will, continue to result in reduced anadromous fish production in the Columbia Basin and its tributaries. Subbasin planning needs to address the problem of cumulative habitat loss if the goals of the Northwest Power Planning Act are to be achieved.

-Habitat Protection Objectives and Strategies

In general, all the fisheries management agencies subscribe to some statement of "no net loss of existing habitat as a management goal. Even though this goal is difficult to

attain, it is an appropriate policy, one that subbasin planning should support and the only one that will protect the production potential of entire river systems for the long term. (WDF 1990)

Washington Habitat Management Objectives:

1) No net loss of existing habitat.

2) No degradation of water quality.

3) No decrease of surface water quantity.

4) Increase security for existing habitat.

5) Increase salmonid use of under utilized habitat.

The combination of an effective public education program, aggressive regulatory program with stiff penalties, tax incentive programs for riparian landowners, and demonstrated resource benefits to local residents is likely the only way the production potential of the region's stream habitat resources will be preserved. Within these broad categories, there is ample opportunity for the Northwest Power Planning Council to take a leadership and coordinating role. However, the day-to-day business of protecting small habitat units will continue to be the burden of the agencies and tribes. The effectiveness of these programs will depend on agency staffing levels of field management and enforcement positions, public and political acceptance of program goals, most importantly, local judicial support and perhaps the level of environmental awareness practiced by the individual landowner. The area of cumulative habitat loss is one which the Northwest Power Planning Council must be involved in for the sake of the investments made in the Columbia River Basin Fish and Wildlife Program to date. Unless the cumulative loss of habitat can be halted, today's losses will become tomorrow's "debt to the past" and the "investment in the future" will have been ill spent.

The Northwest Power Planning Council could support the regulatory habitat protection work of the agencies and tribes and become more involved by:

1) Continuing to broaden the public education and information program it already supports.

2) Hosting a habitat protection symposium entitled, "Are the Investments Being Protected?

3) Purchasing riparian property adjacent to critical habitat.

4) Purchasing water rights if they can revert to instream uses.

5) Publishing additional inventories of "key" habitat for specific stocks that must receive absolute protection if the goals of the Act are to be realized.

6) Working with state and federal government for the development and passage of improved habitat protective legislation (WDF, 1990).

Watershed Assessment

A major effort to develop a cooperative management process between landowners and fish and wildlife management agencies was begun in 1996 model the watershed through time

was developed by WDFW through the Integrated Land Management (ILM) process. It was an attempt to shift management from a species by species approach to that of a broader cohesive watershed approach. Watershed management and its effects could be modeled for a twenty year period. Six wildlife species (elk, black-tailed deer, Canada goose, spotted owl, bald eagle and Larch Mountain salamander), and five fish species (bull trout, kokanee, steelhead, coho and Chinook salmon served as modeled species.

Within the ILM document there is this discussion of riparian habitat.

Riparian Habitat. Riparian habitats cover a relatively small area yet support approximately 90 percent of Washington's fish and wildlife species. Riparian areas in Washington provide essential food, cover, and water, as well as essential breeding habitat during all times of the year. Riparian areas have moist and mild microclimates that moderate seasonal temperature extremes. Riparian areas provide critical habitat for unique and obligate species, and provide physical features that enhance nearby upland habitats for wildlife. Riparian habitats are essential to healthy, productive aquatic systems and to native fish that inhabit them. Unlike most habitat types, intact riparian habitat can offer natural habitat connections and movement corridors, enabling wildlife to persist in fragmented landscapes.

Riparian habitats support abundant and diverse fish and wildlife populations, offer habitat connectivity across the landscape, and play a vital role in maintaining aquatic systems. To sustain the long term productivity of fish and wildlife resources, riparian habitats in good condition must be preserved and those in degraded condition must be restored to a healthy productive state. Protection efforts for riparian habitat--compared to other habitats--may yield the greatest gains for fish and wildlife. Overwhelming evidence exists to support the retention and restricted use of riparian habitat in order to maintain healthy, productive fish and wildlife habitat (DNR-FEIS, 1997).

Desired future conditions (DFC's) for riparian habitat widths in the Lewis River watershed are derived from WDFW's draft PHS Management Recommendation for Riparian Habitat (March 1995). These recommendations are based on an extensive survey and synthesis of the scientific literature (over 400 citations), and present the minimum standards generally needed to retain riparian habitat, protect associated wildlife, buffer streams for fish and other aquatic life, and retain hydrological functions.

Objectives for riparian habitat in the watershed include:

- Maintain or enhance the structural and functional integrity or riparian habitat and associated aquatic systems needed to support fish and wildlife populations on both site and landscape scales.

- Cease the current trend of riparian habitat loss by protecting intact riparian areas and by restoring degraded or lost habitat. Riparian habitat presently in good condition should receive the highest priority for protection.

- Design and implementation of land-use activities in or near riparian areas should strive to retain or restore structural and functional characteristics important to fish and wildlife, and the natural processes that drive these characteristics. These characteristics include: habitat connectivity; vegetation diversity in terms of age,

plant species composition, and vegetation lavers; vegetation vigor; abundance of snags and woody debris; natural rather than human induced disturbance; and an irregular shape and width that mimics natural processes. Planning for riparian areas should be done from a watershed perspective.

Because riparian areas and instream habitat are affected by upland activities, management of the entire watershed is an integral part of riparian habitat management. Although riparian areas play a major role in filtering sediments and pollutants from upland activities and in regulating stream flow, they alone cannot alleviate all upland impacts. Comprehensive planning and coordination among government agencies and land users is key to maintaining functional riparian habitat and associated fish and wildlife resources across the landscape. Land use decisions that include the needs of fish and wildlife will assist in maintaining areas for both people and wildlife. Planning will also help reduce the cost and controversy associated with listing species as threatened and endangered.

Definition: Riparian habitat can be variously defined in terms of vegetation, topography, hydrology, or ecosystem function. Riparian habitat is defined as the area adjacent to lotic systems (aquatic systems with flowing water, e.g., rivers, perennial or intermittent streams, seeps, springs) that contains elements of both aquatic and terrestrial ecosystems which mutually influence each other.

Scope of Riparian Plan: A comprehensive data set documenting current condition of riparian habitat did not exist prior to beginning the project. Therefore, we decided that five of the eighteen Watershed Administrative Units in the Lewis-Kalama watershed would receive extensive field inventories. The watershed riparian plan covers five of the eighteen Watershed Administrative Units found in the watershed (201,597 acres, approximately 24 percent of the basin). These WAU's are; Woodland, Lake Merwin, Cougar Creek, Siouxon, and Canyon Creek. They were selected because of their diversity of land use practices and land cover type. The remaining 13 WAU's were addressed but to a lesser resolution.

Extent of Riparian Data: Extensive field work was conducted in these five WAU's to document the current condition of riparian habitat and to update the Priority Habitats and Species data layer for riparian. Information on current riparian habitat condition was collected using an assessment methodology developed by Steve Manlow and Andy Carlson, WDFW biologists. The assessment methodology involved collecting information on habitat characteristics, land uses and disturbance factors, location, and water typing for each stream reach within the survey area. These data were imported into GIS and corresponding strewn reaches were digitized. Spatially linked data incorporating habitat features were analyzed for the majority of stream reaches within the five WAU's.

Separate data forms were completed for each "stream reach" evaluated within the project area. A stream reach was defined as a discrete segment or segments of riparian habitat with similar physical and biological characteristics. Breaks between stream reaches typically occurred where natural or human-induced changes resulted in distinctly different vegetation plant communities, or where differences in disturbance factors existed. Our goal was to conduct an onsite evaluation for every stream reach within the study area.

However, because of access and time limitations, this was not possible. Approximately 67 percent of the stream reaches in these five WAU's were inventoried (996 miles). In areas with limited or difficult access, aerial photographic interpretation was used to collect information on identifiable habitat characteristics.

It was assumed that the inventoried reaches within the five WAU's contained adequate riparian habitat when the buffer width met PHS recommendations: canopy closure was greater than 70 percent, trees were greater than 60 feet tall, and there were at least three vegetative layers. Twenty-four percent of all inventoried streams met these criteria. Unfortunately, due to the data collection protocol, it is very likely that additional reaches exist in the five WAU's in which adequate riparian habitat exists but were overlooked because data collection was restricted to within the 1995 PHS recommended buffer areas. Because of this, a number of Type 3, 4, and 5 stream segments in the Siouxon WAU that are dominated by deciduous trees within the buffer area did not meet the requirement of three or more vegetation layers. These reaches would have met the criteria had sampling occurred outside of the recommended buffer width at which point conifer becomes dominate.

Discussion: A number of state and local laws address the protection of riparian habitat. These include the Forest Practices Act, the Shoreline Management Act, the Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, the Growth Management Act, Clark County Ordinances, etc. Although a number of laws exist these laws do not provide the level of riparian habitat protection identified in the PHS Riparian Habitat Management Recommendations. Although not specifically required, some landowners are leaving riparian buffers that exceed state regulations. At this time V,'DFW is unaware of any landowner plans designed specifically to meet the PHS riparian management recommendations, therefore it is very important that WDFW and landowners work together to achieve riparian management objectives.

A total of 709 stream reaches were surveyed, spanning 966 linear miles of riparian habitat. The GIS data identified 1,450 linear miles (Table 8) of riparian habitat, representing 67 percent of the riparian habitat within these five WAU'S. The 13 unsurveyed WAU's were modeled at a coarse scale with data that existed prior to the beginning of ILM, therefore, the model results outside of the five inventoried WAU's may be less accurate.

After field work had been completed, the Priority Habitat and Species (PHS) division updated the recommended buffer widths for riparian habitat. Because the field inventory form had been developed for the recommended buffers before that time, and because the new recommended buffer widths cannot be extracted from the data as collected, the riparian analysis is based on the old (1993) PHS buffer width recommendations. Efforts will be made to compare results with current recommendations where possible.

Table 8. Stream miles sampled in five WAU'S, by water type.

Water Type	Total Stream Miles	Miles Sampled	(percent)	Stream Miles Meeting objectives (percent)
1	201	111	*(*55)	28.0 (3)
2	*5*	2	(50)	0. 1 (0)
3	119	107	(90)	35.0 (4)
4	268	205	(76)	45.0 (5)
5	857	541	(63)	117.0 (12)
Total	**1,450**	**966**	**(67)**	**225.0 (23)**

For riparian habitat, objectives are met, or not met, under the following conditions:

- Objectives are currently met, independent of ownership, within the five surveyed WAU's where stream reaches surrounded by riparian habitat contain trees taller than 60 feet, canopy closure is greater than 70 percent, three vegetation layers (or more), and buffers along Type I waters are at least 325 feet, along Type 2, 3, and 4 waters are at least 100 feet, and along Type 5 waters are at least 50 feet. Objectives currently are umnet along all other surveyed streams. Streams within the five WAU's that did not get surveyed, as well as streams outside of the fiv(WAU'S, are labeled "Unknown" because it is not known whether objectives currently are being met or not.
- Objectives will be met in 2014 on federal land along every stream within the entire Lewis/Kalama watershed where the Forest Service has identified Riparian Reserves (RR's) on Federal land. Objectives will be umnet elsewhere on federal land.
- Objectives will be met in 2014 in the DNR Siouxon Block where streams are found within either old growth or DNR Type A or B spotted owl habitat. These areas are not being predicted for harvest. Objectives will be urnnet elsewhere as current riparian habitat related rules and regulations do not protect riparian habitat to the level recommended in the "Priority .Habitats and Species Program - Riparian Habitat Management Recommendations". Additionally, there are no known landowner plans that will adequately protect riparian habitat.

Actions Needed: Further inventory and document current condition of riparian habitat in the remaining 13 WAU'S, identify and develop agreements that maintain healthy riparian habitat, and identify areas in need of riparian habitat restoration activities. Riparian management activities are needed in all areas of the watershed, not just the forested environment.

Limiting Factors

A complete limiting factors analysis for the Lewis River system was developed by Wade (2001). He divided into three sections for limiting factors analysis into the Lower, Upper and East Fork Lewis River.

North Fork Lewis River Limiting Factors

First limiting factor

The main habitat limiting factor on the Lewis river is the system of dams that block passage to 80% of the historic anadromous habitat. Flow regimes and ramping rates have been set to protect a healthy run of native fall chinook downstream of the dams, but revisions may need to be made to protect other ESA listed stocks.

Second limiting factor

Most of the lower floodplain has been diked and disconnected from the river, limiting rearing habitat for juvenile salmonids.

Third Limiting factor

Riparian conditions and LWD abundance were considered poor in most areas within the basin. A large tributary, Cedar Creek provides the majority of spawning rearing habitat left in the Lewis River system for steelhead and coho. Major factors limiting habitat within Cedar Creek include elevated water temperatures, low summer flows, and spawning gravels cemented with fine sediments.

Small populations of native adfluvial bull trout/Dolly Varden are found above the dams in the reservoirs and in Cougar, Rush, and Pine creeks. Limiting factors include excessive fine sediment, loss of riparian habitat, and elevated stream temperatures from the eruption of Mt. Saint Helens, logging, and road construction.

Recommendations for addressing limiting factors in the Lewis River include:

- Continue to look for ways to reintroduce anadromous fish above the dams;
- Increase and/or enhance off-channel and rearing habitat within the lower Lewis River and within Cedar Creek;
- Reduce fine sediment inputs to Cedar Creek and its tributaries;
- Look for ways to reduce water temperatures and augment low flows within the Cedar Creek basin.
- Some of the most critical habitats in need of protection include:
- The Cedar Creek basin provides most of the spawning and rearing habitat for coho, and steelhead within the Lewis River;
- Protection of the native fall chinook spawning grounds and juvenile rearing areas is considered critical;
- Rush, Cougar, and Pine creeks provide the only spawning habitat for bull trout.

East Fork River Habitat Limiting Factors

Large portions of the upper East Fork watershed repeatedly burned during the first half of the century. The watershed is slowly recovering; however, these disturbances have had significant impacts on the hydrology, the structure, composition, and age-class distribution of the plant communities, as well as riparian and instream habitats.

First limiting factor

Elevated water temperatures are considered a major problem in many tributaries and especially within the lower East Fork. The recent avulsion of the East Fork into abandoned gravel pits increased already high rates of erosion and channel instability in the lower river and led to a significant loss in spawning habitat for fall chinook.

Second limiting factor

Diking and development within the floodplain has largely disconnected the river and reduced over-winter habitat and low flows appear to limit the amount of available rearing habitat in the summer for juvenile salmon and steelhead.

Recommendations for addressing limiting factors in the East Fork Lewis River include:

- Assess changes in bank and channel stability, erosion rates, water quality, and predation rates resulting from the recent avulsion into the Ridgefield Pits, and look for both short-and long-term solutions that will help restore the habitat;
- Continue efforts to reduce water temperatures and improve overall water quality, and to augment flow during low-flow periods;
- Reconnect and enhance limited off-channel and floodplain habitat;
- Some of the most critical habitats in need of protection include:
- The lower 10 miles of the East Fork provides most of the limited floodplain habitat that remains within WRIA 27, and critical fall chinook and chum spawning habitat;
- Rock Creek (upper) and the mainstem above Sunset Falls provide the most critical winter and summer steelhead spawning and rearing habitat in the East Fork basin.

Limiting factor recommendation from (Wade 2001) are presented below:

Lower Lewis River (to Merwin Dam)

Access

- Continue to look for ways to pass fish, both upstream and downstream, through the dams to gain access to approximately 80% of the historic anadromous habitat within the Lewis River (North Fork) basin. Historically, the areas above the dams provided important spawning and rearing habitat for summer steelhead, coho, and spring and fall chinook populations.

- Assess and then prioritize the replacement or repair a number of passage problems on the lower reaches of Ross, Johnson, Colvin creeks on the North Fork Lewis, and Brush, Beaver and Unnamed (RM 10.3) creeks on Cedar Creek.

Floodplain Connectivity

- Look for opportunities within the lower floodplain of the Lewis River to reconnect the river to off-channel and floodplain habitats. Almost the entire lower floodplain of the Lewis River has been disconnected from these critical rearing and over-wintering habitats for juvenile salmonids.
- Protect and enhance the limited amount of wetlands and off-channel habitat that provide important rearing areas for salmonid juveniles within Cedar Creek. Wetland complexes in the lower two miles of the South Fork Chelatchie Creek may provide the most significant areas to focus protection and enhancement efforts.

Streambed Sediment Conditions

- Reduce the amount of fine sediment inputs to the Cedar Creek system. Substrates within the system are cemented with fine sediments reducing the available spawning habitat. Suggestions included fence and replant degraded riparian areas, decommission unnecessary roads, reduce impervious surfaces, and create instream structures that will help collect scarce spawning substrates.

Channel Conditions

- Assess LWD concentrations and determine where there would be appropriate areas to supplement LWD in tributaries of the Lewis River. LWD concentrations are well below standards almost throughout the Lewis River system, and the appropriate placement of LWD would help collect spawning gravels, enhance pool habitat, create habitat diversity and cover for salmonids, and stabilize stream channels.

Riparian Condition

- Replant degraded riparian areas with native conifers to help reduce sediment delivery to the streams, to provide shade and reduce water temperatures, and to speed recruitment of conifers for a future supply of LWD.

Water Quality

- Address land use activities along Cedar Creek and its' tributaries that contribute to water quality problems (especially temperature). Specifically, maintain adequate riparian areas along all stream systems to buffer streams from adjacent land uses, fence livestock away from riparian areas, replant degraded riparian areas with native conifers and shrubs, and reduce road densities and impervious surfaces.

Water Quantity

- Continue to assess flow regimes and ramping rates on the Lewis River hydroelectric projects to assure protection of steelhead, and chum and coho salmon populations, as well as for fall chinook.
- Look for ways to augment stream lows in Cedar Creek to increase and enhance limited juvenile rearing habitat during low-flow periods (summer and early fall onths).

Additional Studies

- Continue to fund the trapping and monitoring program that is already underway on Cedar Creek. These studies provide important data on the condition of the stocks and the effectiveness of fish management and restoration efforts.
- Survey small tributaries to Cedar Creek for illegal dams and diversions that may negatively influence water quality, water quantity, the movement of sediment, and the passage of fish. Enforce existing regulations that prohibit these structures.

Upper Lewis River (above Merwin Dam)

General Habitat Conditions

- Pine Creek provides critical spawning and rearing habitat for "threatened" populations of bull trout. The eruption of Mt. St. Helens has removed large areas of riparian vegetation and increased sediment inputs to the stream and increased turbidity. Monitor water quality, look for ways to repair riparian areas, stabilize stream banks, and decrease road densities within Pine Creek watershed.

Additional Studies

- As part of the relicensing process, a number of studies are underway that should provide additional data on the availability and quality of habitat for anadromous species above the dams, on watershed processes affected by the dams, and on the impact that dams may have on downstream habitat.

East Fork Lewis River

Access

- Assess and then prioritize replacement and/or repair a number of passage problems on McCormick, Brezee, Lockwood, Mason, Dean, and Manley Road Creeks.

Floodplain Connectivity

- Reconnect and enhance off-channel and floodplain habitats along the lower 10 miles of the East Fork to help increase limited rearing and over-wintering habitat for juvenile salmonids.
- Reconnection and restoration of small side channels and upwelling areas within the lower river will also be important to any future restoration plans for chum populations within the East Fork. The most dense observed spawning for chum salmon in the Lewis River basin historically occurred in side channels and upwelling areas in the lower 10 miles of the East Fork Lewis River (WDF 1973; Hawkins 1999, personal communication.)

Streambed Sediment Conditions

- Assess and, if possible, stabilize mass wasting and bank stability problems on the mainstem East Fork between RM 6 and RM 11. Excessive fine sediment is likely reaching critical fall chinook spawning areas in this stretch of the river.
- Also, assess and, if possible, stabilize mass wasting and bank instability problems on Mason Creek near Anderson Road Bridge, lower Rock Creek near Rock Creek Rd., and upper Rock Creek near Dole Valley Bridge.
- Assess sediment production from heavily traveled roads into Larch Mountain Corrections Facility, and look for solutions that will reduce sediment inputs to streams.

Channel Conditions

- Assess LWD concentrations and determine where there would be appropriate areas to supplement LWD in the mainstem and within tributaries of the East Fork Lewis River. LWD concentrations are well below standards almost throughout the East Fork system, and the appropriate placement of LWD would help collect spawning gravels, enhance pool habitat, create habitat diversity and cover for salmonids, and stabilize channels.

The highest concentrations of spawning summer steelhead within the Forest Service lands on the upper East Fork occur from Sunset Falls to McKinley Creek on the mainstem. Side-channel and low-velocity habitats adjacent to these spawning sites are limited, and enhancement or creation of these habitats would help increase survival for emerging fry.

Riparian Conditions

- Replant degraded riparian areas with native conifers to help reduce sediment delivery to the streams, to provide shade and reduce water temperatures, and to speed recruitment of conifers for a future supply of LWD. To begin with, focus riparian restoration efforts along the more productive tributaries.

Water Quality

- Find ways, at the watershed level, to reduce water temperatures within the East Fork basin. Excessive water temperatures during the summer and early fall

months continue to degrade salmonid habitat; even as far up the system as Sunset Falls (RM 32.7).

- Eliminate the direct connection between Dean Creek and Stordahl & Sons' gravel processing ponds. Water temperatures within the ponds are well above state standards, and can even reach potentially lethal temperatures at various times of the years. Reduce turbidity in discharge waters from the gravel processing ponds at Stordahl & Sons by using flocculants and/or filters to reduce the suspended sediments of wastewater released into Dean Creek.
- Waste-water from the Larch Mountain Corrections facility may also be degrading water quality in nearby Cedar Creek, and improvements may be necessary.
- Farming operations in Fargher Lake area might be contributing to water quality problems within the lower Rock Creek basin. State standards for water quality were exceeded in lower Rock Creek for DO, turbidity, and fecal coliform over an 20 month period from May 1991 through December 1992 (Hutton, 1995a). There is a need to assess and then address the connection between farming operations and water quality problems in lower Rock Creek.
- Continue to monitor water temperatures within the Ridgefield Pits and develop both short- and long-term plans for restoration of the site.

Water Quantity

Look for ways to augment low summer and early fall flows within the system. It is apparent the pronounced seasonality of precipitation distribution and the subsequent streamflow is significantly limiting fisheries habitat and hence potential fish production in the summer and early fall months in the East Fork Lewis River and its' tributary streams including McCormick Creek, Breeze Creek, Lockwood Creek, Mason Creek, upper and lower Rock Creeks, Yacolt Creek, and Gee Creek (Loranger 1999).

Additional Studies

- Assess mass wasting problems, stream channel conditions, water quality, and predation occurring upstream, within, and downstream of the Ridgefield Pits. All anadromous fish using upstream habitats as well as downstream migrants must navigate this highly dynamic and potentially lethal section of the river. Look for both short-term and long-term solutions that will restore proper functioning habitat in this section of the East Fork.
- Conduct physical surveys of stream reaches within the basin to collect information on site-specific habitat conditions and fish usage. Very little specific data was available that could help quantify habitat conditions within many of the tributaries to the East Fork. This information is necessary to better identify what truly is limiting production of salmonids within the basin.

Existing and Past Efforts

Summary of Past Efforts

Management activities on the Lewis River system have occurred over many years. Recent major emphasis has focused on construction of Merwin Hatchery, Salmon and Steelhead Initiative, Integrated Landscape management, Limiting Factors Analysis, SHIOPS and project relicensing.

Bonneville Power has funded a series of projects in this basin in the past. They are presented in Table 9.

Table 9. Bonneville Power funded activities in the Lewis River Subbasin.

Project	Project Number	Project Focus 1	Project Focus 2	Primary Agency
CODED-WIRE TAG RECOVERY	198201300	Monitoring / Baseline	Adult Mainstem Passage	PACIFIC STATES MARINE FISH COM
SURVEY OF ARTIFICIAL SALMON PRODUCTION FACILITIES	198405100	Monitoring / Baseline	Baseline / Feasibility Efforts	US SMALL BUSINESS ADMIN.
ANADROMOUS FISH HEALTH MONITORING IN WASHINGTON	198601300	Research / Evaluation	Fish Health	WASHINGTON DEPTof WILDLIFE
ANADROMOUS FISH HEALTH MONITORING (WDF)	198605400	Research / Evaluation	Fish Health	WASHINGTON DEPT of FISHERIES
FISH PASSAGE EVALUATIONS - LOWER COLUMBIA RIVER	199204101	Research / Evaluation	Adult Mainstem Passage	COE (PORTLAND DISTRICT)
AUDIT COLUMBIA BASIN ANADROMOUS HATCHERIES	199500200	Monitoring / Baseline	Facility Design / Construction	MONTGOMERY WATSON

Accomplishments by Year

1908 First hatchery constructed
1931 Merwin dam constructed.
1932 Second hatchery constructed at Johnson Ck.
1950 Only remnants of native spring Chinook remain.
1953 Yale dam constructed.
1958 Swift dam constructed.
1958 Speelyai Hatchery constructed.
1971 Carson stock introduced.
1983 Merwin Dam Relicensing Agreement (September 1983)
1993 Merwin Hatchery constructed.
1992 Washington State Salmon and Steelhead Stock Inventory
1998 Integrated Landscape Management (ILM) completed.

1999 Lewis River Projects relicensing process begins.
2001 Limiting Factors Analysis completed.

Present Subbasin Management

Existing Management

Management of the Lewis River subbasin is split between many Federal, State and local agencies. Both the U.S. Forest Service and Washington State Dept. of Natural Resources own and manage land in the upper mainstem and East Fork Watersheds. The cities of Woodland and La Center each lie in the lower watersheds and must develop appropriate development standards. Washington Department of Ecology monitors water quality and Washington Department of Fish and Wildlife and the National Marine Fisheries Service (NMFS) manage the fishery resource. PacifiCorp operates a series of three hydro dams in the watershed and the Cowlitz PUD operates a powerhouse and canal under direction of the Federal Energy Regulatory Commission

Federal Government

The National Marine Fisheries Service

The National Marine Fisheries Service (NMFS) administers the Endangered Species Act (ESA) for anadromous fish. NMFS reviews and comments on activities that affect fishery resources and develop recovery plans for listed species in the Subbasin. Under ESA, summer steelhead, Chinook salmon, chum salmon, and steelhead found in the Lewis are listed as "threatened" by National Marine Fisheries Service and coho salmon are listed as a candidate species. Under the ESA's 4(d)rule, "take" of listed species is prohibited and permits are required for handling. Biological Opinions, recovery plans, and habitat conservation plans for federally listed fish and aquatic species help target and identify appropriate watershed protection and restoration measures.

- Federal Caucus All-H Paper (2000). This document provides a framework for basin-wide salmon recovery and identifies strategies for harvest management, hatchery reform, habitat restoration, and hydropower system operations.
- FCRPS BiOp (2000). This is a biological opinion written by NMFS and the Fish and Wildlife Service regarding the operation of the federal hydropower system on the Columbia River, and fulfills consultation requirements with the US Army Corps of Engineers, the Bureau of Reclamation, and the Bonneville Power Administration under Section 7 of the ESA. This recent BiOp also concluded that off-site mitigation in tributaries is necessary to continue to operate the hydropower system.

United States Fish and Wildlife Service

Bull trout are found in the upper watershed. They were declared "threatened" under the ESA in July 1998. WDFW has a section 6 agreement with USF&WS to conduct bull trout research activities in this upper watershed. The USFS and PacifiCorp also contribute in this cooperative effort. Coastal cutthroat are proposed for a "threatened" listing, and since these are considered as non-anadromous fish they are in the process of being evaluated by the United States Fish and Wildlife Service.

United States Forest Service

Most of the upper Lewis River and Bonneville Tributaries Subbasins are located within the USFS Gifford Pinchot National Forest and Mount St. Helen's National Volcanioc Monument. Fish bearing waters are managed under the North West Forest Plan or are part of the Mount Adams Wilderness Area.

Bonneville Power Authority

The Bonneville Power Authority wholesales hydroelectric power throughout the West. It also provides funding to deal with impacts of the Columbia River Hydrosystem on fish and wildlife (see table in Existing and Past Efforts section).

Yakama Indian Nation

The Yakama Nation is involved with the FERC relicensing process for the three project on the Lewis River. Their goals and objectives are noted in the Goals, Objectives and Strategies section.

Cowlitz Indian Nation

The Cowlitz tribe has recently been granted tribal status from the Federal Government. It has been participating in the FERC relicensing process.

State

Washington Department of Fish and Wildlife

The Washington Department of Fish and Wildlife manages fish and wildlife resources in the subbasin. Bull trout, fall chinook salmon, chum salmon, and steelhead are listed as "threatened" and coho salmon are listed as a candidate species under the ESA. WDFW management attempts to protect these fish and provide harvest opportunity on hatchery fish through the Fish Management and Evaluation Plan.

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 full text of the Fish Management and Evaluation Plan appears in Appendix D.

Artificial Production

WDFW has a long history of hatchery production on the Lewis River. All hatchery-produced fish within the subbasin are marked with an adipose fin clip. Spawners are randomly selected, with one to one mating. The Merwin Steelhead Hatchery began

operation in 1993 producing summer and winter steelhead and sea-run cutthroat. Each hatchery has a hatchery specific hatchery genetic management plan (HGMP). Individual HGMP's are presented in Appendix A, B, C. Lewis River Spring Chinook returns are presented in Figure 12. Lewis River fall chinook adult hatchery returns are presented in Figure 13.

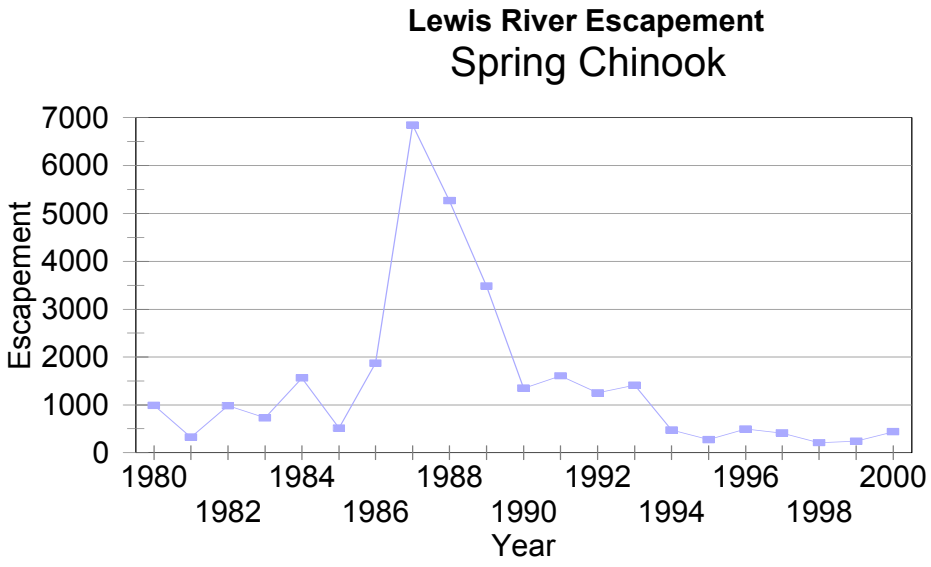

Figure 12. Lewis River spring chinook hatchery returns 1980-2000.

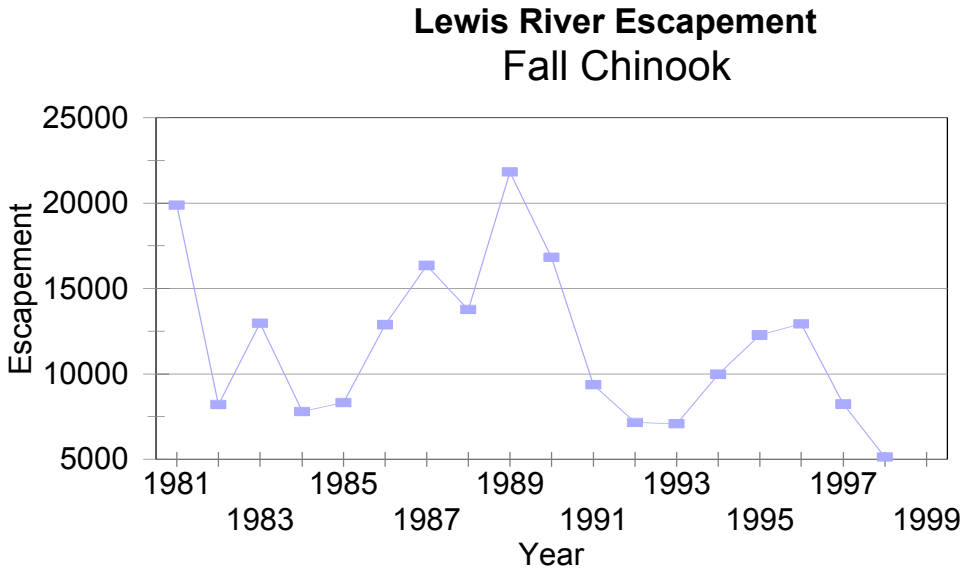

Figure 13. Lewis River adult fall chinook hatchery escapement 1980-1998.

Lewis River Hatchery has produced two stocks of coho over time. Originally, early run coho (Type S) native to the Lewis basin were cultured from 1960 through 1988. Hatchery Adult returns are reported in Figure 14.

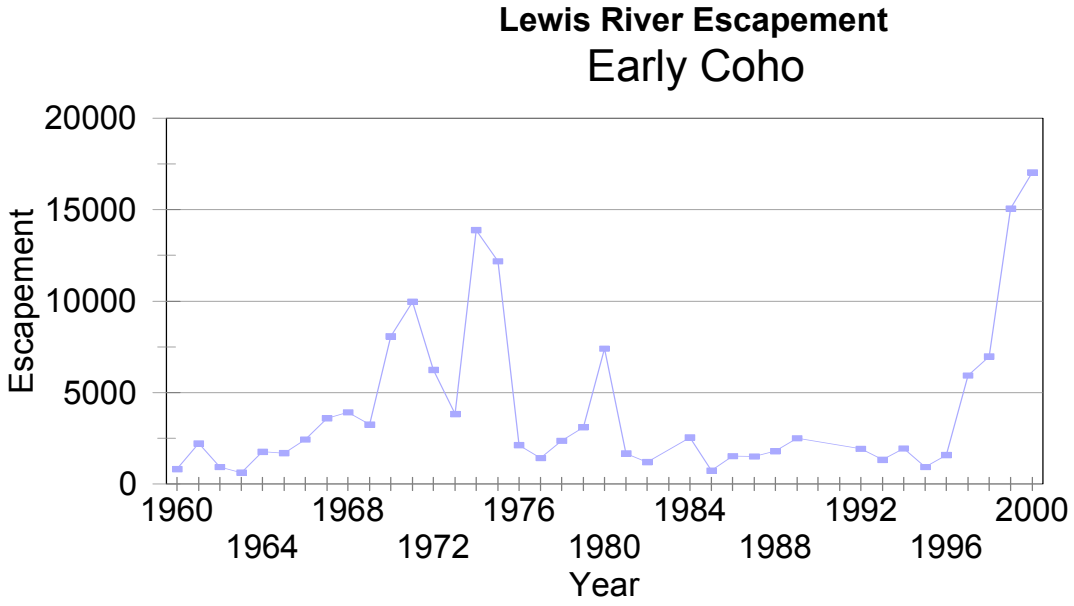

Figure 14. Lewis River Early Coho adult hatchery escapement 1960-2000.

In the late 1970's and early 1980's production shifted to late coho. Late coho (Type N) move northward form the mouth of the Columbia and are more readily caught in Washington waters providing greater benefits to Washington's commercial and recreational fisheries. Washougal late coho returns are presented in Figure 15.

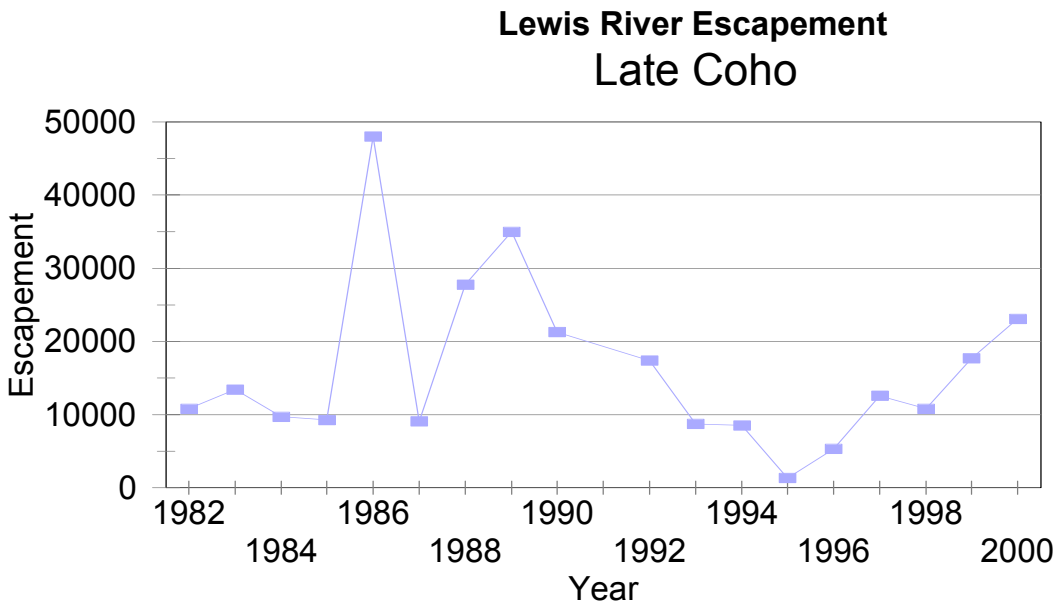

Figure 15. Lewis River Late Coho adult hatchery escapement 1982-2000.

Steelhead Escapement to Merwin Hatchery is presented in Table 10.

Table 10. Lewis River steelhead escapement 1995-2000.

Return Year	Summer Steelhead	Winter Steelhead
1995	905*	653*
1996	1,619*	514*
1997	1,215	381
1998	1,439	590
1999	1,087	373
2000	2,077	504

* from StreamNet All other records from Merwin Hatchery

Other Activities

WDFW is presently conducting or has conducted habitat inventories within the subbasin. Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. It creates a model to predict fish population outcomes based on habitat modifications. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP) which document barriers to fish passage.

WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

Washington SERF Board

The Salmon Recovery Funding Board's mission is to support salmon recovery by funding habitat protection and restoration projects, and related programs and activities that produce sustainable and measurable benefit for the fish and their habitat.

Joint Natural Resources Cabinet

In May 1997, Governor Gary Locke and thirteen agency heads signed a memorandum of agreement to establish a forum to serve as the ". . . formal and ongoing institutional framework to promote interagency communication, coordination, and policy direction on environmental and natural resource issues". This forum was named the Joint Natural Resources Cabinet (JNRC or Joint Cabinet) and is chaired by Curt Smitch, the Governor's Special Assistant for Natural Resources.

Government Council on Natural Resources

As a way to bring together a wider forum to assist with the review and development of the three-part effort to recover salmon, which includes the Statewide Salmon Recovery Strategy, state and federal budget proposals, and a comprehensive legislative package, the Government Council on Natural Resources (GCNR or Government Council) was developed. This group includes representation from JNRC, the Legislature, tribes, cities, counties, federal government, and ports.

Governors Salmon Recovery Office

To assist the Joint Cabinet and Government Council in accomplishing their mission, the Governor's Salmon Recovery Office was established by the Legislature through the Salmon Recovery Planning Act (Engrossed Substitute House Bill 2496). The Salmon office's role is to coordinate and produce a statewide salmon strategy, assist in the development of regional salmon recovery plans, and submit the strategy and plans to the federal government. The office will also provide the Biennial State of the Salmon report to the Legislature.

Department of Natural Resources

DNR through the Forest Practice Board has developed a Forestry Module. The Board has established the following Forestry Module goals: To provide compliance with the Endangered Species Act for aquatic and riparian- dependent species on state and private lands; To restore and maintain riparian habitat on state and private forest lands to support a harvestable supply of fish; To meet the requirements of the Clean Water Act for water quality on state and private forest lands; and To keep the timber industry economically viable in the state of Washington.

Washington Department of Ecology

The Department of Ecology impacts habitat in the subbasin in a variety of ways. Most importantly is the issuance of permits under the State Environmental Policy Act (SEPA) and the Shoreline management Act. DOE also participates in the development of county comprehensive plans for growth management and the development of DNR's Forestry Module.

DOE also issues municipal and industrial wastewater and storm water permits. It is involved in setting water allocations and instream flow.

Local Government

Clark County

Clark County has jurisdiction for most of the East Fork Lewis and the south side watershed for the Lewis mainstem. The County is in the process of bringing a series of ordinances into NMFS 4(d) compliance: the Fish and Wildlife Critical Areas Ordinance, the Stormwater Ordinance, Wetlands Ordinance act. The County has established an Endangered Species Program, and has put much effort into purchase of lands along the East Fork Lewis to incorporate into the County's Park program for salmon protection.

Cowlitz County

Cowlitz County encompasses the North side of the Lewis watershed. Under the Growth Management Act the county must identify and protect critical lands. The county is in the process of bringing their ordinances into compliance.

City of La Center

Under the Growth Management Act La Center must identify and protect critical lands. Protection should be provided by the city developing appropriate ordinances and through application of the Shoreline Management Act to the development permitting process.

City of Woodland

Under the Growth Management Act La Center must identify and protect critical lands. Protection should be provided by the city developing appropriate ordinances and through application of the Shoreline Management Act to the development permitting process.

Lower Columbia Fish Recovery Board

Established in 1998 by state law, the Lower Columbia Fish Recovery Board encompasses five counties in the Southwest Washington Region. The Board's mission is to recover steelhead and other species listed under the Endangered Species Act through the development and implementation of a comprehensive recovery plan. The 15-member board is responsible for implementing the habitat portion of an approved state and federal recovery plan. To accomplish this, the Board is authorized to establish habitat project criteria, prioritize and approve projects, acquire and distribute funds for projects, enter into contracts on behalf of project sponsor, and assess and monitor project outcomes. The Board holds regular monthly meetings on the first Friday of each month at different locations across the region.

Lower Columbia Fish Recovery Board approved projects are listed in Table 11.

Table 11. Lower Columbia Fish Recovery Board approved projects

Lewis River Field Survey	*Clark Conservation District*	*$55,308*	DOT Field Survey
Cedar Crk Riparian	*Clark Conservation District*	*$174,558*	Riparian Restoration
Lockwood Fish Passage	*Clark County Public Works*	*$30,644*	DOT Design
John Creek Fish Passage	*Clark County Public Works*	*$67,778*	DOT Design
Riley Creek Fish Passage	*Clark County Public Works*	*$13,119*	DOT Design
Cedar Creek #3 Fish Passage	*Clark County Public Works*	*$27,198*	DOT Design
Cedar Crk @ Amboy Blockage	*Clark County Public Works*	*$220592*	Fish Passage
Cedar Cr @ Cedar Creek Rd	*Clark County Public Works*	*$85,763*	Fish Passage
DuPuis Chelatchie Creek Project	*Fish First*	*$29,237*	Riparian Restoration
Swift-Killian-Sargent Cedar Crk. Project	*Fish First*	*$102,179*	Riparian Restoration
Carter-Malinowski-Shimano Cedar Creek	*Fish First*	*$66,421*	Riparian Restoration
Chelatichie Creek Restoration/Enhancement	*Fish First*	*$59,610*	Riparian Restoration
EF Lewis River Assessment	*Friends of the East Fork*	*$29,106*	Assessment
Lewis River Preserve Restoration	*PacRock Environmental*	*$198,090*	Riparian Restoration
Eagle Island Acquisition	*Van/Clark Park and Recreation*	*$108,649*	Acquisition/Restoration
EF Lewis River Riparian Restoration Monitoring	*Van/Clark Park and Recreation*	*$5,000*	Monitoring
East Fork Lewis Riparian Restoration	*Van/Clark Park and Recreation*	*$96,450*	Riparian Restoration
Riparian Re-vegetation	*Van/Clark Park and Recreation*	*$42,141*	Riparian Restoration
EF Lewis River Watershed Assessment	*WDFW*	*$130,406*	Assessment
Van Breeman Reparian Restoration	*Clark Conservation District*	*$32,725*	Riparian Restoration
Lockwood Recovery Enhancement	*Clark Conservation District*	*$182,325*	Riparian Restoration
Brezee Creek Culvert Design	*Clark County Public Works*	*$46,750*	DOT Design
Riley Creek Culvert Upgrade	*Clark County Public Works*	*$107,525*	Fish Passage
Dean Creek Fish Passage	*Clark County Public Works*	*$53,334*	DOT Design
Brickie Creek Fish Passage	*Clark County Public Works*	*$24,746*	DOT Design

From LCFRB website.

Existing Goals, Objectives, and Strategies

Wildlife

In 1998, WDFW completed an integrated plan for management of fish and wildlife resources in the Lewis-Kalama River Watershed (WRIA #27). This planning process, referred to as the Integrated Landscape Management (ILM) plan, (WDFW, 1998), identifies goals and objectives for management of fish and wildlife resources on a watershed basis. The ILM project also identifies broad fish and wildlife management goals for watershed management projects that are applicable to all watersheds in southwest Washington, including the Grays River. These goals and objectives include the following (From ILM for Fish and Wildlife 1998):

Goal: Maintain the historic statewide diversity of native wildlife species.
Objective: Develop management guidelines for game and nongame species that are endangered, threatened or sensitive (ETS).
Objective: Identify, map, and update the Priority Habitats and Species (PHS) data.
Objective: Support the PHS and ILM programs with data dissemination and management recommendations.

Goal: Determine the ecological needs and population status of wildlife species of concern.
Objective: Conduct and support research to investigate the population status, habitat requirements and the natural ecology of wildlife species of concern.

Goal: Develop an inventory of the current habitats of wildlife populations.
Objective: Use Geographic Information System and remote sensing to map habitats.

Goal: Protect and manage for recovery of all native wildlife classified as endangered, threatened or sensitive.
Objective: Develop and implement recovery and management plans for ETS species.

Goal: Manage game populations for sustainable natural production where feasible.
Objective: Identify and evaluate acquisition needs for important habitat of game species.
Objective: Determine abundance, distribution and composition of game populations.
Objective: Develop management plans for game species.

Specific objectives for riparian habitat are derived from WDFW's "Management Recommendations for Washington's Priority Habitats: Riparian (1997)", and include the following:

Objective: Maintain or enhance the structural and functional integrity or riparian habitat and associated aquatic systems needed to support fish and wildlife populations on both site and landscape scales.

Objective: Cease the current trend of riparian habitat loss by protecting intact riparian areas and by restoring degraded or lost habitat. Riparian habitat presently in good condition should receive the highest priority for protection

Objective: Design and implementation of land-use activities in or near riparian areas should strive to retain or restore structural and functional characteristics important to fish and wildlife, and the natural processes that drive these characteristics. These characteristics include: habitat connectivity; vegetation diversity in terms of age, plant species composition, and vegetation lavers; vegetation vigor; abundance of snags and woody debris; natural rather than human induced disturbance; and an irregular shape and width that mimics natural processes. Planning for riparian areas should be done from a watershed perspective.

The Washington Department of Fish and Wildlife also has goals and objectives for wildlife. Some Lewis River goals are:

- Maintain the historic statewide diversity of native wildlife species. Determine the ecological needs and population status of wildlife species of concern.
- Develop an inventory of the current habitats of wildlife populations. Protect and manage for recovery of all native wildlife classified as endangered, threatened or sensitive.
- Manage game populations for sustainable natural production where feasible.

The Yakama Nation also has goals and objectives for fish and wildlife in their ceded areas and historical hunting and fishing areas. Some Lewis River goals area:

- Reintroduce anadromous salmonids to the upper basin.
- Provide volitional passage for adult and juvenile migrants
- Utilize a Yakama Nation style supplementation program for fishery and natural production restoration.
- Develop selective harvest techniques for returning adults.
- Develop in-river juvenile collection system to facilitate outbound fish past hydrofacilities.
- Develop and understanding of estuary interactions of lewis river anadromous fishery stocks.
- Protect and restore ecosystem process and functions of spawning, rearing, and migratory habitat.
- Protect and restore ecosystem process and functions to support native plant and wildlife.

- Eliminate or control negative impacts of introduced plant, animals and fish.

- Maintain water quality consistent with fish needs and human consumption.

Fisheries

In the State of Washington's Statewide Salmon Strategy, its goal is to "restore salmon, steelhead, and trout populations to healthy harvestable levels and improve the habitat on which fish rely on." The Washington Department of Fish and Wildlife has a mission statement of "Sound stewardship of fish and wildlife". The WDFW Wild Salmonid Policy goal is to "Protect, restore, and enhance the productivity, production, and diversity of wild salmonids and their ecosystems to sustain ceremonial, subsistence, commercial, and recreational fisheries; non-consumptive fish benefits; and other related cultural and ecological values."(WDFW,1997).

Objective 1 The Draft Endangered Species Act Implementation Plan for the Federal Columbia River Power System has a section on research monitoring and evaluation. It states," the primary objectives of the RM&E component of this Plan are: Track the status of fish populations and their environment relative to required performance standards; identify the physical and biological responses to management actions: and resolve critical uncertainties in the methods and data required for the evaluation of future population performance and needed survival improvements".

Strategy 1. Monitor effects of HGMP's It is imperative to be able to monitor the freshwater production of naturally spawning salmon, cutthroat and steelhead in the subbasin in order to understand the potential effects of hatchery stocking. Spawning and rearing areas should be identified and protected. Smolt production should be determined through the use of downstream migrant traps on major tributaries. Wild escapement should be documented through the use of redd surveys and carcass counts.

Strategy 2. Hatchery and wild interactions on spawning grounds need to be monitored. Spatial and temporal differences between hatchery and wild fish of the same species need to be documented. Spawning ground surveys should provide this information. Snorkel surveys could document interactions of hatchery residuals and wild juvenile fry.

Objective 2 Monitor the effect of Fish Management and Evaluation Plans (FMEP).

Strategy 1. 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.

Strategy 2. Intensive efforts will be needed to determine the extent of the balance between harvest and escapement to fully seed the available habitat. Commercial and recreational fisheries will be monitored to prevent over harvest and insure comparable and temporal similarities between fished and unfished populations. Coded wire tags will identify the disposition of captured fish. Genetic sampling should be conducted to ascertain wild and hatchery genetic profiles and potential stray rates.

Objective 3 Develop management guidelines for game and nongame species that are endangered, threatened or sensitive (ETS) and identify, map, and update the Priority Habitats and Species (PHS) data.

Strategy 1. Maintaining diversity statewide can best be achieved by maintaining diversity in individual watersheds. The wildlife species in the Washougal are a diverse group of native, game and ETS species. Proper management of these species in the watershed will aide in maintaining diversity.

Objective 4 Conduct and support research to investigate the population status, habitat requirements and the natural ecology of wildlife species of concern and determine abundance, distribution and composition of game populations and incorporate into GIS database.

Strategy 1. Spotted owls, bald eagles, and Larch Mountain salamanders are all species of concern statewide and in the Washougal River watershed. Whereas the ecological needs and population status of owls and eagles have been well described, little is understood regarding Larch Mountain salamanders. Work being conducted in the watershed will increase our understanding of this species.

Strategy 2. Mapping and inventorying wildlife habitats is key to protection of the Washougal River wildlife. Remote sensing and GIS technologies have been used elsewhere to map current conditions of critical habitat components. We need to do the same for the Washougal subbasin for the key species and then model habitat changes and their impacts on wildlife in the future.

Objective 5 Develop and implement recovery and management plans for ETS species and develop management plans for game species in the Washougal subbasin.

Strategy 1. Managing the Lewis River watershed at the landscape scale will aide in protecting all native species, including ETS species. Understanding individual species habitat requirements and interactions with other will improve long-term sustainability of wildlife diversity in the watershed.

Objective 6 Identify and evaluate acquisition needs for important habitat of game specie in WRIA #27.

Objective 7 Implement the interim regional habitat strategy as outlined in the goals and strategies the Lower Columbia Fish Recovery Board (Appendix E).

The Lower Columbia Fish Recovery Board and its Technical Advisory Committee has developed goals and strategies that they will use to:

Identify and rank habitat restoration and protection needs and evaluate and rank habitat project proposals. It should be noted that this document is an ***interim*** habitat strategy.

Fish Recovery Goals of the Lower Columbia River Fish Recovery Board:

- Support Recovery of ESA listed stocks.
- Support biodiversity through recovery of native wild stocks.
- Restore or sustain geographic distribution of stocks.
- Maintain healthy stocks of a listed species.
- Support recovery of critical stocks of listed species.
- Habitat Protection and Restoration Goals:
- Restore access to habitat.
- Protect existing properly functioning habitat conditions.
- Restore degraded watershed processes needed to sustain properly functioning habitat conditions.
- Support critical salmonid life-history stages.
- Secure near and long-term benefits.

The LCFRB has developed a process to evaluate Fish Stock Priorities, Habitat Protection and Restoration Priorities, and Evaluation and Ranking of Habitat Projects. This process should be utilized in decision making on habitat and restoration projects. It is presented in Appendix E.

Nez Perce, Umatilla, Warm Springs, and Yakama Tribes in the Tribal Restoration Plan listed the following goals: "Restore anadromous fishes to the rivers and streams that support the historic cultural and economic practices of the tribes. Emphasize strategies that rely on natural production and healthy river systems to achieve this goal. Protect tribal

sovereignty and treaty rights. Reclaim the anadromous fish resource and the environment on which it depends for future generations".

Research, Monitoring, and Evaluation Activities

Fisheries

Current fish research, monitoring, and evaluation activities are listed below:

- Activity 1 Collection of coded wire tags from hatchery returns and fish spawning in river.
    - Activity 1.1 WDFW staff at Washougal and Skamania Hatcheries collect and process coded wire tags from returning fish. Tags are read at the WDFW laboratory in Olympia.
    - Activity 1.2 PSMFC staff conduct spawning ground surveys, marking redd sites and collecting coded wire tags from returned spawners. Tags are read at the WDFW laboratory in Olympia.
- Activity 2 Creel checks and coded wire tags are recovered through sport check surveys. Tags are read at the WDFW laboratory in Olympia.
- Activity 3 SSHIAP (Salmon Steelhead Habitat Inventory Assessment Program) will provide data for the Washougal River basin area. This data will include:
    - Activity 3.1 Comprehensive fish barrier coverage.
    - Activity 3.2 Fish Distribution by species, life stages.
    - Activity 3.3 Habitat Typing by segment- breaks stream reaches into small/large trib, gradients, habitat type (wetlands, etc), and confinement.
    - Activity 3.4 Hydromodifications. SSHIAP will catalogue various hydromodifications in the drainage. Hydromodifications include anthropogenic structures that in some way prohibit natural alluvial processes. These can include rip rap banks, bulkheads, roads, and other features present in the active floodplain.
    - Activity 3.5 Other background information such as stream widths and flow will also be added. Habitat typing will be completed by mid November. Hydromodifications will be completed by Dec. 31, 2001. All of this information will be available in GIS format on the web sometime after Dec. 31.

Wildlife

1. Activity 1 Develop management guidelines for game and nongame species that are endangered, threatened or sensitive (ETS) and identify, map, and update the Priority Habitats and Species (PHS) data.
2. Activity 2 Conduct and support research to investigate the population status, habitat requirements and the natural ecology of wildlife species of concern and determine abundance, distribution and composition of game populations.

3. Activity 3 Develop and implement recovery and management plans for ETS species and develop management plans for game species in the Washougal subbasin.

4. Activity 4 Identify and evaluate acquisition needs for important habitat of game species in Washougal subbasin.

Statement of Fish and Wildlife Needs

Evaluate and monitor fisheries for meeting performance indicators identified in the NMFS Fisheries Management and Evaluation Plan (FMEP) for the Lower Columbia River.

Rationale: Limited monitoring of fish populations is presently occurring (see existing monitoring activities), but should be expanded to insure populations are not exceeding levels identified in the FMEP. This would allow harvest of surplus population while protecting wild populations.

Determine abundance, distribution, and survival by life-stage, and status of fish and wildlife native to the watershed including steelhead, coastal cutthroat, fall chinook, coho salmon, crayfish, and others.

Rationale: Lewis River steelhead, chum and chinook salmon are part of the Lower Columbia River ESU and are currently listed under the ESA. Abundance and survival estimates will be needed to determine if habitat restoration programs are working and to determine if these fish can be removed from the Endangered Species list. Coastal cutthroat trout have been proposed for listing under ESA and coho salmon are considered a candidate for listing under ESA because of possible lowered status across their distributional range. Little is known about historical and current distribution and status of these fish in this watershed. Comparison of recent surveys with historical observations suggest that crayfish have disappeared from some of their former range. Crayfish are likely an important part of the food chain, and documenting their distribution and status is an important factor for assessment of health of the Lewis River ecosystem.

Determine genetic and life history types of native fish and wildlife and the strength of their current expression relative to historical and desired future conditions.

Rationale: Maintaining life history and genetic diversity allow fish to be productive under the current and a wide variety of future conditions. Determining these levels of diversity will help develop successful recovery strategies.

Determine the effectiveness of habitat restoration projects on achieving the desired physical change and measure the response of fish and wildlife populations to these changes.

Rationale: The State of Washington and the Lower Columbia Fish Recovery Board have spent thousands of dollars on habitat restoration in the Washougal River and requests have been made to continue this effort. Large-scale monitoring and site-specific monitoring projects are needed to evaluate the effectiveness of these actions to rebuild fish and wildlife populations.

Assess effect of operations and flow regime of Project Dams on the Lewis River's fish and wildlife production capacity.

Rationale: The flow regime of Swift, Yale and Merwin Dams have modified the natural flow regime of the North Fork Lewis River. The large natural Spring runoff of the river is diminished by the dams and flows are distributed over a greater time period. Water impounded behind the series of upstream dams has raised summer water temperatures. Fish production and wildlife may be negatively impacted by large-scale ecosystem functional changes including sedimentation, water temperature, turbidity, and predator access in the mainstem Lewis subbasin area. In winter reservoirs are drained dramatically to allow for anticipated winter precipitation, affecting habitat for reservoir species.

Conduct routine surveys for chum salmon in the lower Lewis subbasin. Evaluate seeps and other potential spawning areas, particularly in the East Fork, for chum production.

Rationale: Flow regimes at Merwin Dam may cause flooding of chum redds in the lower North Fork Lewis. Chum are seen in Chinook spawning ground surveys and were captured in screw traps on the lower East Fork. Seeps and springs within the lower Lewis subbasin may prove to be alternative sites for successful chum spawning.

Implement restoration actions identified in the watershed assessments that are consistent with recovery of fish and wildlife populations and their habitat.

Rationale: Restoration projects that are the outcome of watershed assessments and have gone through a review process have addressed factors that limit the recovery of fish and wildlife populations. These projects should have a high probability for success. The above or modified monitoring and evaluation programs should be funded as part of these restoration activities.

Continue watershed coordination and local stewardship programs.

Rationale: The land and resource management decision needed to recover fish and wildlife populations and their habitat will impact local residents. Many of these people are knowledgeable about these resources and should be part of the decision process. The involvement of the Clark Skamania Flyfishers and Fish First is important to the outcome of management decisions and address local concerns about long-term community and economic sustainability.

Evaluate the needs and results of a nutrient enhancement project. If determined it is successful, design and implement a comprehensive nutrient introduction plan.

Rationale: Salmon carcasses play a major role in ecosystem health by directly and indirectly contributing to watershed and fish productivity. In recent years, salmon carcasses from the Lewis Hatchery were used as a nutrient source.

Implement aquatic macro invertebrate monitoring program.

Rationale: Aquatic macroinvertebrates serve as an effective measure of a stream's natural potential for productivity, habitat quality and water quality. Analysis of the macroinvertebrate communities can reveal conditions and trends in aquatic ecosystems. Few samples of aquatic macroinvertebrates have been collected in the Lewis River subbasin. Macroinvertebrates are a recommended means of monitoring the effects a nutrient enhancement program.

Implement needed hatchery repairs to bring Lewis River, Merwin and Speelyai Hatcheries into compliance with "wild" fish protection measures.

Rationale: Lewis River intake and adult holding areas are not in compliance with current standards. Adult holding areas are not conducive for rapid sorting of fish and exclusion of wild steelhead. Intakes and holding areas should be brought up to current standards. Old pump systems at Lewis River need more efficient replacement. The intake at Speelyai Hatchery and upstream water diversion need to be modified to reflect the extensive logging and development occurring in the Speelyai basin.

Expand enforcement program for the entire Lower Columbia Basin.

Rationale: Successful fish and wildlife management programs require citizen compliance. While some users will intuitively act in the best interests of the resource, an effective enforcement and compliance regime is necessary to insure full cooperation with management goals.

Lewis Subbasin Recommendations

Projects and Budgets

The following subbasin proposals were reviewed by the Lower Columbia and Estuary Province Budget Work Group and is recommended for Bonneville Power Administration project funding for the next three years.

Continuation of Ongoing Projects

Project: 200001400 - Evaluate Habitat Use and Population Dynamics of Lampreys in Cedar Creek

Sponsor: U.S. Fish and Wildlife Service (USFWS)

Short Description:

With emphasis on Pacific lampreys, identify and quantitatively evaluate populations of lampreys and their habitats in a stream below Bonneville Dam.

Abbreviated Abstract

Pacific lampreys (Lampetra tridentata) in the Columbia River Basin (CRB) have declined to a remnant of their pre-1940s populations. NPPC-FWP 1994 noted this decline and requested a status report identifying research needs. This status report identified a need for information on lamprey abundance, current distribution, and habitat use. More recently, NPPC-FWP 2000 identified a need for any information necessary to restore the characteristics of healthy lamprey populations. Studying the biology, population dynamics, ecology, identification, as well as the relationships among sympatric species of lampreys (L. ayresi, and L. richardsoni) in the CRB will assist in rehabilitating Pacific lamprey populations. The U. S. Fish and Wildlife Service at the Columbia River Fisheries Program Office has been collecting quantitative baseline data including adult and larval abundance estimates, larval distribution and habitat requirements, immigration and emigration timing, and spawning habitat requirements for lamprey on Cedar Creek, Washington since 2000. Continued monitoring is vital to understanding the dynamic nature of this population, especially as it is one that is unaffected by hydropower activity.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
9402600	Pacific lamprey research and restoration projects	common methods for purpose of comparison

Budget

FY2003	FY2004	FY2005
Rec: $197,742 Category: High Priority	Rec: $207,629 Category: High Priority	Rec: $218,011 Category: High Priority

New Projects

Project: 31022 - Establish a Water Cleanup Plan (temperature TMDL) for the East Fork of the Lewis Subbasin

Sponsor: Washington Department of Ecology

Short Description:

Expedite development of a water cleanup plan-TMDL for the East Fork Lewis to identify sources of pollution related to temperature, DO and pH; allocate maximum allowable pollution from various sources; and develop strategies to improve salmonids habitat.

Abbreviated Abstract

This project is designed to accurately assess and address water quality factors limiting anadromous species throughout the East Fork Lewis River subbasin—a broad spatially geographic area, over a two-year period. It would employ a rapid airborne sampling technique to gather temperature data on 70 miles, validation using an extensive network of on the ground water quality monitoring, production of technical analyses and GIS coverage, and development of a water cleanup plan, also called Total Maximum Daily Loads (TMDLs), outlining strategies to achieve water quality standards for temperature. This project would complete the watershed by combining data with the partial FLIR measurements conducted by Pacific Corps for WDFW in March 2001.

The overall success of this project is critical to the enhancement of fish populations in the East Fork Lewis subbasin. By identifying the sources of heat, and recommending strategies to lower the summer temperatures to healthy ranges, this project integrates the work of numerous other fish restoration projects in this subbasin. It will directly complement the success of such other projects as water right and land acquisitions, riparian habitat improvements, fish traps, ladders, and screens.

Relationship to Other Projects

None.

Budget

FY2003	FY2004	FY2005
Rec: $118,000 Category: Recommended Action	Rec: $50,000 Category: Recommended Action	Rec: Category:

Project: 31027 - Movements and Survival of Juvenile and Adult Bull Trout

Sponsor: U.S. Fish and Wildlife Service (USFWS)

Short Description:

Juvenile and adult bull trout in and near Rush Creek will be tagged with 23-mm PIT tags. Using a stationary PIT tag antenna, juvenile survival, migration timing and population numbers will be estimated for in basin modeling efforts.

Abbreviated Abstract

Efforts to manage populations of bull trout have been hampered by a dearth of life history data. It is the goal of this study to provide population data on bull trout for the Columbia River Basin by studying the Lewis River stock as a model system. Bull trout within the Rush Creek watershed will be tagged with 23 mm PIT tags and monitored. A remote stationary interrogation system will bound the downstream end while an impassable waterfall will provide an upper boundary. Emigrating bull trout will be captured in a screw trap operated by WDFW below the stationary interrogation system. The proportion of recaptured bull trout will be used to estimate the total number of migrants. In stream recapture will be used to estimate population size. Back pack interrogation will be used to quantify year class survival and migratory success. Ongoing WDFW efforts to capture adult fish within the upper end of Swift Reservoir will provide opportunities to quantify the spawning migration into Rush Creek. These approaches will provide critical year class survival and migration data necessary to generate models for the long and short term management of bull trout populations within the Columbia River Basin.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
12000	Innovative project -adaptation of PIT tag technology for in stream use	Collaboration, coordination and technical expertise

Review Comments

USFWS has identified that this project is a BiOp project. CBFWA believes this is a potentially useful and interesting research project; however, it is unclear how results will be used in the management of bull trout. It is also unclear why this work should be funded by BPA. Reviewers question the size of PIT tags relative to fish size.

Budget

FY2003	FY2004	FY2005
Rec: $207,585 Category: High Priority	Rec: $140,729 Category: High Priority	Rec: $147,765 Category: High Priority

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