U.S. Fish and Wildlife Service - Pacific Region

Columbia River Basin Hatchery Review Team

Columbia River Basin, Lower Columbia Province

Clackamas Watershed

Eagle Creek National Fish Hatchery

Assessments and Recommendations

Final Report, Appendix B:

Briefing Document; Summary of Background Information

July 2007

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I. Clackamas Watershed

A. Watersheds and geographic description[1]

The Clackamas River flows 83 miles from its headwaters on the west slope of the Cascade Mountains between Mount Hood and Mount Jefferson, to its mouth at River mile 24.8 on the Willamette River. It drains about 934 square miles of the northeastern corner of the Willamette Basin. Major tributaries of the Clackamas include Clear Creek, Deep Creek, Eagle Creek, North Fork, Roaring River, Fish Creek, Collawash River and the Oak Grove Fork.

Eagle Creek originates in the Salmon Huckleberry Wilderness Area of the Mt. Hood National Forest and flows in a westerly direction. Eagle Creek enters the Clackamas River downstream of the town of Estacada at river mile 16. Eagle Creek NFH is located on Eagle Creek 12.4 miles upstream from its confluence with the Clackamas River, which enters the Willamette River near Oregon City, Oregon. The Willamette River then enters the Columbia River at River Mile 102, just west of Portland, Oregon.

The Eagle Creek watershed is approximately 18 miles long and 7 miles wide at its widest point. Eagle Creek generally flows in a westerly direction and has three major tributaries, South Fork (upstream of the hatchery at creek mile 16), Delph Creek (creek mile 9) and North Fork (creek mile 6.5).

Elevations in the Eagle Creek watershed range from about 300 feet at the confluence with the Clackamas River to slightly over 4200 feet in the headwaters of the upper Eagle Creek mainstem and South Fork sub-watersheds around Old Baldy Mountain (4209 feet) and Squaw Mountain (4771 feet).

The climate is temperate, with average annual precipitation ranging from 55 inches near the mouth of Eagle Creek to 100 inches in the upper watershed. Approximately 70% of the precipitation occurs from October through March, while less than 3% occurs in July and August. Less than 35% of the watershed lies within the transient snow zone, where snow levels fluctuate during the winter.

[1] *Section text from Murtagh et. al. 1992 and ECNFH CHMP.*

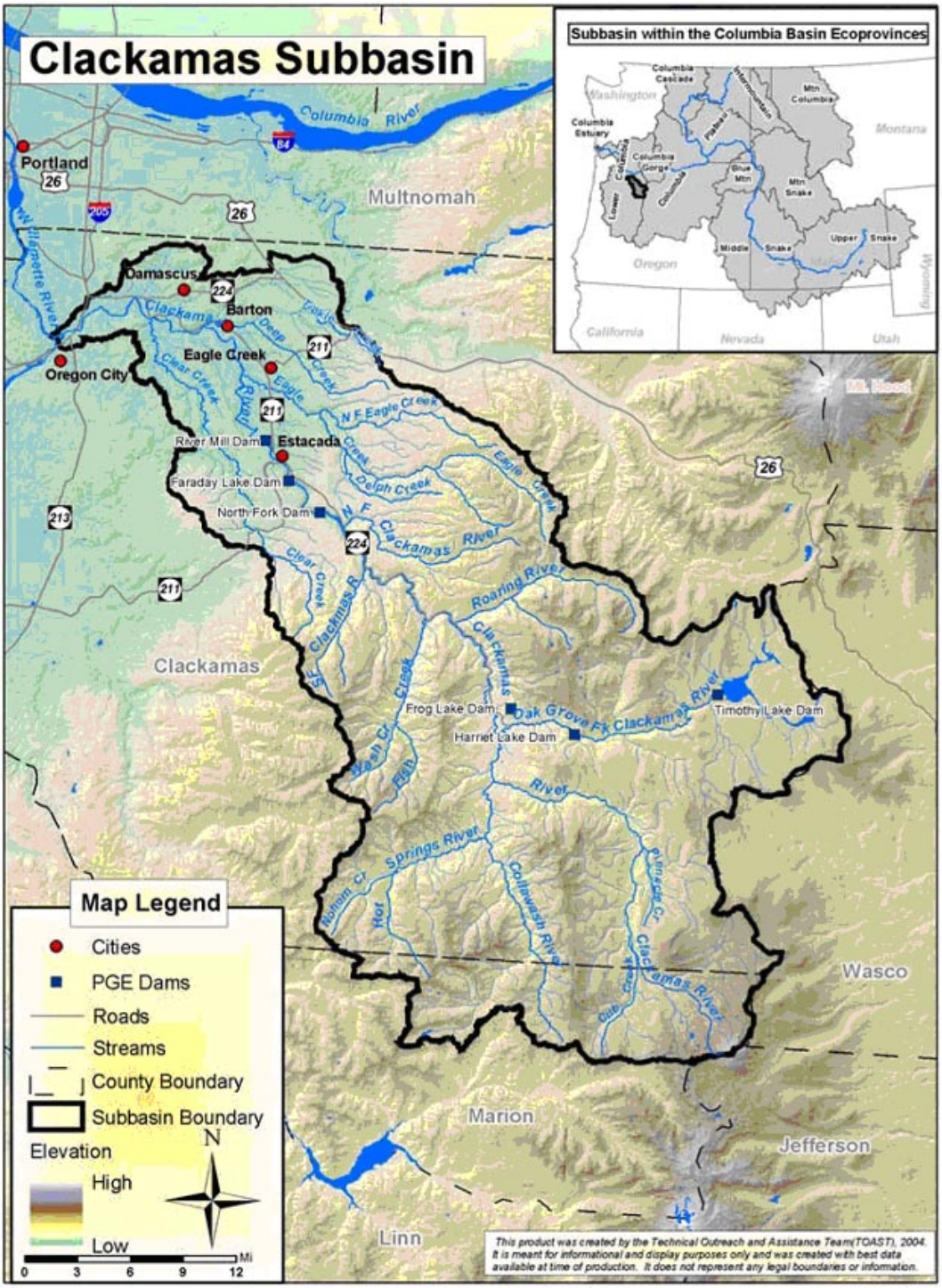


Figure 1. Clackamas Watershed[2]

[2] *From "EDT Assessment of Aquatic Habitat in the Clackamas Subbasin", Mobrand Biometrics, Inc. 2004*

B. Historical distribution of salmon and steelhead throughout region[3]

In the early 1800s, large runs of salmon and steelhead returned each year to the Clackamas River. Estimates of run size are unavailable, but harvest and hatchery records from the mid- to late-1800s suggest that the fish returned in significant numbers. Native anadromous fish runs to the basin included spring chinook, fall chinook, coho salmon, and winter steelhead. The drainage also supported several resident fish species, including cutthroat, rainbow and bull trout, and mountain whitefish. A small run of summer steelhead may have also existed. In 1889 Rudyard Kipling described catching bright steelhead in what was late spring or early summer, when winter steelhead are not typically bright in color.

Pristine conditions in the watershed provided excellent habitat for salmon and steelhead production at the turn of the 19th century. It was an environment containing majestic forests with a dense understory and rivers of clear, cold water with rapids and long, shallow gravel beds that filled each year with an abundant supply of salmon.

C. Historical anthropogenic impacts to salmonid populations in the region[4]

Natural salmon and steelhead production began to drop sharply in the Columbia River and tributaries, including the Clackamas, in the 1870s. The primary cause of the decline is believed to have been overharvest in the Columbia River. Commercial harvest of spring chinook peaked around 1873 with a take of 43 million pounds. When this run began to decrease in size, fishing pressure moved to fall chinook and coho. Fish harvest also escalated on the Clackamas and lower Willamette rivers in the late 1800s — sometimes almost completely closing the river to upstream fish passage.

Destruction of habitat conditions in the lower basin contributed to the decline of Clackamas River salmon runs. The lower river area was undergoing tremendous growth and development during the late 1800s. Heavy harvest of forests in the lower basin resulted in erosion, silting of spawning gravels, loss of streamside vegetation and poor water quality. Other developments in the basin also restricted fish migration. Records show that upstream salmon migration was restricted as early as 1868 after a dam was built on the Clackamas River near Gladstone. This, or another dam near it, continued to impede passage until a fish ladder was provided in 1895. Dams also existed on Clear Creek. Further, while records are scarce, dams probably were also built at other sites on the Clackamas and tributaries to provide water for mills operating at the time. Thus, by the late 1800s fish runs faced overwhelming pressure to adapt to changing habitat conditions.

[3] *Section text from Taylor 1999.*

[4] *Section text from Taylor 1999.*

1. Early 1800's to 1930 (e.g., logging, agricultural development, commercial fishing, canneries).

Timber harvest in the lower basin started in the early 1800s. The lack of good roads above the Estacada area and easy access to trees in the lower basin tied most logging activities to lower basin forests until the 1940s.

The first sawmill in Clackamas County was built in 1825 or 1826 on Sawmill Creek, probably the same stream on which Dr. McLoughlin had his flour mill (Lynch 1973). Timber harvest and sawing lumber developed into an important industry and soon sawmills existed all along the Clackamas and tributaries. Many of these sawmills were apparently washed away by flood waters in December 1849. According to notes by one early settler, Lot Whitcomb, "all (sawmills) but one on the Clackamas" washed away during the 1849 flood (Farnell 1979). Other mills were built in the 1850s, including one on Eagle Creek in 1850 and another on Deep Creek in 1856 (Lynch 1973). By the late 1800s, small sawmills, called "gyppo" mills were everywhere in the lower basin.

When possible, loggers used the Clackamas and tributaries to transport the timber to mill sites. The 1880 census records show that logs were floated to mills on Rock Creek, Clear Creek and the Clackamas River. Use of the river as a transportation corridor for timber continued for several years. The Clarkson and McIrvin Boom Company proposed to charge tolls on the river below Eagle Creek, below the mouth of Deep Creek and portions of Deep Creek. An article in The Oregonian in 1896 discusses the company's actions. According to a newspaper article, the company removed 200,000 feet of piling from the Clackamas River and then gathered timber to transport. When the article was written, the company was waiting for a rise of water to move about 250,000 feet of timber down the river. It expected to have another 250,000 feet of wood before the higher flows came (Farnell 1979). Log drives continued into the 1900s and were often helped by a flash release from the dam (Farnell 1979).

Early logging practices often left scars on the landscape. Since timber harvest was generally unrestricted, loggers cut timber that could be easily reached and moved to markets. They removed timber from riparian areas, unstable slopes and other lands that would be protected today. Such disturbances affected habitat conditions along the lower river and tributaries. They reduced soil stability, leaving the exposed soils more susceptible to erosion during storms and high flows. Other habitat damage resulted from the driving of logs down streams. Log drives scoured stream channels, removed riparian vegetation, and created barriers to fish passage. The log drives also hindered hatchery efforts. In 1902, J. Wisner, a manager of the Clackamas hatchery, reported that about 2,000 cords of wood were being floated down the river. Hatchery personnel had to construct a boom above their egg-taking rack to guide the wood through a gate in the structure (Wisner 1902). Water quality was also affected by sawmill production and logging activities during this time. By 1890, sawdust and other mill waste were common pollutants in any stream in the state (Oregon Fish Commission 1889-1890).

Use of the river to transport logs declined after 1903 when developers brought railway services to the area. In 1904, more than 100,000 cords of wood were hauled by the Estacada line to Portland, which still burned wood almost exclusively for fuel. The rail also provided access to previously unreachable territory, thus supporting the growing logging industry.

Access to the basin's vast forests improved further in the 1920s when Portland General Electric built a road to the Oak Grove drainage, and the Forest Service started developing truck trails. Road construction in the upper drainage continued with the addition of 23.4 miles in the 1940s and 61 miles in the 1950s. Many secondary roads were also developed.

Road development took off in the 1960s when about 210.7 miles of road were constructed in the upper basin. By 1969, about 60 percent of the upper watershed's existing system was in place. During the 1970s, 90 miles of road were added to this system and many existing roads were converted to asphalt. Another 97.4 miles and 10 miles of new road were constructed in the 1980s and 1990s, respectively. In addition, many existing roads were improved with asphalt. Today, the upper Clackamas watershed alone contains about 490 miles of roads (USFS 1995).

The new road system opened the upper basin to timber harvest. Vast quantities of timber were harvested after 1950, nearly all on national forest land. By 1960, approximately 880 acres in the upper basin had been clear-cut harvested using mainly tractor skidding techniques. Harvest increased during the 1960s, occurring throughout the upper watershed. By the end of the 1960s, an additional 7,393 acres had been clear-cut. Harvest escalated during the next 25 years. About 21,000 acres were cut between 1970 and 1994 using all types of harvesting techniques. Several other areas were also harvested during this time, primarily to salvage timber in areas hit by bark beetle or windstorm damage. Overall, between 1950 and 1994 timber harvests occurred on more than 29 percent of the upper Clackamas watershed (USFS 1995).

Road construction and timber harvest critically affected conditions in the upper basin. Logging road construction and timber harvest increased the risk of landslides in the drainage. Generally, logging roads are considered one of the biggest triggers of landslides because they compact soil and reduce its ability to absorb precipitation. Research outside the Mt. Hood National Forest has shown that 80- 90 percent of the sedimentation associated with timber harvest can be attributed to road building (ODFW 1992). Studies in the Clackamas drainage support this finding. In 1988, the Mt. Hood National Forest identified active slide areas in the Collawash, Oak Grove Fork, Hot Springs Fork, Fish Creek and upper mainstem Clackamas drainages (ODFW 1992).

Road-building along the Clackamas River and tributaries also affected stream stability and habitat conditions. Loggers and road builders were often attracted to the floodplains because they were easier to reach and develop than the surrounding rugged territory. Consequently, road building along streams, including the development of several main access roads, caused stream realigning and straightening and the removal of large amounts of riparian vegetation. In the 1950s, for example, Forest Road 46 was extended by realigning the Clackamas River between RM 57 and RM 65. The realigned channel is about 20 percent shorter than the natural channel and contains significantly less fish habitat. The logging of streamside trees, such as in the Fish Creek and upper Collawash systems, affected habitat diversity and channel stability and reduced stream shading. Loss of shade contributed to increases in water temperatures during late summer and fall. Water temperatures exceeding 65 F — a level affecting salmon and trout production — have been recorded in Fish Creek and the lower Clackamas, Hot Springs Fork, and Collawash rivers.

2. Hydropower development: 1930-1975

Incredible population and industrial growth in the Portland metropolitan area during the early 1900s created a hunger for a large electric power supply. Hydro developers recognized the potential for power development on the Clackamas River at the turn of the century. They began site investigations in 1901 and acquired several potential power sites in 1902. In 1948, the region again faced a shortage of energy to meet its growing needs. This propelled Portland General Electric Company to study developments that would increase its generation capability. Again, the company looked to the Clackamas River system to help meet these needs. They initiated several actions in the basin to improve the existing systems' capability. The various hydroelectric projects in the basin are discussed briefly.

Cazadero/Faraday Dam

In 1902, the Oregon Water Power and Railway Company, a predecessor of Portland General Electric, started work on Cazadero Dam in the Clackamas River about 1.25 miles upstream from the town of Estacada. Workers completed the timber-crib, rock-filled dam in 1907. A wooden fish ladder was included as part of the dam's original construction.

When the dam was completed, fish propagators began operating an egg-taking station just below it. These activities prevented full use of the ladder. The fish ladder also suffered repeated damage by floodwaters in the early years and was repaired frequently. Records show the ladder being repaired following a flood the winter of 1909-1910. The ladder was damaged badly by floods in 1917 and was not repaired because egg-taking activities downstream at River Mill Dam prevented fish from reaching Cazadero. In 1939, the company rebuilt the ladder at a cost of about $22,000.

During the 1950s, the company modified the project to handle the water discharged by two units operating on peaking loads at North Fork. A new intake was constructed above the original Cazadero Dam, and a ½-mile-long concrete-lined tunnel was built. The company also built a new turbine generator beside the original powerhouse. A new fish ladder, constructed as part of the North Fork Project, provided passage around both the Cazadero and North Fork dams. The projects were completed in 1958.

In December 1964, a major flood on the Clackamas River severely damaged Cazadero Dam. The dam collapsed when another flood hit five weeks later in January 1965. It was replaced with a new concrete dam, named Faraday, in 1966.

River Mill Dam

The Oregon Water Power and Railway Company began building a second plant on the Clackamas River in 1909. The River Mill project, below the Cazadero plant and less than one mile northeast of Estacada, started generating power in 1911.

Upon completion, River Mill contained a concrete fish ladder that had received approval from Oregon's Master Fish Warden. The ladder was considered a model design for its day. Fish propagators immediately placed a fish rack below the ladder entrance to collect brood stock. The rack prevented full use of the fish ladder for migration over the dam until 1940. Eggs were taken below the ladder from 1913 through 1939, when the hatchery was abandoned.

In 1926, Portland General Electric improved the ladder at River Mill, although salmon migration was stopped most of the time by egg-taking operations. They constructed additional

pools at the lower end of the ladder, widened turning and resting pools, and moved apertures between the pools to meet new state requirements. The ladder was improved again in late 1939. This time the company improved the fish ladder entrance and installed an attraction water pump and diffusion chamber as recommended by the U.S. Bureau of Fisheries.

Passage improvements made at Cazadero and River Mill dams in 1939 restored fish passage to the upper Clackamas basin. When the new North Fork ladder became operable in 1958, the ladder over Cazadero Dam was removed.

A project to upgrade the fish ladder at River Mill should be complete by fall of 2006.

Oak Grove Project

In 1907, the Southern Pacific Company began looking to the Clackamas River Basin to secure power for its contemplated 340-mile Oregon electrification railroad system. The company took steps to secure this power source by filing notices of water appropriation on the Oak Grove Fork of the Clackamas in 1907 and on Three Lynx Creek in 1908. In 1911, the Portland Railway Light and Power Company (a predecessor to Portland General Electric) assumed all legal liabilities and assets of the Oak Grove project.

After a lapse of 10 years, the company again started work on the project. They completed construction of a concrete diversion dam on the Oak Grove Fork in 1923, creating Lake Harriet. No fish passage facilities were required at the dam as two natural 24-foot falls about one mile downstream of the dam blocked fish migration. The plant began generating power in 1924.

In 1952, Portland General Electric began investigating sites for new facilities on the Oak Grove Fork of the Clackamas River to supply additional peak capacity for the two existing Oak Grove generating units. The company decided to create a 430-acre-feet capacity forebay at Frog Lake. They began excavation in 1953. The Frog Lake forebay was placed in service that year. In 1997, Frog Lake was reduced in capacity to 266 acre-feet to control movement associated with ancient landslide terrain. The company also started investigations in the subbasin for another dam site in 1952. This dam would regulate flows to support increased energy generation at the Clackamas River hydro plants during the low flow period, September to April. The company selected a site at Timothy Meadows, about 1,000 feet downstream from a site investigated in 1910. In 1953-1954, they constructed a road up Oak Grove Fork Canyon from Lake Harriet to the selected dam site near the headwaters of the Oak Grove Fork under an agreement with the Forest Service. The company completed construction of a compacted-earth dam in 1956. The dam formed Timothy Lake, a 1,440-acre impoundment, which soon became a popular recreation site.

North Fork Dam

Investigations for a power site above the backwater of Cazadero Dam began in 1907. The project would ultimately become North Fork Dam. The company surveyed and mapped the site in 1907, and began extensive core drilling of the dam foundation in 1908. When the site was deemed suitable for development, the railroad was extended upriver from Cazadero Dam. Ultimate development of the project, however, did not occur until the power shortage period of the 1950s. In 1954, nearly half a century after initial investigations, Portland General Electric began new studies for the North Fork hydroelectric development. The project was completed in 1958.

Upon completion, the North Fork project included extensive fish passage facilities bypassing both Cazadero (later named Faraday) and North Fork dams. The project's 1.9-mile fish ladder transported fish from the river below Faraday and deposited them above North Fork Dam after climbing 196 feet. The ladder, 10 feet wide and 6 feet deep, included a fish trap that has normally been operated from June to October.

The company also built facilities to help downstream migrants. These included a collection device above North Fork Dam to attract the migrants and convey them to the North Fork fishway. Near the lower end of the fishway, they assembled a "separator" to pass fish from the fishway into a pipeline to carry them to the river below River Mill Dam. Today, downstream migrants are counted at the separator. Downstream migrants can also leave North Fork Reservoir over the spillway during high water. Construction of the North Fork project significantly improved fish passage upstream from River Mill Dam and Estacada Lake. Studies have shown that the North Fork screen and diversion facility effectively attracts and passes salmon and steelhead smolts because they typically migrate downstream near the water surface. The downstream migrant bypass is less effective at attracting chinook smolts away from the turbines as chinook often migrate at greater depths.

After discussions with the State of Oregon regarding fish losses and enhancements, Portland General Electric proposed to pay up to one million dollars for building a fish hatchery to be operated by the State of Oregon. The company and State reached formal agreement in 1975. The company committed to paying up to one million dollars for a fish hatchery capable of producing 50,000 pounds of salmonids annually. The state agreed to pay for any expenses to enlarge the hatchery or to produce more fish. All costs of operating and maintaining the hatchery are to be shared equally by the company and State. In signing the agreement, Portland General Electric did not admit past or present liability for abundance of fish on the Clackamas River, but entered the agreement with the purpose of cooperatively increasing salmon production of the river. In addition, the agreement stipulated that the company was not required to construct additional fish passage facilities, protection devices or modify power operations to improve fish passage. Construction of the hatchery began in 1977 on land that the company deeded to the State. The 17.5-acre site, which now supports the Clackamas Hatchery, lies next to McIver State Park on the Clackamas River.

3. Recent developments: 1975-present.

Timber production, agriculture, and urban development, the major land uses in the basin, may each be contributing to declines in water quality. These activities all have potential to contribute nutrients, either directly through soil erosion and inputs of fertilizers, for example, or through ecosystem or habitat disturbances that can alter nutrient cycling processes. The highest concentrations of nitrogen and phosphorus were found in tributaries draining land having these uses, whereas nutrient concentrations (and algal biomass) in streams in undisturbed watersheds, including upper Eagle Creek and Roaring River, were substantially lower.

4. History of hatcheries in the region

The drop in salmon and steelhead runs in the Columbia River fostered the development of fish culture. In the mid-1870s, cannery personnel in the Pacific Northwest began looking at hatchery production as a means to improve salmon harvest in the Columbia River. Upon the

recommendation of Livingston Stone, an agent for the U.S. Commission of Fish and Fisheries, they decided to construct their first hatchery on the Clackamas River. Stone had previously explored potential hatchery sites throughout the Columbia River Basin and found conditions on the Clackamas most acceptable for propagation. Hatchery interests acted quickly after salmon runs dropped significantly in 1876. Cannery personnel in the Pacific Northwest formed the Oregon and Washington Fish Propagating Company and began developing a hatchery on the Clackamas River at the mouth of Clear Creek.

Hatchery practices during this early period evolved through a process of trial and error. Fish propagators knew little about spawning, hatching and growing fish and generally learned by doing. Often they would hatch millions of fry and then release the unfed fry soon after they hatched. Consequently, the mortality rate was very high. A report by Waldo Hubbard, a superintendent of the Clackamas Station, describes some difficulties that early fish propagators faced. He reported that in January 1891 hatching took place very rapidly. They had to use troughs from a previously improvised hatchery to prevent the fry from suffocating. The hatching period ended in February. During and after this period, hatchery personnel released the fry within a three-mile stretch of river when they arrived at the age where they could begin taking food (U.S. Commission of Fish and Fisheries 1890-91). Other reports by early hatchery operators mention problems with disease, water supplies, and food sources that also resulted in high mortality.

Hatchery operators often gathered their brood stock from nearby streams. For many years, fish propagators on the Clackamas placed racks, or fences, with long pickets across streams to capture fish for egg-taking. The rack, placed in the stream before the fish arrived, kept the adults from passing above that point. As the fish neared the spawning period, they were driven downstream into collection traps. The females and males were then stripped for eggs and milt. This method was an adaptation of Indian fishing methods. Gillnets were also used to catch fish at the racks or in deep holes such as at the base of dams.

The hatching house above the mouth of Clear Creek on the Clackamas was completed in late summer 1877 with a capacity for 1 million eggs (U.S. Commission of Fish and Fisheries 1877). Livingston Stone began operating the facility for the United Sates Commission of Fish and Fisheries immediately after its completion. The site was named Stone, and the hatchery became the first such operation in Oregon and second in the United States (Lynch 1973).

The hatchery operated four years. During the first year, about 200,000 eggs were secured, but most were lost with a sudden rise of the river. Hatchery records show that 88,680 eggs were taken in 1877 at the hatchery site, and that 2,085,000, 2,035,100 and 2,838,000 eggs were taken in 1878, 1879 and 1880, respectively (Wallis 1960). Hatchery personnel estimated that they caught 2,000 adults in the racks in 1878 (U.S. Commission of Fish and Fisheries 1878). They released the young fall chinook fry in the Clackamas River soon after they hatched. Hatchery operations stopped in 1880 (Table 2). In 1882, the U.S. Commissioner of Fish and Fisheries again directed Livingston Stone to explore the Columbia River Basin for potential hatchery sites. After completing his search in 1883 he suggested that if Washington Territory and the State of Oregon could agree upon a code of protective laws for salmon (to prevent further overfishing), the Clackamas River would again teem with salmon as before and, in that event, perhaps the best point for a breeding station would be on that river (the Clackamas) where the (previous) station was built in 1877 (Mattson 1950).

In 1887, the newly created Oregon Fish Commission leased the abandoned hatchery at Clear Creek. They operated the facility for about one year, then shared operations with the U.S. Commission of Fish and Fisheries in 1888 after funds fell short. The federal commission bought the facility in 1889. The property, purchased for $5,155.60, included a rack 400 feet long, a 160-foot dam across Clear Creek, a flume, filtering tanks, a dwelling house, a house for workers, a hatching house and a stable — all in good condition. Fry from the station were planted in the Clackamas River and tributaries. In the late 1880s, hatchery operators moved some egg-taking operations to the lower Clackamas River after changes at a dam near Gladstone made it difficult for salmon to pass. Waldo Hubbard, superintendent at the Clackamas station, wrote that by July 1889 many "quinnat" salmon had collected below the obstructing dam across the Clackamas River. Records show that from late August to early November the propagators collected 4,314,000 eggs from 957 females. They caught many more males than females. The fish were collected using four traps, one below the dam and the others in shallows downstream. Fish propagators placed another obstruction rack below the Gladstone area dam in 1890 and captured 1,094 females that September producing 5,860,000 eggs (Hubbard 1889-90). They went below the dam again in 1891 after collecting only 800,000 eggs near the hatchery and gathered the reminder of the 2,036,000 eggs secured that year (McGuire 1894). Records suggest that many of the fish taken below the dam may have been fall chinook since spring chinook could pass except during low flows.

The number of adults reaching the Clackamas Hatchery egg station continued to disappoint hatchery operators in 1892. As a result, they decided to establish an egg-taking station on the Sandy River and look for other opportunities to secure hatchery eggs. In 1894, hatchery managers decided to stop further egg-take operations at Clackamas Hatchery until passage could be provided at the Gladstone Dam. The hatchery managers resumed egg-taking operations in 1895 after the Columbia River Packers Propagating Company put a ladder into the Gladstone Dam, providing satisfactory passage. From 1896 to 1900, the Clear Creek Hatchery operated with salmon eggs from the Clackamas. The hatchery also received eggs from outside the basin, including Michigan, California, and from the Salmon (a tributary of the Sandy River) and Little White Salmon rivers.

In 1895, the Columbia River Packers Propagation Company built a hatchery on the upper Clackamas near the mouth of the Collawash River. The remote site, about 50 miles above the town of Clackamas, was considered especially valuable because it was believed to be the only place in the Columbia River Basin where chinook eggs could be secured before July. Access to the hatchery was by trail only. Hatchery workers spent two or three days traveling about 30 miles to outfit the station. The facility was turned over to the U.S. Commission of Fish and Fisheries in 1897. In June 1897, hatchery personnel placed racks across the Clackamas River and Oak Grove Creek. Fish began collecting below the racks in late June. Between July 17 and August 26, about 5,045,000 eggs were taken from 2,250 salmon after part of the run escaped during high water (USFWS 1950). After hatching, the eggs were liberated as fry into the Clackamas River.

In May 1898, fish propagators again built racks across the upper Clackamas River and Oak Grove Fork. This time they captured 675 females for eggs from mid-July through August. Afterward, hatchery managers concluded that the upper Clackamas station was of little value for egg collection. They decided to use the station to hatch and rear eggs collected at the site or transferred from substations on the Salmon and Little White Salmon. The hatchery was abandoned in 1906. Hatchery managers also moved to limit operations at the lower Clackamas hatchery in 1898. They decided to stop egg collection at the station since arrangements had

already been made to collect eggs on the upper river, the Salmon River and the Little White Salmon. Instead, they began using the facility for hatching and rearing fry from eggs received from other stations (Hubbard 1898-90). In 1899, egg-taking operations began in September at the lower station. Very few fish were seen below the rack. Eggs for the hatchery were purchased from a Mr. Oldenburg who collected the eggs at a point about four miles below the station and sold them at a rate of 40 cents per 1,000 eggs (Downing 1900).

Fish culture remained more art than science in the early 1900s as hatchery operators continued to experiment with techniques and adapt them based on their successes and failures. For instance, in 1901 operators of the lower hatchery station reported heavy losses after feeding the fry canned salmon and clippings from the gauge knives used in canneries. These losses declined after they began feeding the fry liver mixed with cereal and seasoned with salt. The report also mentions that eggs incubated at the hatchery in 1901 hatched after 50 days and most were planted soon after (6,000,000 planted and 2,412,000 retained) because the hatchery lacked space for rearing. When hatchery propagators reached their capacity at the hatchery early that year, they opened the station's rack and allowed the remaining salmon to pass upstream (Carter 1901).

In 1900, propagators moved the lower Clackamas station downstream because the old site at the mouth of Clear Creek had an insufficient egg supply and poor water quality. The hatchery was moved to the present site of the Oregon Fish Commission Research Laboratory where it was operated until 1942. Hatchery records from 1901 note that personnel built a rack below the station in early August and began fishing with gillnets in late September. They continued collecting eggs until early November because of lack of space in the hatchery (Hubbard 1890-1891).

In 1904, the state transferred ownership of the upper Clackamas hatchery to the U.S. Bureau of Fisheries, giving the federal agency full control over salmon propagation in the Clackamas River Basin. The facility was abandoned in 1906 after operating for 10 years. During its years of operation, egg collection at the upper Clackamas hatchery ranged from 1.3 million to 5.1 million eggs, with more than 5 million eggs taken in two of the years.

Hatchery operations were moved again once Cazadero Dam was completed on the Clackamas River. Records show that the Cazadero fish hatchery was planned to be operational at the time the dam was completed, although a fish ladder was constructed with the dam. The hatchery was originally to be built on the right bank of the river about one mile below the dam. Instead, fish propagators built a temporary station on the left bank below the dam's wooden flume. Before a permanent facility could be developed, propagators decided to abandon the site in favor of a new station below River Mill Dam, which was under construction.

Reports from fish propagators below Cazadero Dam show that the spring chinook run was still strong at the time. They reported in 1907 that they had collected spawn from 529 female and 1,010 male spring chinook at the site below the dam. They added that their collection was hampered by the bottom morphology in the rack enclosure allowing about one-third of the fish to spawn naturally within the confines of the racks (Oregon Department of Fisheries 1909). Thus, about 2,309 spring chinook were taken at Cazadero Dam in 1907. This is a large number considering the river had been racked for hatchery egg collection since the late 1800s. From 1907 to 1911, more than 12.5 million salmon eggs were taken below Cazadero Dam.

In 1911, fish propagators moved the hatchery and egg-taking operations from the Cazadero site to one immediately below the newly constructed River Mill Dam. Hatchery construction coincided with the building of the dam. During construction of River Mill Dam, the Bureau of Fisheries asked the Oregon Water Power and Railway Company, Portland General Electric's predecessor, to place a pipe in the dam's bulkhead to supply water for the hatchery. Eggs were taken at this site below River Mill Dam from 1913 through 1939, when the hatchery was abandoned. Many eggs taken after 1935 were transferred to other hatcheries (Wallis 1960).

The Clackamas Hatchery continued to operate at the present site of the Oregon Fish Commission Research Laboratory until 1942. Eggs for the hatchery were collected on the Clackamas near the hatchery site and from below River Mill Dam. Eggs were also transferred in from as far away as Butte Creek and Battle Creek in California and the McKenzie River in Oregon. Releases of all races, local and foreign, were made directly into the Clackamas River.

In 1936, the U.S. Fish and Wildlife Service established a hatchery on Delph Creek, a tributary to Eagle Creek, on property that had previously been used for a state trout hatchery. The hatchery raised mainly spring chinook to rebuild the run in Eagle Creek. Some coho and steelhead were also reared at the facility.

D. ESUs identified by NMFS and current ESA status[5]

- NMFS classifies Eagle Creek NFH coho as a Type 2c hatchery population and includes them with the threatened Lower Columbia River Coho ESU

[5] *Section text from McElhany et. al. 2004.*

Lower Columbia River Coho Salmon Historical Accessibility

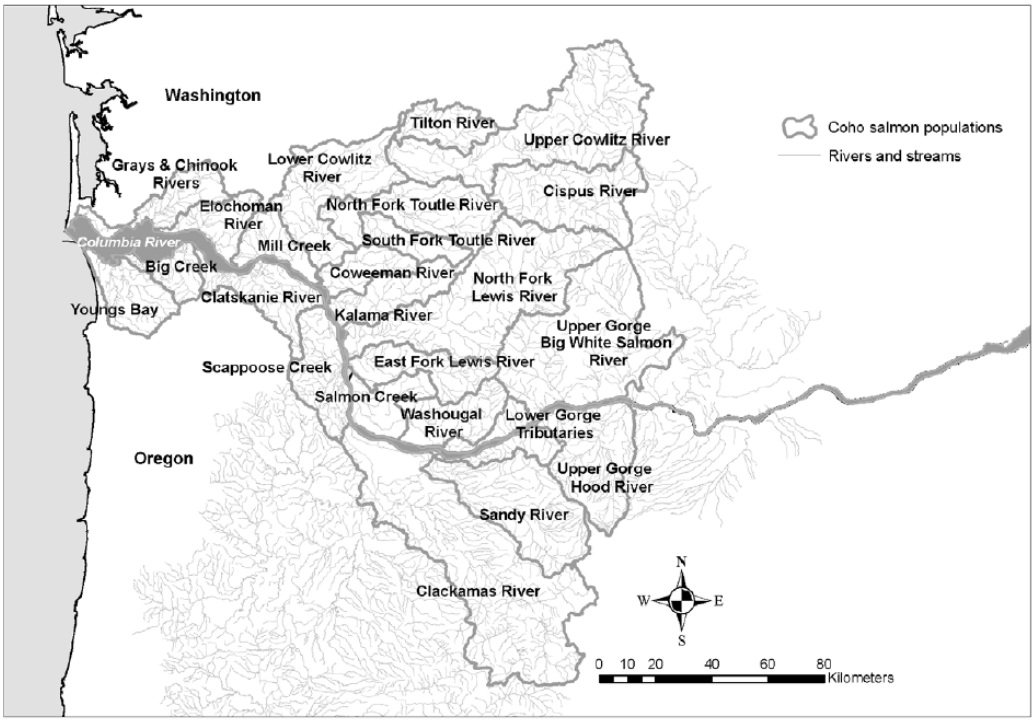


Figure E-72. Coho salmon population areas.

- Eagle Creek hatchery winter steelhead are not listed. Excluded by NMFS from the Lower Columbia Steelhead ESU.
- Clackamas River fall Chinook are listed as Threatened. Included with the Lower Columbia Chinook ESU

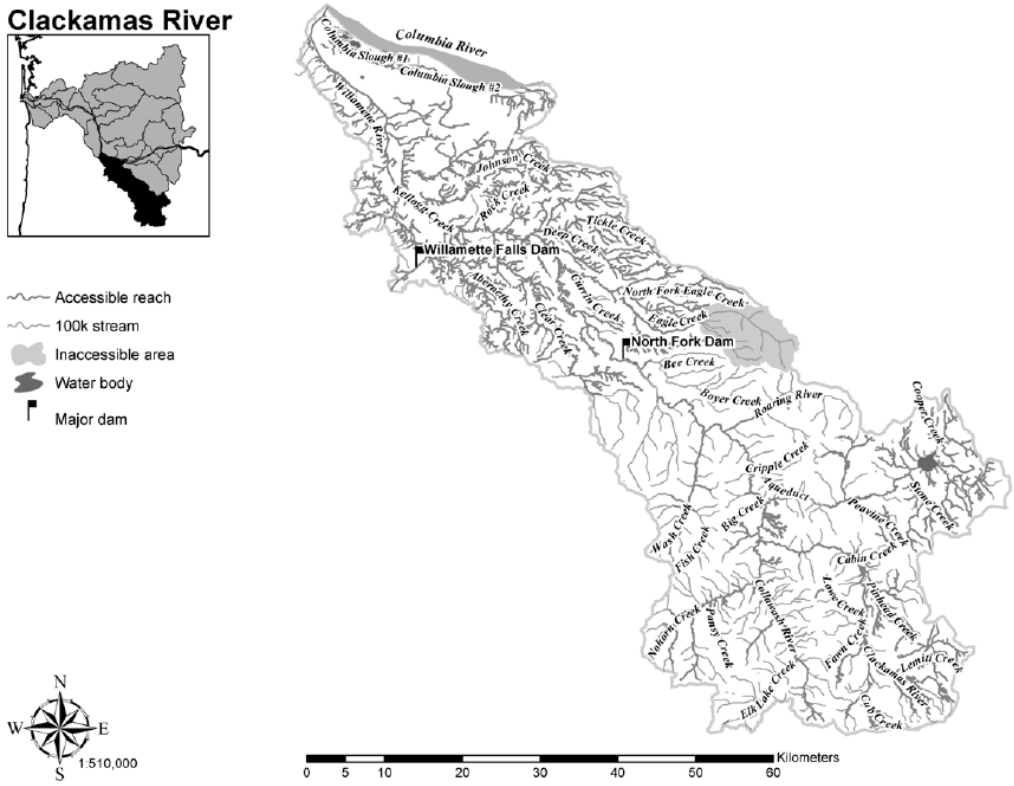


Figure E-4. Historical accessibility of fall Chinook salmon to the Clackamas River.

- Clackamas River spring Chinook are listed as Threatened. Included with the Upper Willamette Spring Chinook ESU

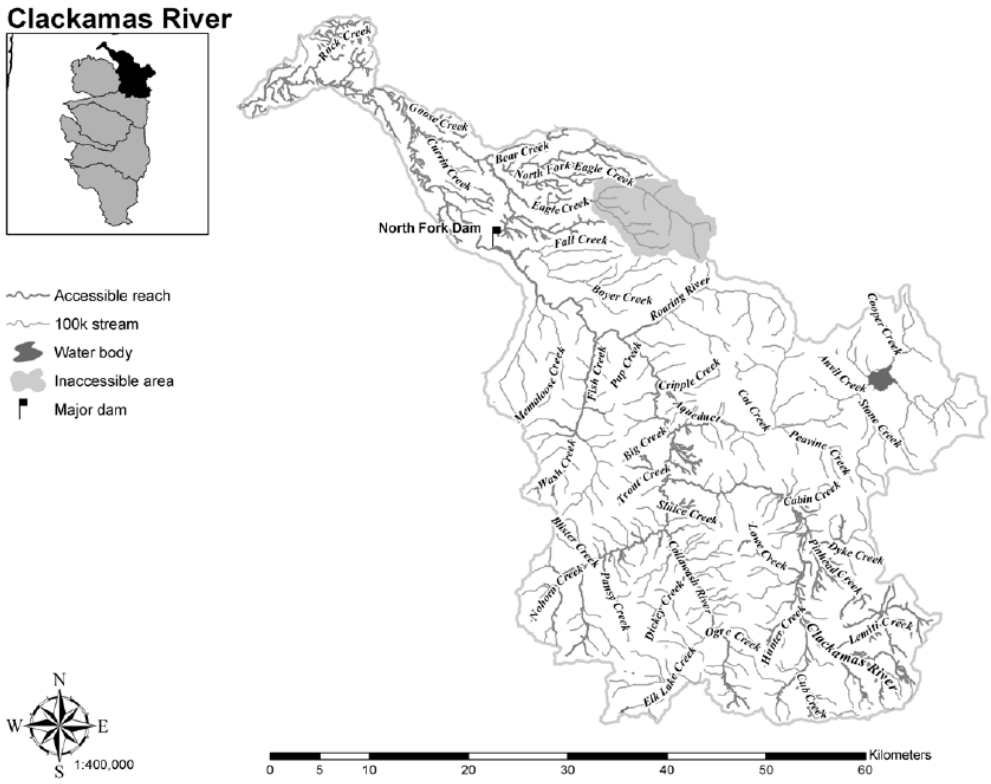


Figure E-35. Historical accessibility of spring Chinook salmon to the Clakamas River.

- Clackamas River hatchery spring Chinook are listed as Threatened. Included with the Upper Willamette Spring Chinook ESU

Upper Willamette River Spring Chinook Salmon Historical Accessibility

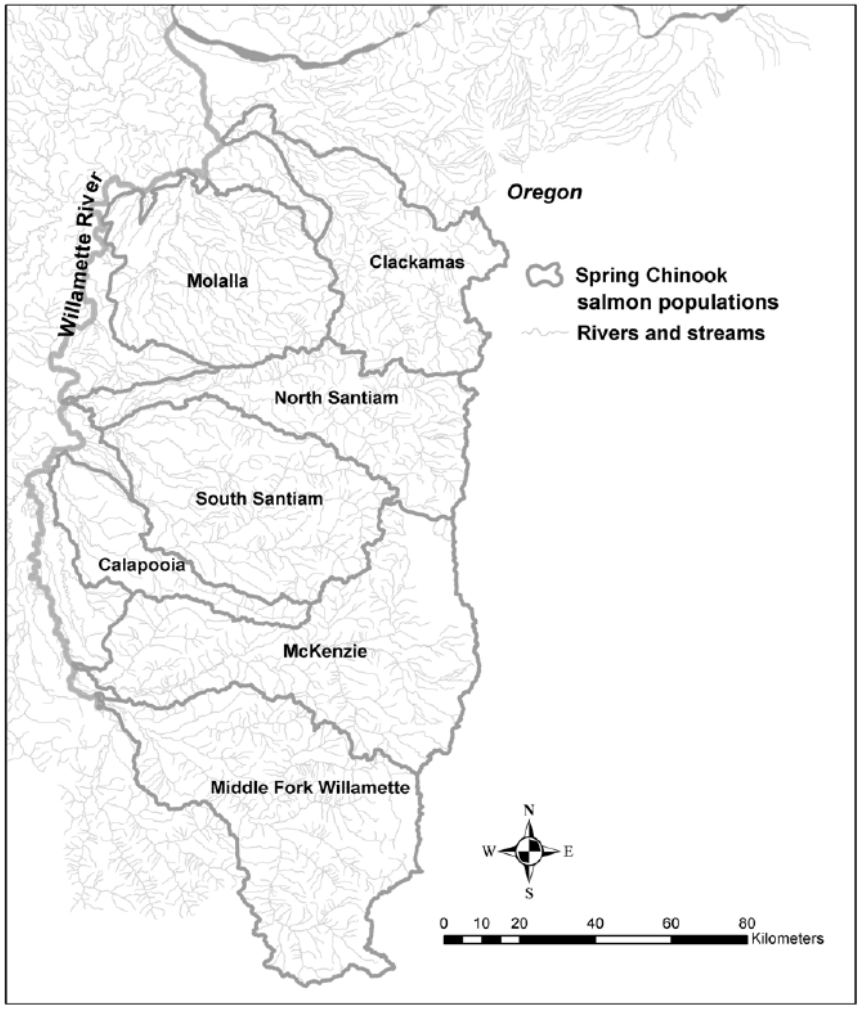


Figure E-33. Upper Willamette River spring Chinook salmon population areas.

- Clackamas River coho are listed as Threatened Part of the Lower Columbia Coho ESU

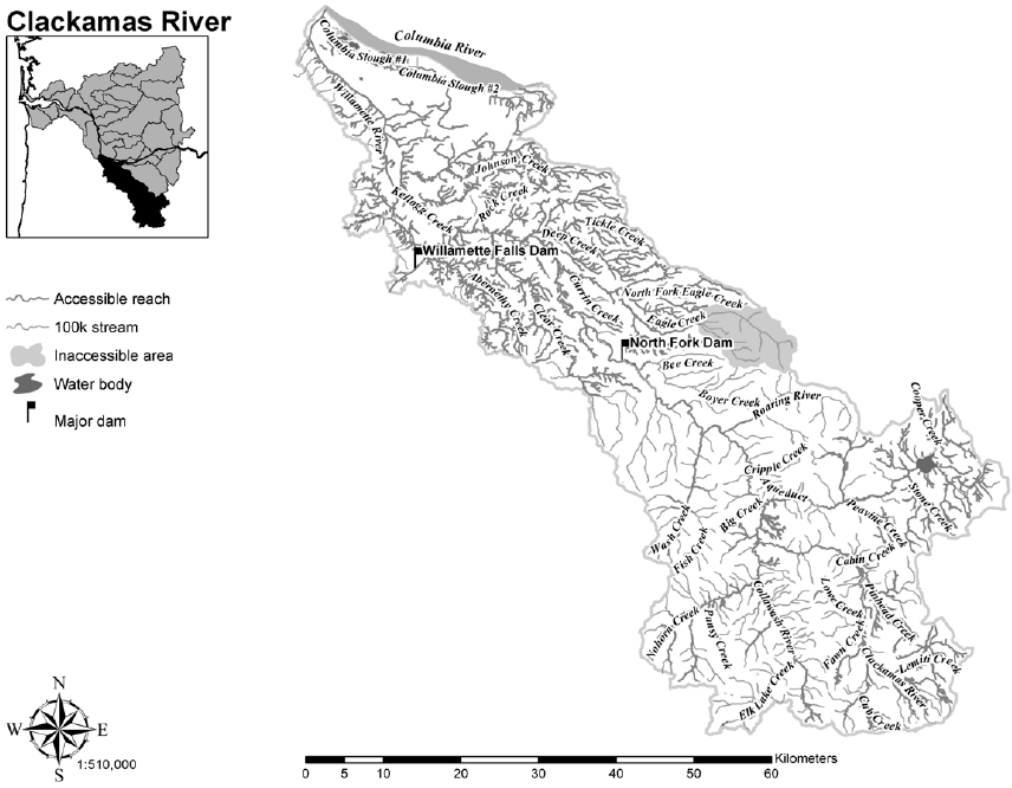


Figure E-76. Historical accessibility of coho salmon to the Clackamas River.

- Clackamas River "late" winter run steelhead are listed as Threatened. Included with the Lower Columbia Steelhead ESU

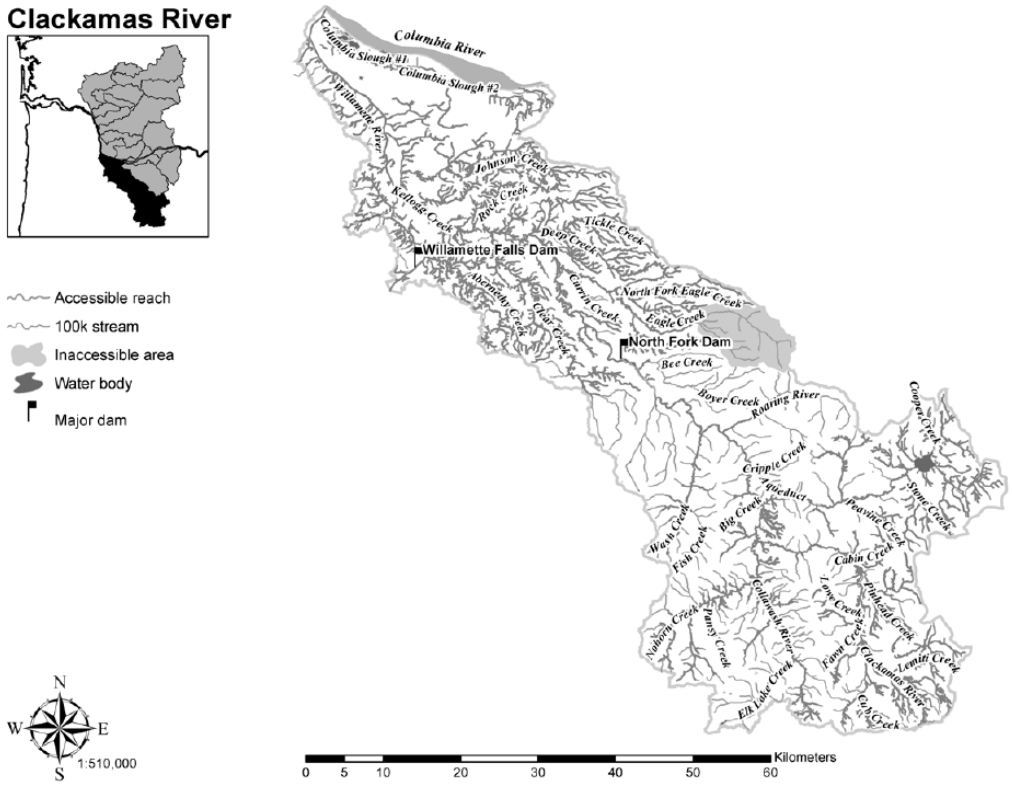


Figure E-50. Historical accessibility of winter steelhead to the Clackamas River.

- Clackamas River hatchery-run summer steelhead are not listed

E. Salmonid stocks in the region

1. Stocks identified by state and tribal comanagers

- Eagle Creek hatchery coho (segregated harvest)
- Eagle Creek hatchery "early" winter-run steelhead (segregated harvest)
- Clackamas River fall chinook (natural)
- Clackamas-River spring chinook (natural)
- Clackamas River hatchery spring chinook (segregated harvest)

- Clackamas River coho (natural)
- Clackamas River winter-run steelhead (natural + integrated harvest)
- Clackamas River (Skamania) hatchery summer-run steelhead (segregated harvest)
- Clackamas River cutthroat trout
- Clackamas River bull trout (extirpated)

2. "Independent populations" and "major population groups identified by NMFS

The Population Identification Subcommittee of the Willamette-Lower Columbia Technical Recovery Team (WLC-TRT) convened in 2000 to review information relevant to the identification of historical, demographically independent populations (DIPs) of listed Chinook salmon (Oncorhynchus tshawytscha), steelhead (O. mykiss) and chum salmon (O. keta) within their recovery domain. In 2004 coho salmon (O. kisutch) were included in response to the proposed listing of lower Columbia River coho salmon under the U.S. Endangered Species Act. These are the preliminary conclusions of the subcommittee:

- In the Lower Columbia River Chinook Salmon Evolutionary Significant Unit (ESU), 32 DIPs—23 fall and late fall runs and nine spring runs—existed historically.
- In the Upper Willamette River Chinook Salmon ESU, seven DIPs existed historically.
- In the Lower Columbia River Steelhead ESU, 23 historical DIPs were identified.
- In the Upper Willamette River Steelhead ESU, four historical DIPs were identified.
- In the Lower Columbia River Coho Salmon ESU, 24 historical DIPs were identified.
- No coho salmon DIPS existed historically in the upper Willamette River.
- In the Lower Columbia River Chum Salmon ESU, 17 historical DIPs were identified.
- No chum salmon DIPs existed historically in the upper Willamette River.

F. Current regional management objectives for salmonid resources

Upstream of North Fork Dam: Salmonid populations are restricted to naturally spawned fish only. No hatchery fish are passed with the exception of catchable rainbow trout released in North Fork Reservoir. Fishing upstream of North Fork Dam is catch and release only, no bait, again with the exception of marked rainbows in North Fork reservoir. Hatchery fish returning to North Fork trap are hauled back downstream for the fishery, or to the hatchery for rendering or in the case of hatchery steelhead to Faraday Lake for the trout fishery.

Downstream of North Fork Dam: The emphasis is to provide a fishery on hatchery fish, while trying to minimize impacts to wild fish, so unmarked fish must be released. The release strategy for hatchery fish is to have them return to areas of big public accessibility (acclimation sites) to maximize catch and/or have them return to sites where they can be removed before they spawn in

the wild. In addition, ODFW has switched to use of native broodstock for winter steelhead and no out of basin transfers for spring Chinook to reduce the opportunity of infusing non-native genetics from hatchery fish spawning naturally.

G. Current state, federal, and tribal hatchery programs/facilities in the region

1. Federal

a) Eagle Creek NFH[6]

The Eagle Creek NFH is located near Estacada, OR, approximately 40 miles southeast of Portland, OR, on 126 acres of deeded land and 600 acres of Bureau of Land Management reserved land. The hatchery is also responsible for maintaining two fish-way ladders on Eagle Creek. The lower ladder (Dwyer Falls) is just downstream of the confluence of the North Fork (creek mile 6) and the middle ladder at creek mile 9. The hatchery raises 1.5 million coho salmon and 150,000 winter steelhead annually. The hatchery releases 500,000 coho and the winter steelhead on site with 500,000 coho transferred to the Yakama Nation and 550,000 coho transferred to the Nez Perce Tribe.

2. State

a) Clackamas State Fish Hatchery (Oregon Department of Fish and Game)[7]

Clackamas Hatchery is located on the Clackamas River, approximately 5 miles west of Estacada, Oregon. The hatchery is operated by Oregon Department of Fish and Wildlife with approximately 5 FTE. Rearing units consist of 3 rearing ponds, 10 raceways and 2 adult holding ponds. The hatchery began operations in 1979 and is operated from four funding sources: Oregon Department of Fish and Wildlife, National Marine Fisheries Service, Portland General Electric, and the City of Portland (IHOT 1996). The hatchery raises spring Chinook salmon (700,000 smolts + 300,000 pre-smolts) and winter steelhead trout (165,000 yearling smolts, which includes 25,000 each to Cassidy Pond and Foster Creek). The spring Chinook salmon are a segregated Willamette River stock and the winter steelhead are an integrated Clackamas River stock. Eggs and fish are moved from Clackamas hatchery to other hatchery facilities because summer use water problems exacerbate pathogen levels and severely reduce survival. exacerbate pathogen levels and severely reduce survival. exacerbate pathogen levels and severely reduce survival.

Summer steelhead juvenile fish are also released into the Clackamas River from other hatchery programs (South Santiam – Skamania stock at 400,000 prior to 1998 and 170,000 since 1998 (Tod Alsbury ODFW July 24, 2006 communication). Trout stocking also occurs in the North Fork Clackamas River reservoir.

[6] *Section text from ECNFH CHMP.*

[7] *Section text from ODFW 2006.*

3. Tribal

a) None

H. Special considerations in region (e.g., ESA listings, Habitat Conservation Plans, Fishery Management Plans, FERC relicensing, etc.)

- Oregon Chub – The Clackamas population is apparently extirpated. Most locations containing Oregon chub are currently isolated from others that comprise the local population. Current flow management in the Willamette basin restricts movements between populations.

- Bull Trout– The Clackamas population is apparently extirpated.

- ODFW – Wild Fish Management Plan

  Listed species occupying habitats in the lower Clackamas River and its tributaries, the lower Willamette River, and the lower Columbia River migration corridor(s) may be impacted by the presence of Eagle Creek NFH coho salmon and winter steelhead trout. NMFS ESA listed populations that may be incidentally affected are:

  - Steelhead Trout *(Oncorhynchus mykiss)*, Lower Columbia River ESU (Threatened Species, 63 FR 13347; March 19, 1998).

  - Chinook Salmon *(Oncorhynchus tshawytscha)*, Lower Columbia and Upper Willamette River ESUs (Threatened Species, 64 FR 14308; March 24, 1999).

  - Coho Salmon (*Oncorhynchus kisutch*), Lower Columbia River / Southwest Washington ESU (Candidate Species in 2004, subsequently listed as Threatened Species, 2005)[a]

  [a] Note: the Oregon Fish and Wildlife Commission listed lower Columbia River wild coho salmon as an endangered species in July 1999. For the Clackamas River this constitutes the late-stock wild coho salmon produced primarily upstream of the North Fork Dam on the Clackamas River.

  (Murtagh 1992)

- PGE FERC re-licensing

II. Eagle Creek National Fish Hatchery

A. Description of hatchery

- Eagle Creek NFH is at Rkm 16 on Eagle Creek, (46°16'34" N Lat. and 122°12'04" W Long.) which flows into Rkm 27 on the Clackamas River, which flows into Rkm 40 of the Willamette River, which flows into Rkm 163 of the Columbia River, HUC code 17090011 (ECNFH Steelhead HGMP, p. 9)

- The hatchery is located on Eagle Creek, 12.4 miles upstream from it's confluence with the Clackamas River, in Clackamas County, Oregon. (ECNFH Update, p. 1)

- The facility began producing tule fall and spring Chinook salmon in 1956. (ECNFH Update, p. 1)

- The hatchery abandoned fall Chinook production very quickly, but continued to raise spring Chinook salmon until 1987, when production was discontinued due to funding and other production priorities. (ECNFH Update, p. 1)

- Eagle Creek NFH currently produces coho salmon and winter steelhead exclusively. (ECNFH Update, p. 1)

- No ESA fish are reared at hatchery. (ECNFH Steelhead HGMP, p. 43)

- Today the U.S. Fish and Wildlife Service operates Eagle Creek National Fish Hatchery to restore and maintain coho salmon and winter steelhead to provide sport and commercial fisheries and provide a source of coho salmon for Tribal restoration programs upstream of Bonneville Dam. (ECNFH Update, p. 1)

- Eagle Creek National Fish Hatchery is authorized by laws and agreements to mitigate for salmon and steelhead losses at Federal dams and other Federal activities (Mitchell Act). (ECNFH Steelhead HGMP, p. 9)

- Funding for the hatchery is through Mitchell Act funds, which are administered by NOAA Fisheries. (ECNFH Update, p. 1)

- Eagle Creek National Fish Hatchery is authorized by laws and agreements to mitigate for salmon and steelhead losses at Federal dams and other Federal activities (Mitchell Act). (ECNFH Steelhead HGMP, p. 9)

- Type of program –
    - Steelhead--Isolated Harvest (Lower Columbia River) (ECNFH Steelhead HGMP, p. 3)
    - Coho— (ECNFH Coho HGMP, p. 1)
        - Isolated Harvest (Lower Columbia River)
        - Integrated Recovery (tribal restoration programs)

- Purpose (Goal) of program –

  - Produce winter steelhead trout to help *mitigate* for fish losses in the Columbia River Basin caused by federal dams and provide opportunities for sport fisheries. (ECNFH Steelhead HGMP, p. 3)
  - Produce coho salmon to help *mitigate* for fish losses in the Columbia River Basin caused by federal dams, to provide fish for commercial, sport, and tribal harvest, and to provide fish to support tribal *restoration* programs upstream of Bonneville Dam. (ECNFH Coho HGMP p.1)

- Legal Justification for the program: (ECNFH Steelhead HGMP, p. 3; ECNFH Coho HGMP, p.1)
  - Treaty of 1855
  - Mitchell Act
  - Fish and Wildlife Act
  - Pacific Northwest Electric Power Planning and Conservation Act
  - U.S. v Oregon court agreements

- Eagle Creek NFH currently operates as part of the Columbia River Fisheries Development Program and is funded through the Mitchell Act - a program to provide for the conservation of Columbia River fishery resources, administered by NOAA Fisheries (NMFS). This program is a part of the mitigation for habitat loss resulting from flooding, siltation, and fluctuating water levels caused by Bonneville Dam. The Columbia River Fish Management Plan under U.S. v Oregon is currently under renegotiation, however, current production goals are generally consistent with the production goals in the expired plan. (ECNFH Steelhead HGMP, p. 3)

- In addition, Eagle Creek NFH production is consistent with court adopted management agreements for upper Columbia River fall Chinook, steelhead, and coho which specifically identifies production from Eagle Creek NFH for tribal restoration programs. (ECNFH Coho HGMP)

- The funding source for the Eagle Creek National Fish Hatchery (NFH) is through Mitchell Act funding, administered by the National Marine Fisheries Service. (ECNFH Steelhead HGMP, p. 2)

- The approved staffing matrix for the hatchery includes 7 permanent and 1 term employee; includes the project leader, assistant manager, program assistant, maintenance mechanic and four fish culturists. (ECNFH Steelhead HGMP, p. 2; Coho HGMP, p. 2)

- The annual hatchery O&M cost for FY 2002 for the combined production of coho salmon and steelhead trout was $524,000, approximately $25,000 less than needed. The balance of funds in FY 2002 were supplied by the Yakama Nation which purchased fish food for the coho program. ECNFH Steelhead HGMP, p. 2-3; Coho HGMP, p. 3)

- A return of 3,000 adult coho salmon is needed to collect enough eggs for a full production of 0.5 million fish for on-station volitional release, in addition to a 1.3 million egg and 1.05 million pre-smolt transfer for Tribal and the State of Idaho restoration programs, above Bonneville Dam. (ECNFH Update, p. 2 and ECNFH CHMP)

- A return of 350 adult winter steelhead is needed to collect enough eggs for full production for the on-station volitional release of 150,000 smolts. (ECNFH Update, p. 2 and ECNFH CHMP)

B. Hatchery water sources

- Eagle Creek is the water source for the Eagle Creek NFH. (ECNFH Steelhead HGMP, p. 26)
- The main water source for the hatchery is Eagle Creek. (ECNFH Update, p. 1)
- Water rights for the Eagle Creek NFH total 110.02 cfs. This includes 0.02 cfs from one spring for incubating eggs, two fish ladder passage ways at 27 cfs each located downstream of the hatchery in Eagle Creek, and 56 cfs for fish culture use derived from the hatchery intake structure located one quarter mile upstream of the hatchery in Eagle Creek. (ECNFH Steelhead HGMP, p. 32)
- Water withdrawals for hatchery operation are not expected to have a significant negative impact on natural spawning populations. Hatchery effluents meet established NPDEP release standards criteria and are diluted by the flow in Eagle Creek reducing potential negative impacts to natural stocks. (ECNFH Steelhead HGMP, p. 26)
- Water use for production ranges from 5,785 gpm to 12,380 gpm. (ECNFH Steelhead HGMP, p. 33)
- The hatchery monitors water discharges and is in compliance with the current NPDES permit. (ECNFH Steelhead HGMP, p. 33)
- The hatchery has low water alarm probes positioned in three strategic locations to prevent fish losses due to water flow failures. The alarm system is linked with a 24hr./ 7day security operator. Operators telephone hatchery staff and identify the trouble zone. Also the alarm sounds on station to alert staff. (ECNFH Coho HGMP, p.9-40)
- Hatchery intake screens currently conform with NMFS screening guidelines. (ECNFH Steelhead HGMP, p. 33)
- An impassable barrier (falls) just above the hatchery site precludes access to the watershed above the hatchery for anadromous species use. (ECNFH Steelhead HGMP, p. 26)

C. Adult broodstock collection facilities

- Fish enter the hatchery volitionally via a fish ladder below an electric weir. Fish are trapped in the fish ladder after passing through a V-trap which is installed on one of the steps of the ladder. (ECNFH Steelhead HGMP, p. 33)
- Adult fish are manually netted in the fish ladder, placed in a 300 gallon fiberglass tank which is mounted on a pickup and transported to the adult holding channel where they are held for sorting. (ECNFH Steelhead HGMP, p. 33)

D. Broodstock holding and spawning facilities

- Brood stock facilities a 10' x 120' x 3' holding channel. A mechanical crowder moves the fish into a braille lift from which the fish slide into the carbon dioxide anesthetic tank. (ECNFH Steelhead HGMP, p. 33)

- The fish are checked for ripeness with green fish being returned to the upper section of the holding channel. Ripe fish are killed using a guillotine and placed on aluminum racks. (ECNFH Steelhead HGMP, p. 33)

E. Incubation facilities

- Egg incubation takes place in the nursery building using six (6) vertical 16-tray incubators with trout screens. (ECNFH Steelhead HGMP, p. 33)

- Water flow is initially set at 3 gpm and increased to 4 gpm after hatching. (ECNFH Steelhead HGMP, p. 33)

- Water use is primarily ambient Eagle Creek with limited spring water available for warmer incubation water to speed up egg development. The ambient water flows through a down-flow gravel bed prior to incubation or nursery tank use. (ECNFH Steelhead HGMP, p. 33)

- Eggs are treated 5 times weekly with 1,667 ppm formalin for fifteen (15) minutes to control fungus. The formalin is dispensed using a delivery system ensuring proper dilution and timing. (ECNFH Steelhead HGMP, p. 34)

F. Indoor rearing facilities

- Rearing of winter steelhead begins inside the hatchery building in 3' x 16' x 3' fiberglass nursery tanks with a 30 gpm flow of filtered Eagle Creek water. (ECNFH Steelhead HGMP, p. 34)

G. Outdoor rearing facilities

- Rearing facilities at Eagle Creek NFH include 75 8’x80’ raceways and one adult holding/rearing pond. (ECNFH Update, p. 1)

- The main water source for the hatchery is Eagle Creek.

- When the steelhead attain a size of 250-300 fish/lb, they are moved to the outside 8' x 80' x 2' raceways for rearing. (ECNFH Steelhead HGMP, p. 34)

- The fish are held in the raceways until late March when the pond screens are removed allowing the fish to volitionally migrate downstream. (ECNFH Steelhead HGMP, p. 34)

- There are three upper banks of twelve raceways and three lower banks of thirteen raceways. (ECNFH Steelhead HGMP, p. 33)

- During low creek flows water is serial used through all six banks of raceways. In 2001 the water line to the upper raceways was replaced with a larger size that increased the potential for 25% more water flow. (ECNFH Steelhead HGMP, p. 33)

H. Release locations and facilities

- The fish are volitionally released from their production raceways into Eagle Creek. (ECNFH Steelhead HGMP, p. 34)

I. Outmigrant monitoring facilities

- There are no outmigrant monitoring facilities. Impoundment structures on both the Clackamas and Willamette Rivers are upriver of the migration route for Eagle Creek NFH releases. (pers. comm. D. Dysart 2006)

- There are several dams that provide power to the growing region. Three dams — River Mill (RM 23.3), Faraday (RM 28.4) and North Fork (RM 30.1) — are owned and operated by Portland General Electric and sit on the lower Clackamas River. Fish bypass facilities were originally constructed for these dams. Eagle Creek enters the Clackamas River at RM 16, below these structures. (Fisheries Partnerships in Action, Accomplishment Report 2004 and 2005 p. iv)

- Through the use of small abdominal radio tags, the downstream movement of coho and steelhead yearlings in Eagle Creek and the Clackamas River have been observed during the past two years. Results of the tagging initially shows that both species move rapidly downstream through the system. Some steelhead tags have not been picked up through the migration corridor and may be an indicator of residualism or lost tags. (CHMP, p. 40)

J. Additional or special facilities

- The hatchery is also responsible for maintaining two fish-way ladders on Eagle Creek. The lower ladder (Dwyer Falls) is just downstream of the confluence of the North Fork (creek mile 6) and the middle ladder at creek mile 9 (CHMP, p. 19).

K. Outreach and public education facilities/programs

- Although hatchery is close to a major metropolitan area, it has a very limited outreach program. On station activities include tours of the facility to schools and special interest groups. Fall spawning of coho salmon, winter spawning of steelhead and early summer rearing are the most popular tour times. Hatchery staff takes advantage of these opportunities to give the visiting public a better understanding of hatchery operations and the life cycle of salmon.

- Off station outreach efforts focus primarily on formal presentations to special interests groups. A majority of these presentations describe Basin-wide fishery restoration and enhancement efforts where the use of hatcheries is integrated with the more global issues of Columbia River water management, habitat restoration, harvest management and operation of the hydropower system. (CHMP p.65)

- Some assistance with environmental education and outreach activities has been provided by the Columbia Gorge Information and Education Office located at the Spring Creek NFH. Eagle Creek NFH may become a full participant of the Columbia Gorge outreach team, providing an opportunity to expand their outreach efforts.

- Formerly, Eagle Creek NFH had a Kid's Fishing Day but this was discontinued because the state would no longer outplant the left-over fish.

L. Special issues or problems (e.g. water and property rights issues, law suits, etc.)

Steelhead

- Increased demands on hatchery programs, including those required by ESA Biological Opinions, have strained hatchery budgets. Reductions in production programs are being made. Reducing hatchery production may allow the hatchery, and the Service, to meet some ESA requirements, but may not uphold mitigation and tribal trust responsibility. The Service is working with NOAA-Fisheries and other co-managers to address current budget shortfalls. (ECNFH Steelhead HGMP, p. 9)

- Tribal managers generally disagree with the management strategy for mass marking and selective fisheries.

- In the past, there probably has been an overlap between the early winter steelhead (hatchery program) and native late winter fish in Eagle Creek. This should be expected as the current hatchery strain is a composite of the late winter fish, the original spawning population at the hatchery, mixed with earlier returning fish from Big Creek, University of Washington and the Skamania River. The Eagle Creek early-run stock, although starting as early as December, is strongest in mid-February through mid-March. For native late-run winter steelhead trout, adults would be expected in Eagle Creek during March, April, and May, with the peak of the adult migration occurring in April and May. (ECNFH Steelhead HGMP, p. 9)

- The states of Washington, Oregon and Idaho are implementing selective sport fisheries on marked hatchery fish. This selective fisheries management strategy requires that all hatchery produced fish targeted for harvest be mass marked. (ECNFH Steelhead HGMP, p. 9)

Coho

- **Insufficient Operations and Maintenance Funding Through the Mitchell Act.** Increased demands on hatchery programs, including those required by ESA Biological Opinions, have strained hatchery budgets. Reductions in production programs are being made. Reducing hatchery production may allow the hatchery, and the Service, to meet some ESA requirements, but may not uphold mitigation and tribal trust responsibility. The Service is

working with NOAA-Fisheries and other co-managers to address current budget shortfalls. As of December 2003, Eagle Creek NFH is in-process of eliminating the one million smolts that have been destined for the Clatsop Economic Development Commission (CEDC) in the lower Columbia River and transferring one staff person to another non-Mitchell act funded facility. The on-station release will be maintained at 500,000 smolts. (ECNFH Coho HGMP, p. 9)

- **Tribal Programs.** Eagle Creek NFH supports important tribal restoration programs, including approximately 550,000 coho yearlings for the Nez Perce Tribe to the Clearwater River, Idaho and 500,000 coho yearlings for the Yakama Nation to the Yakima River, Washington. The goal is to help support the tribal development of locally adapted brood stock.

- Coho salmon reared at Eagle Creek NFH for transfer to tribal programs have varied during the past 10 years. The varying production in numbers, size, time of transfer and transfer destination to the tribes has been due to program changes at the federal hatcheries, budget problems, and fish health concerns. Future funding and policy decisions will continue to dictate changes in the production program for the tribes. (ECNFH Coho HGMP, p. 9-10)

- **Marking.** The states of Washington, Oregon and Idaho are implementing selective sport and commercial fisheries (non-tribal) on marked hatchery fish. This selective fisheries management strategy requires that all hatchery produced fish targeted for harvest be mass marked.

- Tribal managers generally disagree with the management strategy for mass marking and selective fisheries. Juvenile fish transferred to the Tribes are usually tagged with an internal coded-wire tag for evaluation purposes but not mass marked solely with an adipose fin clip. (ECNFH Coho HGMP, p. 10)

- **Ladder Operations and Unmarked Coho Salmon Adults.** The historical parentage of coho salmon at Eagle Creek NFH is a mixture of Sandy River, Toutle River and Big Creek stocks, which were brought to the hatchery to initiate production of early-run coho salmon. Early-run hatchery coho salmon are collected for brood stock at the hatchery rack September through November. Spawning operations typically occur October through November, with the peak typically in late October. The native, late-run coho salmon start passing over the North Fork Dam on the Clackamas River in October and November, with peak numbers migrating past the dam in December, January, and February. Natural spawning of late-run coho occurs from late-January through mid-March with a peak in mid to late February. Most of the production of late-run wild coho occurs above North Fork Dam on the Clackamas River and the use of Eagle Creek by native, late-run coho is unknown. There may also be adults returning to the hatchery which are the progeny of natural spawning hatchery adults in Eagle Creek. All of these fish would be unmarked, naturally produced fish.

- All juvenile coho salmon reared at Eagle Creek NFH and released into Eagle Creek are marked by an adipose fin clip (450,000), an adipose fin clip plus coded-wire tag (25,000), or a coded-wire tag (CWT; 25,000 with no external fin clip) only. On spawning days, fish are sampled for marks/coded-wire tags, with the sampling occurring after the fish have been killed. Only a sample of the total hatchery return is typically sampled, unless fewer than 1,000 fish return. All non-adipose clipped coho adults are sent through the tag detector to determine presence/absence of a CWT. Because of the run-timing separation and marking efficiency is less than 100%, it is believed that the small component of unmarked to marked fish returning are most likely hatchery fish and not the native, late-run stock. However, any coho salmon

returning after November 25 with a full adipose fin and absent of an internal coded-wire tag is designated as a native late-stock coho and returned to the stream. (ECNFH Coho HGMP, p. 10)

M. History of Hatchery Stocks at Eagle Creek National Fish Hatchery[8]

The Eagle Creek NFH was built in 1956 to propagate tule fall Chinook, spring Chinook, coho salmon and winter steelhead trout with the fish being liberated in the Clackamas River watershed. Initial stocks utilized at the hatchery from outside the watershed involved tule fall Chinook salmon from the Spring Creek NFH, Willamette River spring Chinook, and coho salmon from the Sandy River, OR, Big Creek, OR and Toutle River, WA. A few spring Chinook, coho salmon and steelhead trout entered the hatchery trap and were also utilized in establishing the hatchery run.

Tule Fall Chinook Salmon (program terminated in 1968)

Tule fall Chinook were not able to ascend Eagle Creek during the early fall months and remained in the Clackamas River or that part of Eagle Creek downstream of the lower falls to spawn. Continuation of this propagation program necessitated the annual receipt of eyed eggs or fry from the Spring Creek NFH from 1956 through 1968, the last year tule fall Chinook were reared at Eagle Creek. Except for 1961 and 1965, when no eggs or fry were received, Eagle Creek's Tule fall Chinook program varied from 1,500,000 to 7,500,000 eggs/fry annually. Tule fall Chinook fingerlings were released in Eagle Creek, Mollala River, Clackamas River, Willamette River, Santiam River and the McKenzie River.

Spring Chinook Salmon (program terminated in 1987)

Although a few spring Chinook initially entered the trap on Eagle Creek in 1957, the spring Chinook run in Eagle Creek was initially built on eggs received from Willamette River, Santiam River and McKenzie River stocks. The spring Chinook program at Eagle Creek varied from an on-station release of 200,000 in 1958 to 1,800,000 in l967. Additional releases were made into the north fork of the Clackamas River, the mainstem Clackamas River, the Molalla River, and the Warm Springs River. In 1987, with a management decision to focus on coho salmon, the program terminated with the release of spring Chinook smolts in April 1987.

Coho Salmon

Coho salmon production at the Eagle Creek NFH began with the receiving of eyed eggs from brood year (BY) 1956 adults of Toutle River and Sandy River parentage. During following years, additional eyed eggs were received from Sandy River, Big Creek and Elochoman River early returning stocks, which spawn in October and November. At the same time, Eagle Creek native coho salmon adults were trapped and spawned at the hatchery during late November through February, providing a late run of coho. The rearing of the late run coho was discontinued in the mid-1960's in favor of the early run coho which were more desirable to and contributed more to the ocean and lower Columbia River commercial fisheries. Coho salmon reared at Eagle Creek were mostly released at the hatchery with additional releases in nearby streams including the north fork of the Clackamas River, Delph Creek, Deep Creek, North Fork Eagle Creek, and the Mollala River.

[8] *Section text from ECNFH CHMP, p. 35-37.*

With the termination of the Spring Chinook production program at Eagle Creek in 1987, the hatchery increased coho production, which was transferred to release sites in estuaries of the lower Columbia River. These release sites were developed into net pen acclimation sites where the yearling coho smolts were held 2-3 weeks prior to release. This program was developed in concert with efforts by NOAA-Fisheries to move the commercial gill netting of salmon from the mainstem lower Columbia River into terminal fishery areas in an effort to reduce the take of threatened and endangered upriver stocks of salmon. The hatchery program involved rearing 1.0 million fish for release at the hatchery and 1.0 million smolts for transfer to net pen sites in Young's Bay, Tongue Point and Blind Slough. The hatchery also became involved in the rearing of coho salmon to assist the Yakama Nation (YN) restore coho salmon runs in the Yakima, Wenatchee and Methow Rivers. Up to 500,000 yearling coho smolts were transferred to various acclimation sites on these rivers annually.

With the return of adult coho back to the Wenatchee River system (BY 2000), and the disease finding that some of the adult fish tested positive for infectious hematopoietic necrosis virus (IHNV), a disease deadly to steelhead trout, it was determined that the coho eggs from the Wenatchee River would not go to Eagle Creek for rearing. Instead of rearing coho for the YN, the hatchery began rearing 550,000 yearling smolts for the Nez Perce Tribe for restoration of coho in the Clearwater River Basin, Idaho. This was a trade in production programs between the Little White Salmon/Willard NFH Complex and Eagle Creek NFH. In 2003, with a substantial reduction in Mitchell Act funding, Service management changed the coho production at Eagle Creek, reducing the on-station release to 500,000 yearling smolts and eliminating the coho production for Clatsop Economic Development Corporation (CEDC). In 2004, with a further Mitchell Act funding reduction, a 500,000 coho smolt program for the Yakima River at the Willard facility was reprogrammed to Eagle Creek NFH. The current coho program now constitutes 500,000 smolts for Eagle Creek, 550,000 smolts for the Clearwater River and 500,000 smolts for the Yakima River.

Eyed coho salmon eggs from Eagle Creek have been shipped to other Service hatcheries (Abernathy, Carson, Coleman, Garrison Dam, Leavenworth, Little White Salmon, Quilcene, Spring Creek, Willard, Winthrop); state fish and game agencies (North Carolina, Maine, Missouri, Nevada, Oregon, Tennessee, Vermont, Wisconsin); foreign nations (Canada, France, Japan, North Korea); Native American tribes (Elwah, Lummi, Nez Perce, Paiute, Quinault, Warm Springs); and research facilities (University of Idaho, USGS Western Fish Disease Laboratory).

Winter Steelhead

Winter steelhead production at the Eagle Creek NFH was initiated with the spawning of native Eagle Creek steelhead during the period of April 15 to June 1, 1957. Forty-two females and forty-seven males were spawned producing 121,665 eggs. The spawning of Eagle Creek native winter steelhead continued through 1965 with the resulting progeny being released as both one year-old yearlings and two year-old smolts. When released as yearlings, the steelhead ranged from 16 to 150 fish per pound in comparison to being released as two year-old smolts being 6 to 10 fish per pound.

In 1965, the hatchery began receiving winter steelhead eyed eggs of the Big Creek strain. This importation of eyed eggs continued until 1974 when a sufficient return of adult steelhead assured fishery managers that sufficient brood stock were returning to the hatchery to meet egg requirements. In 1965, the hatchery and Dr. Lauren Donaldson, University of Washington, began fertilizing returning female steelhead with sperm from male rainbows from the

University of Washington. This hybridization program continued for 4 years. In 1970, winter steelhead eyed eggs from the Skamania Hatchery (State of Washington) were received instead of Big Creek strain eyed eggs. In 1972 through 1974, eyed eggs from Big Creek were shipped to the Abernathy facility for incubation and initial rearing prior to transfer to Eagle Creek. Over time, the spawning of the earlier returning fish took precedence over the native Eagle Creek strain as the earlier fish provided a greater sport fishery and only required fish to be held one year rather than two years in the hatchery.

In the spring of 2001 and 2002, under direction from NOAA-Fisheries, the hatchery began rearing the native winter steelhead stock using eggs spawned from adults collected at PGE's Faraday Dam on the Clackamas River. A trial was set up with these eggs using chilled water to slow down incubation as these fish would be released as two year old smolts. After two years of rearing the native stock, upon recommendation by ODFW, NOAA-Fisheries decided that the hatchery would discontinue the rearing of the native stock. In place of rearing the native stock, the hatchery was directed to return to rearing the earlier Big Creek/Skamania strain which they had successfully propagated and released as one year old smolts.

Currently, the hatchery propagates and volitionally releases 150,000 early winter steelhead into Eagle Creek. A density study is on-going using raceway populations of 7,500; 15,000; and 22,500 fish per raceway. There are three raceways of each population with each of the nine raceways having different coded wire tags and all fish having an adipose – right ventral fin clip.

Eyed eggs from the Eagle Creek native steelhead stock have been shipped to other Service hatcheries (Carson, Hagerman, Little White Salmon, Willard); state fish and game agencies (Alaska, Connecticut, New Jersey, Oregon, Washington); foreign nations (USSR); Native American tribes (Warm Springs); and research facilities (USGS Columbia River Research Laboratory, University of Idaho). As the early strain run strengthened, eyed eggs from this stock were shipped to other Service hatcheries (Abernathy, Carson, Garrison Dam, New London); state fish and game agencies (North Carolina, Tennessee, Vermont); foreign nations (France); Native American tribes (Elwah, Lummi, Quinault); and research facilities (USFWS LaCrosse Laboratory, USGS Western Fish Disease Laboratory, USGS Columbia River Research Laboratory, University of Idaho).

N. NMFS ESA-listed population(s) that may be affected by the program[9].

Listed species occupying habitats in the lower Clackamas River and its tributaries, the lower Willamette River, and the lower Columbia River migration corridor(s) may be impacted by the presence of Eagle Creek NFH coho salmon and winter steelhead trout. NMFS ESA listed populations that may be incidentally affected are:

- Steelhead Trout *(Oncorhynchus mykiss)*, Lower Columbia River ESU (Threatened Species, 63 FR 13347; March 19, 1998).

[9] *Section text from ECNFH Coho HGMP, p.14-15.*

- Chinook Salmon *(Oncorhynchus tshawytscha)*, Lower Columbia and Upper Willamette River ESUs (Threatened Species, 64 FR 14308; March 24, 1999).

- Coho Salmon (*Oncorhynchus kisutch*), Lower Columbia River / Southwest Washington ESU (Candidate Species in 2004, subsequently listed as Threatened Species, 2005)[a]

[a] Note: the Oregon Fish and Wildlife Commission listed lower Columbia River wild coho salmon as an endangered species in July 1999. For the Clackamas River this constitutes the late-stock wild coho salmon produced primarily upstream of the North Fork Dam on the Clackamas River.

O. Current on-station hatchery objectives for Eagle Creek National Fish Hatchery[10]

Hatchery Objectives	Coho Salmon	Winter Steelhead
Release to EC	500,000	150,000
Transfers/Other Programs	500K to YN 550K to NPT	0
# Females Spawned	1400	175
Fecundity	2,800	4,000
Prespawn Mortality	2%	2%
Survival Egg to Eye	>92%	>92%
Survival Eye to Fry	97%	97%
Survival Fry to Smolt	93%	93%
Survival Smolt to Adult (number back to hatchery)	0.6% (3,000)	0.23% (350)

Note: In the 2004 HGMPs for Eagle Creek NFH, the hatchery Brood stock objectives were previously identified as 4,000 adults for coho salmon and 500 adults for winter steelhead. The most recent estimate today is 3,000 adult coho and 350 adult steelhead as the hatchery brood stock objectives to meet the current production level.

[10] *Section text from ECNFH CHMP, p. 52.*

Eagle Creek NFH Coho

A. General information

- Species and population (or stock) under propagation, and ESA status. coho salmon (Oncorhynchus kisutch), non-listed hatchery stock (ECNFH Coho HGMP, p. 2)

- A return of 3,000 adult coho salmon is needed to collect enough eggs for a full production of 0.5 million fish for on-station volitional release, in addition to a 1.3 million egg and 1.05 million pre-smolt transfer for Tribal and the State of Idaho restoration programs, above Bonneville Dam. (ECNFH Update, p. 2 and ECNFH CHMP, p. 46)

- Eagle Creek NFH supports important tribal restoration programs, including approximately 550,000 coho yearlings for the Nez Perce Tribe to the Clearwater River, Idaho and 500,000 coho yearlings for the Yakama Nation to the Yakima River, Washington. The goal is to help support the tribal development of locally adapted brood stock. (ECNFH Coho HGMP, p.10)

- Fish were transferred to lower Columbia River CEDC net pens for terminal area fisheries near Youngs Bay, Astoria, Oregon, which was covered under a separate HGMP. (ECNFH Coho HGMP, p. 9). The CEDC program from Eagle Creek NFH was terminated in 2003.

- Eagle Creek NFH is at Rkm 16 on Eagle Creek, in the Clackamas River watershed, Estacada, Oregon (46o16'34" N Lat. and 122o12'04" W Long. , pers. comm. Steve Vigg, NMFS). (ECNFH Coho HGMP, p.10)

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

- Legal Justification: (ECNFH Coho HGMP, p.3)
    - Treaty of 1855
    - Mitchell Act
    - Fish and Wildlife Act
    - Pacific Northwest Electric Power Planning and Conservation Act
    - U.S. v Oregon court agreements

- Eagle Creek NFH currently operates as part of the Columbia River Fisheries Development Program and is funded through the Mitchell Act - a program to provide for the conservation of Columbia River fishery resources, administered by NOAA Fisheries (NMFS). (ECNFH Coho HGMP, p.3)

2. Goals of program

- This program is a part of the mitigation for habitat loss resulting from flooding, siltation, and fluctuating water levels caused by Bonneville Dam. The Columbia River Fish Management Plan under U.S. v Oregon is currently under renegotiation, however, current production goals are generally consistent with the production goals in the expired plan. In addition, Eagle Creek NFH production is consistent with court adopted management agreements for upper Columbia River fall Chinook, steelhead, and coho which specifically identifies production from Eagle Creek NFH for tribal restoration programs. In addition, Eagle Creek NFH production is consistent with court adopted management agreements for upper Columbia River fall Chinook, steelhead, and coho which specifically identifies production from Eagle Creek NFH for tribal restoration programs. (ECNFH Coho HGMP, p.3)

3. Objectives of program

- Produce coho salmon to help mitigate for fish losses in the Columbia River Basin caused by federal dams, to provide fish for commercial, sport, and tribal harvest, and to provide fish to support tribal restoration programs upstream of Bonneville Dam. (ECNFH Coho HGMP, p.3)

4. Type of program

- Isolated Harvest (Lower Columbia River) (ECNFH Coho HGMP, p.3)
- Integrated Recovery (tribal restoration programs) (ECNFH Coho HGMP, p.3)

5. Alignment of program with ESU-wide plans

- 1999 Biological Opinion on Hatchery Operations in the Columbia River. (ECNFH Coho HGMP, p. 10)
- ESA Informal Consultation and EFH Consultation regarding the Eagle Creek fish barrier replacement project at the Eagle Creek National Fish Hatchery, Clackamas County, Oregon (tracking number I/NWR/2002/00771). (ECNFH Coho HGMP, p. 10)
- Lower Columbia River Coho Endangered Species Management Plan, Oregon Fish and Wildlife Commission, July 2002. (ECNFH Coho HGMP, p. 11)
- Listed species occupying habitats in the lower Clackamas River and its tributaries, the lower Willamette River, and the lower Columbia River migration corridor(s) may be impacted by the presence of Eagle Creek NFH coho salmon. NMFS ESA listed populations that may be incidentally affected are:
    - Steelhead Trout (Oncorhynchus mykiss), Lower Columbia River ESU (Threatened Species, 63 FR 13347; March 19, 1998).
    - Chinook Salmon (Oncorhynchus tshawytscha), Lower Columbia and Upper Willamette River ESUs (Threatened Species, 64 FR 14308; March 24, 1999).

- Coho Salmon (Oncorhynchus kisutch), Lower Columbia River / Southwest Washington ESU (Note: when HGMP was written this was a Candidate Species. Columbia River coho were ESA listed as Threatened on 6/28/05 (70 FR 37160)

(ECNFH Coho HGMP, p. 13)

- Lower Columbia River/Southwest Washington Coho Salmon

Status: This ESU includes naturally-spawning coho from all tributaries of the Lower Columbia River up to the Deschutes River on the Oregon side, including the Willamette River up the Willamette Falls (NMFS 2002). This ESU was previously reviewed by NMFS for possible listing as a threatened species but was determined not to warrant listing because of apparent widespread dilution of the native populations with hatchery fish. The NMFS is presently reviewing new information on the status of coho in this ESU and will be making a determination of whether to go forward with another proposal to list in the near future. *(Note: when HGMP was written this was a Candidate Species. Columbia River coho were ESA listed as Threatened on 6/28/05 (70 FR 37160)*

Wild coho salmon that migrate through the Lower Willamette River spawn in the Clackamas River and are included in this ESU. Coho salmon that spawn in the Clackamas River consist of an early-run spawning component and late-run spawning component (Cramer and Cramer 1994). ODFW considers the late run component to be a native population. The native coho population of the Clackamas River is thought to be the last remaining viable wild coho population in the Columbia Basin (Cramer and Cramer 1994). Genetic evidence suggests that native, late-run coho component in the Clackamas River is unique from the native coho of the Sandy River and other Columbia River tributaries. The early-run coho population is thought to be remnant of liberated hatchery fish that persist as naturally-spawning, self-sustaining population. The Clackamas River late-run coho population is considered depressed, vulnerable to over-harvest, and in danger of extinction in the foreseeable future (Weitkamp et al. 1995).

Use of the Action Area: Adult, late-run, native coho salmon migrating through the lower Willamette River are returning primarily to the Clackamas River to spawn. Most of the production of late-run wild coho is thought to occur above North Fork Dam on the Clackamas River (ODFW 1992). The ten-year average late run of coho to the Clackamas River numbered 759 fish from November 1989 through March 1998 (StreamNet 2002). This number dropped to a record low in the 1996-1997 migration when only two (2) late-run fish were recorded at the North Fork Dam (Strobel and Hansen 2001). The native, late-run coho salmon start passing over the North Fork Dam (RM 31.0) in October and November, with peak numbers migrating past the dam in December, January, and February. Spawning occurs from late-January through mid-March with a peak in mid to late February (Cramer and Cramer 1994).

The use of Eagle Creek by native, late-run coho is not well documented. Adult migration timing on Eagle Creek would be expected to follow the same pattern as found on the Clackamas River at the North Fork dam. Coho smolts and fry are collected at the North Fork Eagle Creek screw trap from March through June indicating that spawning occurs in the North Fork Eagle Creek (Lumianski 2000, Strobel and Hansen 2001). It is not known if the coho spawning there are native or hatchery strays. Hatchery coho are produced at the Eagle Creek NFH and hatchery adults may spawn naturally below the hatchery.

Spawning by native coho or by coho of hatchery origin may also occur in the main stem Eagle Creek below the hatchery and in Delph Creek.

The majority of coho salmon mature in their third year of life, having spent about four to six months in incubation and up to fifteen months rearing in freshwater, followed by a sixteen-month growing period at sea (Sandercock 1991). These fish are designated 1.1 (i.e., one winter in freshwater and one winter in salt water), based on scale patterns. There are many variations to this pattern as some juveniles may rear in freshwater for two winters and return as age 2.1 fish (Sandercock 1991). Juvenile coho are known to rear throughout the summer in the upper Clackamas River basin preferring beaver ponds, glides and side channels and quiet edge habitats where woody debris and cover is prevalent (Everest et al. 1986). Juvenile coho would be expected to be present in Eagle Creek throughout the summer.

Juvenile coho are counted migrating downstream though the North Fork Clackamas River migrant bypass system in every month of the year. Generally, outmigrants captured at the North Fork trap from April through June have a silvery smolt-like appearance, but most juveniles migrating December through March and July through October appear to be parr. The outmigration of coho juveniles for the Clackamas River generally begins in April, peaks in May and June and is essentially over by early July. Historically, a second outmigration of smolts occurred in the fall, primarily during November (Cramer and Cramer 1994).

The outmigration timing of coho juveniles on Eagle Creek would be expected to generally follow the same pattern as that found in the Clackamas River. On the North Fork Eagle Creek, coho juveniles (fry, parr and smolts) have been collected by screw trap since 1997 (Lumianski 2000, Strobel and Hansen 2001). The peak capture date for coho juveniles (fry and parr) was March 14 and June 1 in 1999 and 2000, respectively. The mean length of these juveniles was 71.9 mm and 60.0 mm FL in 1999 and 2000, respectively.

In 2000, North Fork Eagle Creek produced an estimated 598 coho smolts, down from the 1999 estimate of 3,246 smolts (Strobel and Hansen 2001). Coho smolts were collected during all weeks between March 17 and June 8, 2000, with the majority of smolts being collected between April 14 and May 25, 2000. The peak capture date for coho smolts was May 11 and 12 in 2000 and May 19 in 1999. Mean fork length for emigrating coho smolts was 111.4 mm and 112.5 mm FL in 1999 and 2000, respectively (Lumianski 2000, Strobel and Hansen 2001).

(ECNFH Coho HGMP, p. 19-20)

6. Habitat description and status

- Habitat management and protection strategies in the Clackamas watershed are described in ODFW (1992) and for Lower Columbia River coho salmon in Oregon Fish and Wildlife Commission (2001). Habitat degradation has occurred from past forestry practices, roads, urban development, hydroelectric facilities, water rights over-appropriation, and poor ocean conditions. Refer to Federal Columbia River Power System (FCRPS) Biological Opinions (NMFS 2000 and USFWS 2000) and the Willamette

Subbasin Summary (Bastasch et al. 2002) for further discussion on the subject. (ECNFH Coho HGMP, p. 29)

7. Size of program and production goals (No. of spawners and smolt release goals)

- A return of 3,000 adult coho salmon is needed to collect enough eggs for a full production of 0.5 million fish for on-station volitional release, in addition to a 1.3 million egg and 1.05 million pre-smolt transfer for Tribal and the State of Idaho restoration programs, above Bonneville Dam. (ECNFH Update, p. 2 and ECNFH CHMP)

Performance Standards for Coho Salmon at Eagle Creek National Fish Hatchery. Modified from IHOT (1996): (ECNFH Coho HGMP, p. 8 and ECNFH CHMP)

Measures	Hatchery Goal	Average	Range	Comment
Adult Capture (excludes jacks)	3,000		1,246-33,106	1
On-Station Fish Releases	500K	1.0M	0.5-1.2M	2
Egg Transfers variable		1.5M		3
Fish Transfers	1.4-1.7 M			
Percent Survival				
Smolt to Hatchery	0.6%	0.85%	0.09-3.54%	4
Smolt to Hatchery + Harvest	2%	1.20%	0.12-2.10%	5
Smolt Size for On-station Release (fish/lb)	12	12	10-14	6

Constraints/Comments—Eagle Creek National Fish Hatchery

1. Adult capture dependent on off-station survival rates, harvest rates, and stream flow in Eagle Creek during fall immigration. Data is from 1997-2001 and excludes jacks. CRiS\ReturnPr
2. On-station release data from calendar years 1998-2002. On-station release goal was recently reduced from 1.0 million to 500K, in-part from improved survival rates and largely from reduced Mitchell Act funding. CRiS\DistBA2
3. Eggs have been transferred to other early stock hatcheries to meet Columbia River program needs or for tribal restoration programs, as agreed to by PAC.
4. Hatchery return data for brood years 1980 to 1998 including both age classes, jacks and adults.
5. Coded-wire tag data for coho salmon from Eagle Creek NFH, brood years 1993 through 1997 (CRiS\rd2). Survival is from juvenile release to total expanded recoveries of coded-wire tagged fish, including harvest and hatchery escapement, where recoveries include both age classes, jacks and adults. Although the data is not complete, brood year 1998 should exceed 3% survival. Review of the data also indicates that coded-wire tag recoveries from Eagle Creek for brood year 1997 may have some problems, and may in-fact grossly underestimate survival. For example, brood year 1997 return to the hatchery was reported as 945 jacks and 33,106 adults returning in 1999 and 2000, respectively, based on actual hatchery rack

returns. Whereas, the brood year 1997 hatchery return based only on coded-wire tag recoveries was expanded to only 14,345 fish. Brood year 1997 survival may actually exceed 3.5% vs. the 1.8% calculated by coded-wire tag expansion.

6. Smolt size for fish transferred to the Yakama Nation and Nez Perce Tribe is 22-25 fish per lb.

Performance Indicators" addressing benefits. (ECNFH Coho HGMP, p. 4-6 and ECNFH CHMP)

	Benefits	
Performance Standard	**Performance Indicator**	**Monitoring and Evaluation**
Program contributes to mitigation for construction of dams as defined in the Mitchell Act of 1937.	Achieve 0.6% smolt to adult survival back to the hatchery to collect 3,000 coho salmon brood stock to produce 500K smolts for on-station release, 1.5M off-station release, and up to 1.5 million eggs for off-station programs.	Monitor adult returns, smolt production, and survival rates and perform best rearing strategies to meet spawning and production goals.
Successfully maintain a brood stock of coho salmon at Eagle Creek NFH without the need for out of basin egg or fish transfers to the hatchery.	Achieve a minimum 0.1% smolt-to-adult return back to the hatchery.	Smolt-to-adult survival rates are monitored for each brood-year release.
Assure that hatchery operations support Columbia River Fish Management Plan (U.S. v Oregon) production and harvest objectives.	Contribute to a meaningful harvest for sport, tribal, and commercial fisheries from August through October of each year in the Columbia River. Achieve a 10-year average of 2% smolt-to-adult survival that includes harvest plus escapement.	Survival and contribution to fisheries will be estimated for each brood year released. Work with co-managers to manage adult fish returning in excess of brood stock need. Work with states and tribes to establish meaningful fisheries (through US v Oregon forums).
Develop outreach to enhance public understanding, participation, and support of the U.S. Fish and Wildlife Service and Eagle Creek NFH programs.	Increase the visibility of the Fish and Wildlife Service facilities and to provide information about Service programs to internal and external audiences. For example, local schools and special interest groups tour the facility to better understand hatchery operations. Off station efforts include festivals, classroom participation, stream adoptions, and county fairs.	Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program.
Implement measures for brood stock management to maintain integrity and genetic diversity	A minimum of 1,000 adults are collected throughout the spawning run in proportion to	Annual run timing, age and sex composition, and return data is collected and compared to historical

	Benefits	
Performance Standard	**Performance Indicator**	**Monitoring and Evaluation**
of Eagle Creek hatchery stock.	age and sex composition at return.	data.
Program contributes to fulfilling tribal trust responsibility mandates and treaty rights.	Follow pertinent laws, agreements, policies, and executive orders on consultation and coordination with Native American tribal governments. Columbia River tribes support the service program at Eagle Creek NFH. An annual report on stock assessment and contribution to fisheries will be developed.	Hold an annual coordination meeting between the Service, Yakama Nation, and Nez Perce Tribe to identify and report on issues of interest, coordinate management, and review programs.
Communicate and coordinate effectively with co-managers in the Columbia River basin.	Participate in US v Oregon production advisory committee (PAC) and technical advisory committee (TAC) meetings. Discuss management issues for Eagle Creek NFH at an annual coordination meeting each spring between the Service and cooperators, including ODFW, NOAA Fisheries, Yakama Nation, Nez Perce Tribe, BLM, USFS, CEDC, and PGE.	Develop technical reports for PAC and TAC. Hold hatchery evaluation team meetings each spring to review progress.
Design and implement projects to improve the quality of fish production at Eagle Creek NFH.	Projects are identified, reviewed, and implemented that will increase survival of program fish while minimizing impacts on wild populations.	Monitoring programs will be incorporated into project designs. Examples of projects include: diet studies, rearing and release studies, and rearing environment projects.
Release groups are sufficiently marked in manner consistent with information needs and protocols to determine impacts to natural and hatchery origin fish in fisheries.	On-station release: Most fish are adipose fin clipped (90%) for selective fisheries with another 25K (5%) AdCWT and 25K (5%) CWT only for evaluation purposes.	Returning fish are sampled throughout their return for length, sex, mark, and coded-wire tags.
Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens.	Necropsies of fish to assess health, nutritional status, and culture conditions.	Columbia River Fish Health Center (LCRFHC) inspect adult brood stock yearly and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, the LCRFHC recommends remedial or

	Benefits	
Performance Standard	**Performance Indicator**	**Monitoring and Evaluation**
Follow USFWS Fish Health Policy and Implementation Guidelines and the Integrated Hatchery Operation Team (IHOT) Policy.		preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary.
	Release and/or transfer exams.	Three to six weeks prior to transfer or release, 60 fish per lot are examined in accordance to the USFWS and co-managers policies.
	Inspection of adult brood stock.	At spawning, a minimum of 150 female and 60 male brood stock are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery.	Control of specific fish pathogens through eggs/fish movements are conducted in accordance to the USFWS and co-managers policies. No fish or eggs from virus-positive brood stock are allowed into Eagle Creek NFH.
	Applied research on new and existing techniques.	Evaluate new and existing procedures for effects on health, disease control and prevention.

C. Description of program and operations

1. Broodstock goal and source

- The hatchery stock at Eagle Creek is early-run. The wild indigenous stock is considered late-run. There are no known late-run wild coho regularly returning to Eagle Creek, however additional sampling through underwater video, radio telemetry, and snorkeling would help answer this question. If late stock coho are found in Eagle Creek, reproductive success / genetics studies would be valuable as well. (ECNFH Coho HGMP, p. 41)

- Current brood stock goal is 3,000 fish, averaging 50% female. (ECNFH Coho HGMP, p. 40 and ECNFH CHMP)

- 3,000 proposed annual brood stock collection level, assuming equal numbers of males and females (maximum number of adult fish). (ECNFH Coho HGMP, p. 7 and ECNFH CHMP)

- There are no wild coho salmon currently used for Eagle Creek NFH production. (ECNFH Coho HGMP, p. 40)

- Returns to the hatchery are used for hatchery production of early coho. If numbers of returning brood stock are insufficient to meet the hatchery production goals, the coho production may be achieved using Sandy River, Big Creek, Bonneville, Toutle River, or Willard stocks, depending upon availability and fish health concerns. (ECNFH Coho HGMP, p. 40)

- The original stock of coho salmon used at Eagle Creek NFH was a combination of Sandy, Toutle, and Big Creek stocks. (ECNFH Coho HGMP, p. 40)

- Fish health policy mandates that non-Eagle Creek stocks come from adults individually certified as virus-free. (ECNFH Coho HGMP, p. 40)

2. Adult collection procedures and holding

- Fish enter the spawning facility volitionally via a fish ladder below an electric weir. Fish are trapped in the collection pond, which is 80 ft. x 120 ft. x 5 ft. with sloping sides. (ECNFH Coho HGMP, p.8)

- Adult fish can be moved using a 400 gallon fish tank, hauled by 1 ton pick-up truck. (ECNFH Coho HGMP, p.9)

- Brood holding facilities include the collection pond and a 10 ft. x 120 ft. x 3 ft. holding channel. (ECNFH Coho HGMP, p.9)

3. Adult spawning

a) Spawning protocols

- Fish are moved from the collection pond using a mechanical crowder, crowding fish into a water lift. Then fish slide down a tube into the holding channel. A mechanical crowder moves fish into a brail lift that transfers fish into the carbon dioxide anesthetic tank where fish are sorted. (ECNFH Coho HGMP, p.9)

- Fish not ready to spawn are returned to the holding channel. (ECNFH Coho HGMP, p.9)

- Ripe fish are handled on aluminum spawning racks. (ECNFH Coho HGMP, p.9)

- If more fish return to the hatchery than are needed for brood stock, excess fish are randomly selected and removed throughout the run. (ECNFH Coho HGMP, p. 42)

- Eagle Creek NFH coho are spawned randomly over entire run, from ripe fish on selected days over a 3 to 4 week period. (ECNFH Coho HGMP, p. 43)

b) No. of males and females spawned each year over past 10 years (Table)

- 3,000 adult coho and 50% female. (ECNFH Coho HGMP, p. 42 and ECNFH CHMP)

Brood stock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available: (ECNFH Coho HGMP, p. 42)

Year	Adults Spawned			Eggs	Juveniles
	Females	Males	Jacks		
1988	646	550			
1989	405	391			
1990	452	486	8		
1991	1317	1257			
1992	1539	1461			
1993	190	209			
1994	937	886	161		
1995	1396	1191			
1996	717	665			
1997	585	621			
1998	2315	2260			
1999	2795	2782			
2000	1728	1707			
2001	1715	1696	31		

Data source: USFWS Columbia River information System (CRiS), Vancouver, WA

4. Fertilization

a) Protocols

- Fish are randomly selected and spawned at a 2:2 male to female ratio. (ECNFH Coho HGMP, p. 41)
- Coho Jacks are spawned at 1% (or less) of the spawning population. (ECNFH Coho HGMP, p. 41)
- Excess eggs are either destroyed or transferred for use in other programs where acceptable. (ECNFH Coho HGMP, p. 41)

- Fish are randomly spawned throughout run. (ECNFH Coho HGMP, p. 41)
- If short of males, the hatchery will use males more than once as needed. (ECNFH Coho HGMP, p. 41)
- 2:2 individual matings, 1% saline solution used to enhance fertilization, ovarian fluid is drained. (ECNFH Coho HGMP, p. 43)
- Cryopreservation is not used at Eagle Creek NFH. (ECNFH Coho HGMP, p. 43)

b) Number of eggs collected and fertilized each year over past 10 years (Table)

Number of eggs taken and survival rates to eye-up and/or ponding. (ECNFH Coho HGMP, p. 44)

Brood Year		Eggs Taken	Eyed	On-Feed[11]	Released[12]
92	#	2,694,220	2,531,105	2,494,665	980,327
	%		94	93	
93	#	486,992	463,258	461,260	987,877
	%		95	95	
94	#	2,664,780	2,238,979	2,093,958	996,618
	%		84	79	
95	#	3,796,721	3,596,253	3,505,572	769,509
	%		95	92	
96	#	2,075,656	1,982,719	1,974,024	1,010,044
	%		96	95	
97	#	1,768,593	1,681,597	1,672,928	1,147,711
	%		95	95	
98	#	6,501,558	5,632,381	2,600,005	1,006,688
	%		95	88	
99	#	9,191,106	8,802,790	2,654,769	1,423,854
	%		96	87	
00	#	5,580,332	5,333,899	1,949,485	1,016,642
	%		96	88	

[11] *Accounts for number of eggs and unfed fry discarded, shipped, and mortality (from CRiS Egg Summary report). Percent survival is cumulative from eggs taken to # on-feed.*

[12] *The number transferred in and out will need to be accounted for before calculating survival from # on-feed to # released (from CRiS SR80s distribution report), but is generally about 90% (IHOT 1996).*

- Extra eggs may be taken to safeguard against potential incubation losses and short falls at other facilities. Excess eggs are fed to trout saved for "kids fishing day". (ECNFH Coho HGMP, p. 45)

5. Incubation

- Incubation is done in the nursery building. (ECNFH Coho HGMP, p.9)
- There are 38 vertical 16-tray incubators with flow set initially to 3 gpm and raised to 4 gpm after hatching. (ECNFH Coho HGMP, p.9)
- Water use is primarily from Eagle Creek. It is screened and filtered by a gravel bed before incubation. (ECNFH Coho HGMP, p.9)
- Water temperature is monitored using thermograph probes and recorded. Temperature during incubation ranges from 32^{o} F with typical temperatures around 42^{o} F. (ECNFH Coho HGMP, p. 45)
- Dissolved oxygen levels are not regularly monitored, but have been tested and found to be at saturation. (ECNFH Coho HGMP, p. 45)
- Eggs are placed into incubation trays at four females (approximately 10,000-12,000 eggs) per tray. (ECNFH Coho HGMP, p. 45)
- At eye-up, bad eggs are removed, the remaining eggs are enumerated, then placed back into trays at a rate of 7,000-9,000 eggs per tray. Initial water flows are set at 3 gpm and increased to 4 gpm at hatch. These loading densities have been found to be the best management practice at Eagle Creek NFH to control abrasion to the yolk sac and subsequently control disease. (ECNFH Coho HGMP, p. 45)
- Eggs are treated daily with 1,667 ppm formalin for fifteen minutes to control fungus. Formalin is dispensed using a delivery system ensuring proper dilution and timing. (ECNFH Coho HGMP, p.9)
- The installation of egg isolation units has been proposed to prevent potential disease transmission from eggs transported from outside the facility to Eagle Creek stocks. (ECNFH Coho HGMP, p.9)

6. Ponding

a) Protocols

- Swim-up coho salmon fry are ponded directly into 8 ft. x 80 ft. x 2 ft. raceways (ECNFH Coho HGMP, p.9)

- In late fall, the fish are moved to the volitional release pond (converted adult collection pond) for the remainder of containment and volitionally released. (ECNFH Coho HGMP, p.9)
- Temperature readings are taken using thermograph probes which take readings continuously. Temperatures in the raceways range from 32 ^{o} F to 65 ^{o} F for the containment of coho salmon. (ECNFH Coho HGMP, p. 46)
- Mortalities are removed daily, recorded, and deducted from raceway inventory. (ECNFH Coho HGMP, p. 46)
- Raceways are cleaned with a broom while effluent water is drained to a pollution abatement pond. Cleaning is performed as needed but no less than once a week. (ECNFH Coho HGMP, p. 46)
- Dissolved oxygen, carbon dioxide and total gas pressure have not been regularly monitored, is not considered a problem, and is measured periodically, as necessary. (ECNFH Coho HGMP, p. 46)
- Fish are reared on creek gravity flow water. (ECNFH Coho HGMP, p. 46)

b) Number of fry ponded each year, including % hatch each year[13]

- Put in 8X80' Raceways.
- Raceway numbers 1-12 and 37-49.
- 100,000 to 115,000 per raceway one 16 tray incubator tray per stack
- Split in June (at tagging and clipping) to 48,000 to 52,000 per raceway

7. Rearing/feeding protocols

- Swim-up coho salmon fry are ponded directly into 8 ft. x 80 ft. x 2 ft. raceways. (ECNFH Coho HGMP, p.9)
- In late fall, the fish are moved to the volitional release pond (converted adult collection pond) for the remainder of containment and volitionally released. (ECNFH Coho HGMP, p.9)
- Coho scheduled for transfer are reared and kept in raceways until transported by other agencies. (ECNFH Coho HGMP, p.9)
- The raceways are set initially at 300 gpm and raised to 500 gpm when the fish reach 450 fish per pound. (ECNFH Coho HGMP, p.9)

[13] *Section text pers. comm. D. Dysart 2006.*

- Current production goals are to have a final density index of below 0.54 and a flow index of no higher than 1.5 (Piper et al., 1982, Banks et al 1992). Maximum density and loading criteria are for maximum loadings of 8 lbs/gpm or 3.25 lbs/cu. ft. (ECNFH Coho HGMP, p. 46)

8. Fish growth profiles

- The fish are fed Bio Diet Starter, 1.0 mm to 1.5 mm grower, and Silver Cup Slow Sinking Salmon Diet, 2.0-3.0 mm, by hand until 45 fish per pound. After that, demand hoppers are used. The feeding ration follows manufacturer recommendations, except in December and January when no feeding is done. Overall conversions are around 1.0. (ECNFH Coho HGMP, p. 47)

End of Month Growth Parameters for ECNFH Coho Brood Year 2001. (ECNFH Coho HGMP, p. 47)

Month	Length	#/lb	Condition	Conversion Factor C	Density Index	Flow Index
March	1.3	1275	.00035	0.85	0.06	0.25
April	1.8	472		0.88	0.12	0.49
May	2.3	225		0.93	0.20	*0.56
June	2.9	116		1.00	0.30	0.73
July	3.4	72		1.10	**0.17	**0.42
Aug.	4.0	45		1.15	0.23	0.29
Sept.	4.6	30		1.17	0.30	0.75
Oct.	5.0	23		1.20	0.36	0.90
Nov.	5.4	18		1.20	0.43	1.06
Dec.	5.4	18		0	0.43	1.06
Jan.	5.4	18		0	0.43	1.06
Feb.	5.4	18		0	0.43	1.06
Mar.	5.7	15		1.22	0.48	***1.08
April	6.0	13	.00035	1.22	0.53	1.19

Fish were volitionally released by May 15th.
Data extrapolated from Lot History Production for Brood Year 2001 Coho Salmon.
* Increased water flows from 300 gpm to 500 gpm.
** Split raceway fish numbers
*** Increased water flows by 10%

9. Fish health

- Fish health and disease prevention is managed in accordance with the U.S. Fish and Wildlife Service's Fish Health Policy, the "Policy and Procedures for Columbia Basin Anadromous Salmonid Hatcheries" (IHOT 1995), and protocols of Oregon. (ECNFH Coho HGMP, p. 40)

- Any health problems are managed promptly by fish health personnel to limit mortality and reduce disease transmission. (ECNFH Coho HGMP, p. 40)

- The Eagle Creek coho juveniles and adults remain free of the regulated pathogens (viruses and *Myxobolis cerebralis*). No offspring from virus-positive brood stock are allowed on station. (ECNFH Coho HGMP, p. 40)

- Eagle Creek NFH is classified as a virus-free facility so adult fish from facilities with a history of virus are not allowed on station. (ECNFH Coho HGMP, p. 40)

- Fish health policy mandates that non-Eagle Creek stocks come from adults individually certified as virus-free. (ECNFH Coho HGMP, p. 40)

10. Chemotherapeutant use

Chemotherapeutants are used as deemed necessary to control bacterial or parasitic problems. Chronic bacterial coldwater disease (CWD) occurs annually in the coho but since 1999, mortality from this disease is much reduced and has not necessitated treatment. This is likely due to improvements in rearing practices. In addition, high water temperatures (60-70oF) in the summer serve to ameliorate this disease, the only health issue ever consistently noted in the coho. (LCRFHC fish health reports).

- The most recent (and last) use of antibiotic occurred in June, 1999 when a epizootic of bacterial coldwater disease (CWD) occurred in the coho yearlings. In a comparison of antibiotic efficacy, replicate raceways of fish received either oxytetracycline-medicated feed, top-coated florfenicol feed or no antibiotic treatment. While the florfenicol treatment was deemed the most efficacious treatment, the warming water temperatures that normally occur in July also played a role in relieving mortality in the other two groups.

- In summer 1998, a FDA pivotal study for oxytetracycline control of CWD in coho juveniles was completed. The expected epizootic of CWD did not occur in the 9 study ponds and all fish (control and medicated) remained healthy throughout the study. Several factors may have contributed to this outcome: in the study ponds, dead fish were collected every day; nets and equipment were disinfected before use; and density indices were at <0.3. In contrast, three non-experimental ponds of fish, experienced a CWD epizootic despite being medicated with oxytetracycline. Densities in these ponds were nearly double that in the experimental ponds and it is unlikely that the mortalities were picked daily.

- An infestation of gill amoeba in the juvenile coho caused mortalities of up to 2.5% per pond in early August. This amoeba is rare at Eagle Creek and its life cycle was likely enhanced by the sustained and higher than normal water temperatures that occurred in July. A drip treatment of formalin was initiated to control the infestation.

- Historically, moderate to epizootic losses of CWD occurred annually through the 1990's, though often confined to a few raceways.

11. Tagging and marking of juveniles

- Nearly all (95%) on-station releases of coho are mass marked (adipose clipped) for the purpose of selective fisheries management. An additional 5% are coded-wire tag only fish to assess selective fisheries. (ECNFH Coho HGMP, p. 24)

- All hatchery releases from Eagle Creek are externally marked with either fin clip and/or internal coded-wire tag. (ECNFH Coho HGMP, p. 41)

- All coho released into Eagle Creek are marked and/or tagged, depending on fin clip and tag quality control, in the following proportions: (ECNFH Coho HGMP, p. 51)
    - Adipose fin clip only = 90%
    - Adipose fin clip plus coded-wire tag = 5%
    - Coded-wire tag only = 5%

12. Fish Release

a) Protocols

- In late fall, the fish are moved to the volitional release pond (converted adult collection pond) for the remainder of containment and volitionally released. (ECNFH Coho HGMP, p.9)

- Coho yearlings are volitionally released on-station at approximately 12 fish/lb. Those remaining at the end of the volitional release period are forced out (generally less than 2% of total production). (ECNFH Coho HGMP, p. 48)

- Fish are volitionally released directly into Eagle Creek. (ECNFH Coho HGMP, p.9)

- Coho smolts are volitionally released from the hatchery into Eagle Creek, March through May, at approximately 12 to 14 fish/lb. Those remaining at the end of the volitional release period are forced out (generally less than 2% of total production). (ECNFH Coho HGMP, p. 50)

- Specific location(s) of proposed release(s). (ECNFH Coho HGMP, p. 49)

  Stream, river, or watercourse: On-Station Release into Eagle Creek

  Release point: Eagle Creek, Rkm 16, 46°16’34” N Lat. And 122°12’04” W Long.
  Major watershed**:** Clackamas, Oregon
  Basin or Region**:** Lower Willamette and Columbia Rivers

  Stream, river, or watercourse: Lower Columbia River
  Release point**:** Transfer to Lower Columbia River CEDC net pens, Astoria, OR

Major watershed**:** Lower Columbia River
Basin or Region**:** Lower Columbia River

Stream, river, or watercourse: Clearwater River
Release point**:** Transfer to Nez Perce Tribe Clearwater River, Idaho
Major watershed**:** Snake River
Basin or Region: Columbia River

b) Number of fish released each year (subyearlings?; yearlings?; other?)

Proposed annual fish release levels (maximum number) by life stage and location. (ECNFH Coho HGMP, p. 7 and ECNFH CHMP)

Life Stage	Release Location	Annual Release Level
Eyed Eggs	Transfer to Nez Perce Tribe (Clearwater River) Transfer to Yakama Nation (Yakima River) Transfer to State of Idaho (annual request) Transfer to Oregon (STEP) as requested	600,000 100,000 700,000 5,000
Unfed Fry		
Fry		
Fingerling		
Yearling	On-station release Transfer to Clearwater River, ID for Nez Perce Tribe Yakima River for Yakama Nation Transfer to lower Columbia River CEDC net pens (Terminated in 2003)	500,000 March through May 550,000 in March 500,000 500,000 to CEDC in April 500,000 to CEDC in May

Actual numbers and sizes of fish released by age class through the program. Eagle Creek NFH coho releases in Eagle Creek. (ECNFH Coho HGMP, p. 49-50)

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988					159,396	171/lb.	1,006,329	18/lb.
1989							1,052,382	16/lb.
1990							1,012,793	13/lb.
1991					26,440	230/lb.	1,199,000	15/lb.
1992							1,087,346	16/lb.
1993							1,060,888	14/lb.
1994							980,327	14/lb.
1995							987,877	11/lb.
1996							996,618	14/lb.
1997							769,509	13/lb.
1998							1,010,044	11/lb.
1999							1,147,711	13/lb.
2000							1,006,688	12/lb
2001							711,927	14/lb.
2002							508,321	13/lb.
Average							969,184	14/lb.

Data source: USFWS Columbia River information System (CRiS), Vancouver, WA 11/19/02

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns (data for the past 10-20 years)

- Range 1,246-33,106 (1997-2001) (ECNFH Coho HGMP, p. 8)

b) Return timing and age-class structure of adults

- On average, 15% of Eagle Creek's coho have returned as two year old male jacks, and 85% as three year old adults. (see cohort table-next page)

c) Smolt-to-adult return rates

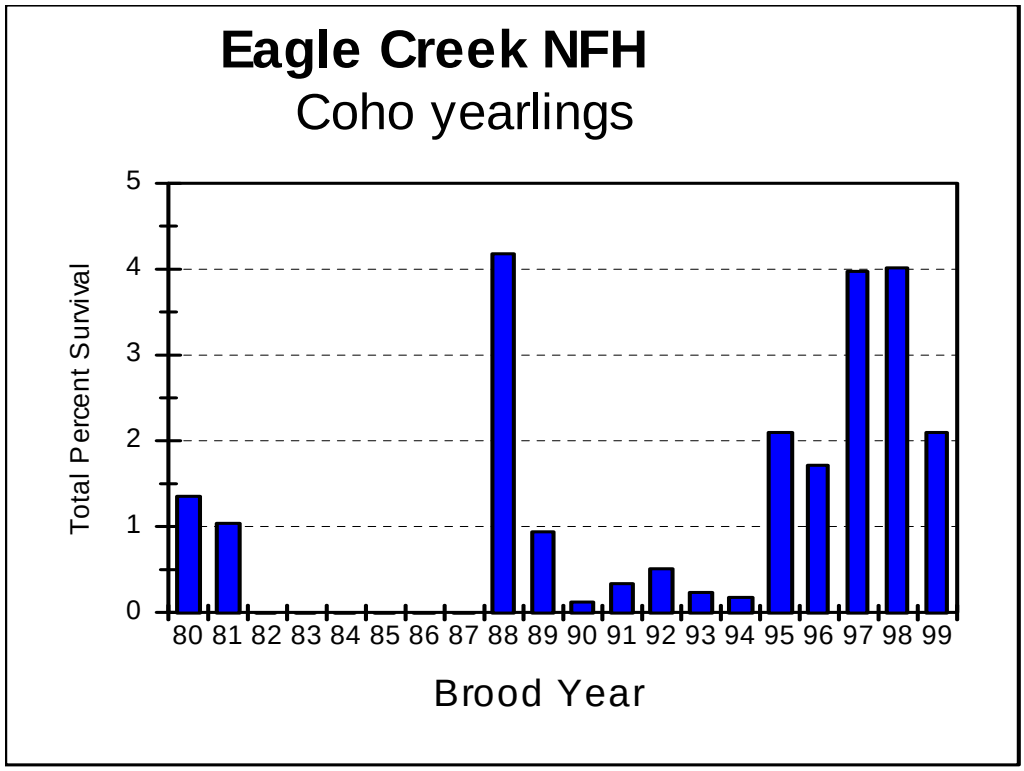
- Survival for Eagle Creek NFH coho salmon based on coded-wire tag recoveries at the hatchery, in the ocean, and Columbia River fisheries averages 1.7% of the total number of fish released for the brood years 1988 through 2001. (ECNFH Update, p. 3) Note that this does not include coho harvested in the Clackamas River and Eagle Creek, which do not have coded-wire tag sampling programs.

- Smolt-to-adult return rates back to the hatchery has averaged 0.9% for brood years 1980 through 2002 (see cohort table-next page)

Returns to Eagle Creek NFH from Coho released in Eagle Creek as yearlings

CRiS\SME 07/19/20

BY	Number Released	Returns to the Hatchery Age 2	Age 3	Age 4	Age 5	Age 6	Total	% Return
80	929,274	1,027	1,875				2,902	0.312
81	573,512	105	2,166				2,271	0.396
82	1,030,354	239	4,461				4,700	0.456
83	1,022,505	998	13,394				14,392	1.408
84	970,229	1,200	2,105				3,305	0.341
85	805,821	434	2,892				3,326	0.413
86	1,006,329	928	9,165				10,093	1.003
87	1,052,382	863	1,314				2,177	0.207
88	1,012,793	1,897	5,724				7,621	0.752
89	1,199,000	689	3,435				4,124	0.344
90	1,087,346	369	575				944	0.087
91	1,060,888	34	2,795				2,829	0.267
92	980,327	337	2,853				3,190	0.325
93	987,877	258	1,564				1,822	0.184
94	996,618	101	1,246				1,347	0.135
95	769,509	579	12,612				13,191	1.714
96	1,010,044	1,214	11,779				12,993	1.286
97	1,147,711	945	33,106				34,051	2.967
98	1,006,688	5,440	30,146				35,586	3.535
99	711,927	863	6,326				7,189	1.010
00	508,321	1,086	4,808				5,894	1.160
01	505,400	879	7,776				8,655	1.713
02	557,016	567	8,921				9,488	1.703
03	524,356	1,020					1,020	0.195
(age 3 > 0)								
Number		915	7,436					
Average %		15%	85%					0.944



- No coded-wire tags were released in brood years 1982 through 1987.
- BY1988: Nearly 300,000 Eagle Creek coho released were from the Sandy Hatchery, and these fish did not have a unique coded-wire tag. This is highest rate survival rate on record for Eagle Creek coho.
- BY1990: Only 31 observed recoveries and an overall survival rate of 0.1228% making this the lowest survival rate since coded-wire tagging has been done consistently.
- Brood year 1993 releases included both forced and volitional releases of Eagle Creek stock and Toutle stock coho.
- Brood year 1995 was the first brood year at Eagle Creek in which coho production was "mass marked" with an adipose fin clip. A small number of fish were not adipose fin clipped, but received a coded-wire tag.
- The estimate of survival for brood year 1998 is a near record 4.0163%. Only brood year 1988 is higher. However, ODFW recoveries for this brood year are not in the most recently down loaded data set.

d) Stock productivity (e.g. recruits per spawner)

- The current number of adult recruits per hatchery-spawned adult (R/S) has averaged from approximately 10-30 recruits per spawner over the past few years.

2. Contributions to harvest and utilization (e.g. food banks)

- Eagle Creek NFH produces fish for on-station release, produced coho salmon for use in Oregon's Youngs Bay Net Pen Program (discontinued in 2003), for restoration goals on Tribal lands, and other programs as requested and agreed through U.S. v Oregon forums. The production program for on-station release and Youngs Bay are specifically targeted for selective fisheries and not natural supplementation. (ECNFH Coho HGMP, p. 24)

- Eagle Creek coho contribute to ocean commercial and sport fisheries; in-river main stem sport and commercial fisheries; and terminal area sport fisheries. (ECNFH Coho HGMP, p. 24)

- Weak stock management restrictions directed at other coho stocks along with jeopardy standard restrictions for Snake River wild fall chinook and wild Group B steelhead effectively keep coho fishery impacts at low levels relative to very high harvest rates in past fisheries. (ECNFH Coho HGMP, p. 24)

- Carcasses have been utilized by the Warm Springs and Yakama Indian Reservations. If available, fish are also distributed to suppliers for federal prisons. (ECNFH Coho HGMP, p. 43) For the years 1999-2003 an average of 1,657 coho salmon (range of zero to 5,350) were distributed to Tribes. During the same period, an average of 13,584 (range of zero to 32,662) were distributed to food banks (StreamNet data).

- Adult coho salmon carcasses have been distributed by the state and U.S. Forest Service for stream enrichment. There is minimal concern for disease transmission as the fish are historically negative for virus and *Myxobolis cerebralis* and have a low incidence and level of bacterial kidney disease. (ECNFH Coho HGMP, p. 43)

- Recoveries of coded-wire tagged coho salmon from Eagle Creek National Fish Hatchery (Pastor 2002). (ECNFH Coho HGMP, p. 24)

Hatchery escapement, freshwater, and ocean harvest for Eagle Creek NFH coho salmon brood years 1979-2000. The total adult production number given includes all estimated sport, tribal, and commercial harvest of Eagle Creek NFH fish. Data presented in this table are calculated from coded-wire tag recovery information in the 2004 Annual Stock Assessment Report (Pastor 2006). From draft Comprehensive Hatchery Management Plan, July 2006. Clackamas River and Eagle Creek harvest data estimated from sport fishery card returns as provided by Todd Alsbury ODFW.

Brood Year	National Fish Hatchery Escapement	Columbia River Harvest	Ocean Harvest	Clackamas/ Eagle Cr.
1979	2,219	1,124	24,779	a/
1980	1,728	187	10,673	
1981	1,601	1,589	2,782	
1988	7,589	8,909	25,826	
1989	4,332	823	6,156	
1990	429	310	596	
1991	3,267	205	137	
1992	3,696	215	1,109	
1993	1,867	121	358	436
1994	1,423	66	263	407
1995	14,031	1,052	1,078	44
1996	13,229	1,566	2,549	2,792
1997	39,181	1,214	5,255	6,639
1998	21,898	8,525	9,965	6,087
1999	12,682	1,352	883	1,567
2000	7,207	452	524	430

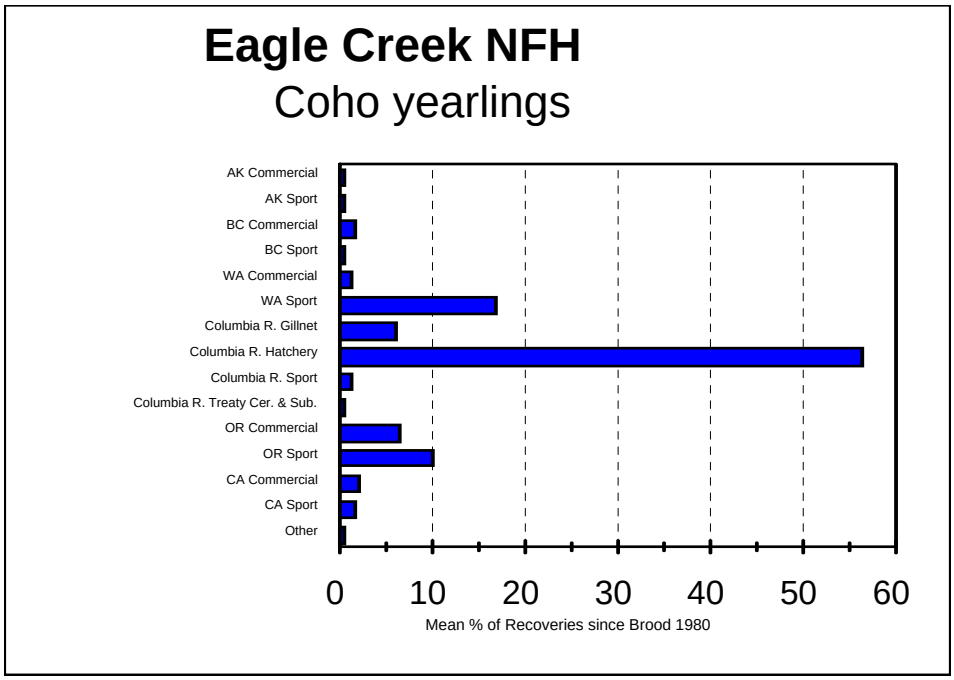
a/ Clackamas River and Eagle Creek harvest from 1979-1992 was not analyzed.

Notes: Mass marking was implemented in brood year 1995 to present.
This table accounts for most coded-wire tag recoveries, i.e. homing to Eagle Creek is estimated at 99.9% (Pastor 2004), with very few recoveries at other hatcheries or on spawning grounds.

Examining data from 1993 to 2000, the average escapement to the hatchery was 13,939 fish and average harvest was 1,794 in the Columbia River, 2,609 in the ocean, and 2,300 in the Clackamas/Eagle Creek areas. For every two fish returning to the hatchery one was harvested. In the late 1970's and 1980's harvest rates were substantially higher. For example in 1979, for every fish returning to the hatchery over 10 fish were harvested.

Contributions of Eagle Creek coho released in Youngs Bay to marine and lower Columbia River fisheries as part of the CEDC SAFE program. This program component was discontinued in 2003. (from USFWS CRiS database, 10/02/06)

Brood Year	Number of Smolts released	Estimated Harvest Marine	Estimated Harvest Columbia River
1988	388,477	13,204	17,912
1989	2,137,061	14,408	12,045
1990	405,076	221	295
1991	1,658,961	599	7,375
1993	747,943	149	1,888
1999	482,414	212	2,311
2000	971,523	9,996	45,181
2001	990,467	1,999	11,943



Mean percent recoveries of CWTs for adult Eagle Creek hatchery coho to fisheries and hatchery, 1980-1999, excluding BY1982-1987 when no fish were CWTs were released.

3. Contributions to conservation

- Production releases of Eagle Creek coho are not expected to add adverse effects to listed species or other stocks of concern from a harvest management perspective beyond those currently allowable under non-jeopardy biological opinions for harvest. (ECNFH Coho HGMP, p. 24)

- Eagle Creek's coho production program for restoration efforts on Tribal lands include(ECNFH Coho HGMP, p. 7)

Life Stage	Release Location	Annual Release Level
Eyed Eggs	Transfer to Nez Perce Tribe (Clearwater River) Transfer to Yakama Nation (Yakima River)	600,000 100,000
Yearling	Transfer to Clearwater River, ID for Nez Perce Tribe Transfer to Yakima River, WA For Yakama Nation	550,000 in March 500,000

4. Other benefits

- No additional benefits

E. Research, monitoring, and evaluation programs

- The Service has developed monitoring and evaluation programs to determine the extent of ecological interactions between fish released from the hatchery and wild fish populations in the Eagle Creek subbasin. For example, the migration timing of hatchery juveniles released volitionally in the spring was determined using radio-telemetry. A monitoring program is in place to (1) determine the movement and behavior of adult hatchery fish using radio telemetry; and (2) estimate the reproductive success and contribution to smolt production of hatchery fish using genetic analyses. (ECNFH Update, p. 2)

- A proportion of returning adults are sampled at the hatchery for biological information. Sex and length are recorded and scales are collected so that age can be determined. Fish are also sampled for coded-wire tags implanted in the snouts of fish during juvenile rearing. By using sample information and the number of returning fish, it is possible to calculate the number of returning fish for each age group and, consequently, the number of fish returning from each brood year or release year. (ECNFH Update, p. 2)

- Reports on various hatchery evaluations and monitoring programs can be found on the web at: http://www.fws.gov/columbiariver/ (ECNFH Update, p. 2)

F. Program conflicts

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

- More research is needed to assess the impacts of both hatchery releases and natural spawning coho and winter steelhead on wild steelhead in Eagle Creek. (ECNFH Update, p. 2)

- The hatchery stock at Eagle Creek is early-run. The wild indigenous stock is considered late-run. There are no known late-run wild coho regularly returning to Eagle Creek, however additional sampling through underwater video, radio telemetry, and snorkeling would help answer this question. If late stock coho are found in Eagle Creek, reproductive success / genetics studies would be valuable as well. (ECNFH Coho HGMP, p. 41)

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

- The number of fish returning from a hatchery release is influenced by early rearing at the hatchery, downstream migration, ocean conditions, and the harvest rate in the various fisheries. (ECNFH Update, p. 2)

- Harvest rates on coho salmon have been substantially reduced from the 1980's and earlier time period. For example in 1979, for every fish returning to the hatchery over 10 fish were harvested. For the 1993-2000 period, for every two fish returning to the hatchery one was harvested. Harvest rates were adjusted to protect depressed and ESA listed fish populations. (ECNFH Coho HGMP)

- The earlier return timing of hatchery coho reduces harvest on the later returning wild stocks in the Clackamas River. However, there is some return timing overlap with the later returning early stock and early returning late stock. The wild coho late stock return October to March, peak in December through February. The hatchery early stock return Labor Day to Thanksgiving (September through November). (ECNFH Coho HGMP)

- Mass marking of hatchery coho was implemented starting with brood year 1995. Selective fisheries are in-place to harvest marked hatchery fish, with catch & release on unmarked and wild fish. (ECNFH Coho HGMP)

3. Conservation conflicts

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc.)

Few natural origin adult coho are observed in Eagle Creek. For example, the lower ladder of Eagle Creek, located downstream from the North Fork Eagle Creek, was closed

periodically in 2005 from January through June to trap adult winter steelhead and look for late returning coho; and then again from September through November to trap adult coho. A "V"-trap fish weir was placed in the ladder and used to trap adult fish migrating upstream to spawn. The presence of natural origin coho at the ladder in 2005 was minimal. A total of 5 unmarked adults, (no CWT and intact adipose fins), were trapped at the ladder. Capture dates for these unmarked, possibly natural origin coho were 10/3, 10/26, and 11/2. No coho were observed during the Jan 1st through May 31st sampling period. (Kavanagh et al. 2006)

Hatchery coho released from Eagle Creek have a very high homing fidelity. Based on coded-wire tag recovery data 1979 to 1997 broods, 99.9% of all recoveries were recovered at the hatchery or on the route to it. (Pastor 2004)

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish)

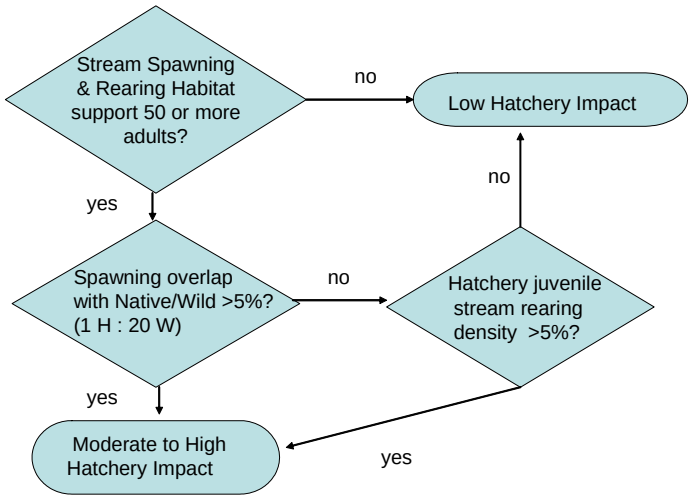
- The hatchery strives to produce functional smolts which survive and quickly migrate to the ocean. From the analysis presented in Section 3.5 of the HGMP document, hatchery operations will not adversely affect listed species in the watershed. However, additional studies on the behavior of hatchery and wild fish in Eagle Creek would be helpful for assessing risk (Pearsons and Hopley 1999) and provide information for future production management decisions. (ECNFH Coho HGMP, p. 51)

- 2003 telemetry data indicates that the mean travel time between Eagle Creek and Clackamas River receiver was 14.2 hours for tagged coho released from the hatchery, compared to hatchery steelhead with a mean travel time of 40.1 hours (Hoffman et al. 2003).

- Juvenile fish released from the hatchery could potentially prey on naturally produced fish, particularly listed steelhead juveniles in Eagle Creek and the lower Clackamas River. However, the general hypothesis is that predation by hatchery fish is not a major source of mortality to naturally produced populations. (ECNFH Coho HGMP, p.6)

- Eagle Creek hatchery releases also have the potential to attract predators (fish, birds, mammals) or provide a forage base to sustain predator populations. (ECNFH Coho HGMP P.37)

- The USFWS Hatchery Review Team developed the following decision matrix to help determine the level of impact a segregated hatchery stock may have on its wild counterpart in the watershed.



Decision Matrix for Determining Impact to Wild Fish from Segregated Hatchery Program

Decision Key for Determining Impact to Wild Fish from Segregated Hatchery Program

1. Stream habitat can support natural spawning and rearing?
   50 or more adult spawning fish can be sustained in the stream…….. 2
   Less than 50 adult spawning fish can be sustained in the stream……5

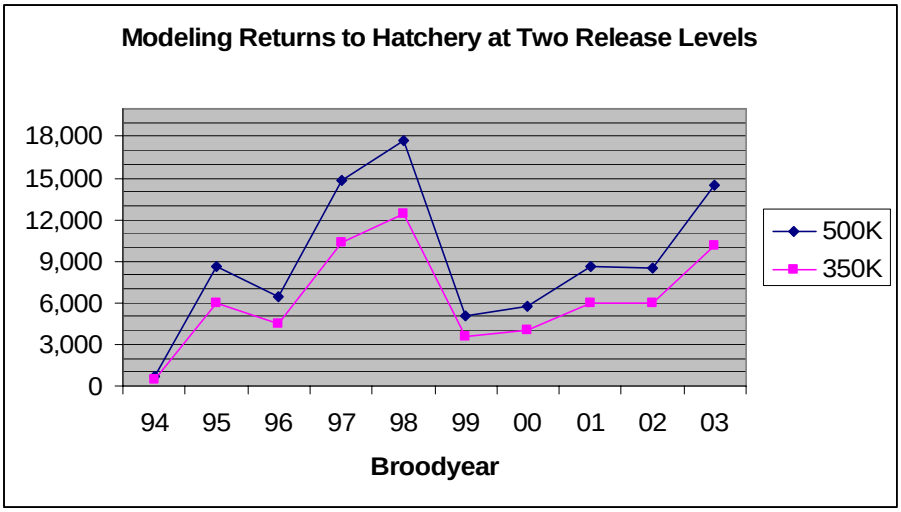
2. Proportion of hatchery and wild fish that spawn in the stream?
   Hatchery fish represent < 5% of the stream spawning population.....3
   Hatchery fish represent 5% or more of the stream spawning population…….…..4

3. Proportion of hatchery and wild juvenile fish stream rearing?
   Hatchery juveniles are 5% or more of stream's summer rearing density……4
   Hatchery juveniles are < 5% of stream's summer rearing density…….…….5

4. Moderate to High Hatchery Impact

5. Low Hatchery Impact

- Reducing the number of smolts released from the hatchery would reduce ecological interactions in the stream. The USFWS Hatchery Review Team developed a model to determine if this could be accomplished while still meeting broodstock goals. Smolt to adult return rates back to the hatchery were reviewed over a 10-year period (broodyears 1994-2003) (see figure below). Nine out of ten years, the broodstock goal of 3,000 adult fish back to the hatchery was met at both the 350,000 and 500,000 smolt release level (USFWS Hatchery Review Team 2007).



Modeled return rates for ECNFH coho at a 500,000 and 350,000 release level.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

Insufficient operations & maintenance and monitoring & evaluation funding through the Mitchell Act, NOAA Fisheries program (ECNFH Coho HGMP, p. 10).

Eagle Creek NFH Winter Steelhead

A. General information

- Species and population (or stock) under propagation, and ESA status. Winter steelhead trout (*Oncorhynchus mykiss*), non-listed hatchery stock. (ECNFH Steelhead HGMP, p. 1)

- The stock of winter steelhead used at ECNFH is a combination of Big Creek and native Clackamas winter steelhead stocks. Current practice is to use only those adults returning to the hatchery." (ECNFH Steelhead HGMP, p. 35)

- There are no wild fish currently used for Eagle Creek NFH production. (ECNFH Steelhead HGMP, p. 35)

- Eagle Creek NFH on-station releases are moderate in magnitude (around 150,000 winter steelhead trout) relative to other Columbia River production programs. (ECNFH Steelhead HGMP, p. 27)

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

- Legal Justification for the program: (ECNFH Steelhead HGMP, p. 3)
    - Treaty of 1855
    - Mitchell Act
    - Fish and Wildlife Act
    - Pacific Northwest Electric Power Planning and Conservation Act
    - U.S. v Oregon court agreements

- Eagle Creek NFH currently operates as part of the Columbia River Fisheries Development Program and is funded through the Mitchell Act - a program to provide for the conservation of Columbia River fishery resources, administered by NOAA Fisheries (NMFS). (ECNFH Steelhead HGMP, p. 3)

2. Goals of program

- This program is a part of the mitigation for habitat loss resulting from flooding, siltation, and fluctuating water levels caused by Bonneville Dam.

- The Columbia River Fish Management Plan under U.S. v Oregon is currently under renegotiation, however, current production goals are generally consistent with the production goals in the expired plan.

3. Objectives of program

- Produce winter steelhead trout to help ***mitigate*** for fish losses in the Columbia River Basin caused by federal dams and provide opportunities for sport fisheries. (ECNFH Steelhead HGMP, p. 3)

4. Type of program (Integrated or Segregated)

- Isolated Harvest (Lower Columbia River) (ECNFH Steelhead HGMP, p. 3)

5. Alignment of program with ESU-wide plans

- Lower Columbia River Steelhead Trout ESU (Threatened Species)

  Status: Listed as a threatened species on March 19, 1998, this ESU includes all naturally spawned populations of steelhead (and their progeny) in streams and tributaries to the Columbia River between the Willamette and Hood Rivers, in Oregon (Myers et al. 1998). This would include Eagle Creek and its tributaries. Excluded are steelhead in the upper Willamette River Basin above Willamette Falls. Both winter and summer steelhead are present in this ESU. (ECNFH Steelhead HGMP, p. 13)

- No NMFS ESA-listed populations will be directly affected by Eagle Creek National Fish Hatchery. (ECNFH Steelhead HGMP, p. 12)

- The primary NMFS listed species potentially affected by hatchery operations is the late Clackamas winter steelhead. This species is found in Eagle Creek, usually in the main stem below the middle falls and in the North Fork of Eagle Creek. (ECNFH Steelhead HGMP, p. 20)

- Listed species occupying habitats in the lower Clackamas River and its tributaries, the lower Willamette River, and the lower Columbia River migration corridor(s) may be impacted by the presence of Eagle Creek NFH winter steelhead trout. NMFS ESA listed populations that may be incidentally affected are:

  - Steelhead Trout (Oncorhynchus mykiss), Lower Columbia River ESU (Threatened Species, 63 FR 13347; March 19, 1998).
  - Chinook Salmon (Oncorhynchus tshawytscha), Lower Columbia and Upper Willamette River ESUs (Threatened Species, 64 FR 14308; March 24, 1999).
  - Coho Salmon (*Oncorhynchus kisutch*), Lower Columbia River / Southwest Washington ESU (Candidate Species in 2004, subsequently listed as Threatened Species, 2005)[a]

  [a] Note: the Oregon Fish and Wildlife Commission listed lower Columbia River wild coho salmon as an endangered species in July 1999. For the Clackamas River this constitutes the late-stock wild coho salmon produced primarily upstream of the North Fork Dam on the Clackamas River.

  (ECNFH Steelhead HGMP, p. 12-13)

6. Habitat description where fish are released.

The Clackamas River is the principal spawning and rearing area for members of this ESU that pass through the Lower Willamette River and only late-run winter steelhead are included in the Clackamas River population (Busby et al. 1996). The steelhead trout populations in this ESU are of the coastal genetic group (Schreck et al. 1986, Reisenbichler et al. 1992) and a number of genetic studies indicate that they are part of a different ancestral lineage than inland steelhead from the Columbia River. Genetic Studies also show these populations to be distinct from those in the upper Willamette River and coastal streams in Oregon and Washington (61 FR 41541). (ECNFH Steelhead HGMP, p. 13)

Critical Habitat: Critical habitat was designated February 16, 2000 (65 FR 7764); this designation was vacated by the District of Columbia District Court and remanded to NOAA Fisheries for new rulemaking pursuant to a court order in May, 2002. (ECNFH Steelhead HGMP, p. 13-14)

Use of the Action Area: Adult winter steelhead migrate up the Clackamas River starting in November with low numbers being counted at the North Fork Dam (RM 31.0), on the Clackamas River from November through February. Greater numbers of native, winter-run steelhead occur at the North Fork Dam starting in March, with the peak of the adult migration occurring in April and May usually ending in June (ODFW 1992). The timing of adult Lower Columbia River winter-run steelhead on Eagle Creek and its tributaries is expected to be nearly the same as that documented on the Clackamas River. Adults from this ESU would be expected in Eagle Creek from November through mid-June, with a peak in March, April and May. (ECNFH Steelhead HGMP, p. 14)

7. Size of program and production goals (No. of spawners and smolt release goals)

- A return of 350 adult winter steelhead is needed to collect enough eggs for full production for the on-station volitional release of 150,000 smolts. (ECNFH Update, p. 2)

Performance Indicators" addressing benefits. (ECNFH Steelhead HGMP, p. 4-5)

	Benefits	
Performance Standard	**Performance Indicator**	**Monitoring and Evaluation**
Program contributes to mitigation for construction of dams as defined in the Mitchell Act of 1937.	Achieve 0.23% smolt to adult survival back to the hatchery to collect 350 winter steelhead brood stock to produce 150K smolts for on-station release.	Monitor adult returns, smolt production, and survival rates and perform best rearing strategies to meet spawning and production goals.
Successfully maintain a brood stock of winter steelhead at Eagle Creek NFH without the need for out of basin egg or fish transfers to the hatchery.	Achieve a minimum 0.1% smolt-to-adult return back to the hatchery.	Smolt-to-adult survival rates are monitored for each brood-year release.

	Benefits	
Performance Standard	**Performance Indicator**	**Monitoring and Evaluation**
Assure that hatchery operations support production and harvest objectives.	Contribute to a meaningful harvest for sport fisheries from December through March of each year in the Willamette and Clackamas rivers and Eagle Creek. Achieve a 10-year average of 1% smolt-to-adult survival that includes harvest plus escapement.	Survival back to the hatchery will be estimated for each brood year released. Work with co-managers to establish meaningful fisheries and manage adult fish returning in excess of brood stock need.
Develop outreach to enhance public understanding, participation, and support of the U.S. Fish and Wildlife Service and Eagle Creek NFH programs.	Increase the visibility of the Fish and Wildlife Service facilities and to provide information about Service programs to internal and external audiences. For example, local schools and special interest groups tour the facility to better understand hatchery operations. Off station efforts include festivals, classroom participation, stream adoptions, and county fairs.	Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program.
Implement measures for brood stock management to maintain integrity and genetic diversity of Eagle Creek hatchery stock.	A minimum of 350 adults are collected throughout the spawning run in proportion to age and sex composition at return.	Annual run timing, age and sex composition, and return data is collected and compared to historical data.
Communicate and coordinate effectively with co-managers in the Columbia River basin.	Participate in US v Oregon production advisory committee (PAC) and technical advisory committee (TAC) meetings. Discuss management issues for Eagle Creek NFH at an annual coordination meeting each spring between the Service and cooperators, including ODFW, NOAA Fisheries, Yakama Nation, Nez Perce Tribe, BLM, USFS, and PGE.	Develop technical reports for PAC and TAC. Hold hatchery evaluation team meetings each spring to review progress.
Design and implement projects to improve the quality of fish production at Eagle Creek NFH.	Projects are identified, reviewed, and implemented that will increase survival of program fish while minimizing impacts on wild populations.	Monitoring programs will be incorporated into project designs. Examples of projects include: diet studies, rearing and release studies, and rearing environment projects.

	Benefits	
Performance Standard	**Performance Indicator**	**Monitoring and Evaluation**
Release groups are sufficiently marked in manner consistent with information needs and protocols to determine impacts to natural and hatchery origin fish in fisheries.	On-station release: All winter steelhead released into Eagle Creek are adipose and right ventral (AdRV) fin clipped.	Returning fish are sampled throughout their return for length, sex, and mark recovery.
Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens. Follow USFWS Fish Health Policy and Implementation Guidelines and the Integrated Hatchery Operation Team (IHOT) Policy.	Necropsies of fish to assess health, nutritional status, and culture conditions.	Columbia River Fish Health Center (LCRFHC) inspect adult brood stock yearly and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, the LCRFHC recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary.
	Release and/or transfer exams.	Three to six weeks prior to transfer or release, 60 fish per lot are examined in accordance to the USFWS and co-managers policies.
	Inspection of adult brood stock.	At spawning, a minimum of 150 female and 60 male brood stock are examined for pathogens.
	Inspection of off-station fish/eggs prior to transfer to hatchery.	Control of specific fish pathogens through eggs/fish movements are conducted in accordance to the USFWS and co-managers policies. No fish or eggs from virus-positive brood stock are allowed into Eagle Creek NFH.
	Applied research on new and existing techniques.	Evaluate new and existing procedures for effects on health, disease control and prevention.

C. Description of program and operations

1. Broodstock goal and source

- 350 proposed annual brood stock collection level, assuming equal numbers of males and females (maximum number of adult fish). (ECNFH Steelhead HGMP, p. 7 and ECNFH CHMP)

- Steelhead hatchery production from Eagle Creek NFH are uniquely marked and only those marked fish from the hatchery are used for brood stock. (ECNFH Steelhead HGMP, p. 36)

2. Adult collection procedures and holding

- The stock of winter steelhead used at ECNFH is a combination of Big Creek and native Clackamas winter steelhead stocks. Current practice is to use only those adults returning to the hatchery. (ECNFH Steelhead HGMP, p. 35)

- There are no wild fish currently used for Eagle Creek NFH production. (ECNFH Steelhead HGMP, p. 35)

- Returning winter steelhead are collected for brood stock at the hatchery rack in Eagle Creek, December to mid-March. (ECNFH Steelhead HGMP, p. 26)

- Returns to the hatchery are used for hatchery production of winter steelhead. If numbers of returning brood stock were insufficient to meet the hatchery production goals, production was met using Clackamas River stock. (ECNFH Steelhead HGMP, p. 35)

- Fish enter the hatchery volitionally via a fish ladder below an electric weir. Fish are trapped in the fish ladder after passing through a V-trap which is installed on one of the steps of the ladder. (ECNFH Steelhead HGMP, p. 33)

- Adult fish are manually netted in the fish ladder, placed in a 300 gallon fiberglass tank which is mounted on a pickup and transported to the adult holding channel where they are held for sorting. (ECNFH Steelhead HGMP, p. 33) In 2006, hatchery staff switched to an alternative strategy for brood stock collection that requires adult steelhead to swim through a long pipe to enter hatchery facilities.

- Brood stock facilities include the collection pool in the fish ladder and a 10' x 120' x 3' holding channel. A mechanical crowder moves the fish into a braille lift from which the fish slide into the carbon dioxide anesthetic tank. (ECNFH Steelhead HGMP, p. 33)

- Stray steelhead from other locations are not known to occur at Eagle Creek NFH. (ECNFH Steelhead HGMP, p. 26)

- Steelhead hatchery production from Eagle Creek NFH are uniquely marked and only those marked fish from the hatchery are used for brood stock. (ECNFH Steelhead HGMP, p. 26)

3. Adult spawning

a) Spawning protocols

- The fish are checked for ripeness with green fish being returned to the upper section of the holding channel. Ripe fish are killed using a guillotine and placed on aluminum racks. (ECNFH Steelhead HGMP, p. 33)
- Eagle Creek brood stock are randomly selected and spawned at a 2:2 male to female ratio. (ECNFH Steelhead HGMP, p. 36)
- When excess steelhead eggs are taken, a portion of eggs from each female is kept for on-station rearing. (ECNFH Steelhead HGMP, p. 36)
- The remaining eggs are either destroyed or transferred for use in other programs where acceptable. (ECNFH Steelhead HGMP, p. 36)
- Fish are randomly spawned throughout run. (ECNFH Steelhead HGMP, p. 36)

b) No. of males and females spawned each year over past 10 years (Table)

Brood stock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available: (ECNFH Steelhead HGMP, p. 37)

Year	Adults Spawned			Eggs	Juveniles
	Females	Males	Jacks		
1988	149	149			
1989	213	188			
1990	152	150			
1991	207	167			
1992	324	335			
1993	488	345			
1994	125	117			
1995	401	475			
1996	115	122			
1997	308	327			
1998	307	258			
1999	389	441			
2000	171	171			
2001	252	263			

Data source: USFWS Columbia River information System (CRiS), Vancouver, WA

4. Fertilization

a) Protocols

- Eagle Creek brood stock are randomly selected and spawned at a 2:2 male to female ratio. (ECNFH Steelhead HGMP, p. 36)
- When excess steelhead eggs are taken, a portion of eggs from each female is kept for on-station rearing. (ECNFH Steelhead HGMP, p. 36)
- Fish are spawned randomly over entire run, from ripe fish on selected days over a 3 to 4 week period. (ECNFH Steelhead HGMP, p. 38)
- If short of males, the hatchery will use males more than once as needed. (ECNFH Steelhead HGMP, p. 38)
- 2:2 individual matings, 1% saline solution used to enhance fertilization, ovarian fluid is drained. (ECNFH Steelhead HGMP, p. 38)
- Cryopreservation is not used at Eagle Creek NFH. (ECNFH Steelhead HGMP, p. 38)

b) Number of eggs collected and fertilized each year over past 10 years

Number of eggs taken and survival rates to eye-up and/or ponding. (ECNFH Steelhead HGMP, p. 39)

Brood Year		Eggs Taken	Eyed	On-Feed[14]	Released[15]
92	#	1,119,573	1,057,043	358,407	187,654
	%		94	84	
93	#	2,287,269	2,023,158	441,086	175,669
	%		95	71	
94	#	574,547	515,960	325,117	178,199
	%		90	87	
95	#	1,443,214	1,272,801	1,250,839	175,765
	%		88	87	
96	#	450,913	417,530	411,605	206,735
	%		93	91	
97	#	1,233,044	1,178,944	342,449	206,051

[14] *Accounts for number of eggs and unfed fry discarded, shipped, and mortality (from CRiS Egg Summary report). Percent survival is cumulative from eggs taken to # on-feed.*
[15] *The number transferred in and out will need to be accounted for before calculating survival from # on-feed to # released (from CRiS SR80s distribution report), but is generally about 93% (IHOT 1996).*

Brood Year		Eggs Taken	Eyed	On-Feed[14]	Released[15]
	%		96	85	
98	#	1,346,569	1,285,415	329,132	204,931
	%		96	83	
99	#	1,592,107	1,516,965	305,397	205,447
	%		95	79	
00	#	789,864	772,040	189,512	112,717
	%		98	91	

5. Incubation

- Egg incubation takes place in the nursery building using six (6) vertical 16-tray incubators with trout screens. (ECNFH Steelhead HGMP, p. 33)
- Fertilized eggs from four females (12,000 - 20,000 eggs) are placed into each incubation tray. (ECNFH Steelhead HGMP, p. 40)
- Temperatures during incubation range from 34 to 50 degrees F. (ECNFH Steelhead HGMP, p. 40)
- Water flow is initially set at 3 gpm and increased to 4 gpm after hatching. Water use is primarily ambient Eagle Creek with limited spring water available for warmer incubation water to speed up egg development. (ECNFH Steelhead HGMP, p. 33)
- The ambient water flows through a down-flow gravel bed prior to incubation or nursery tank use. (ECNFH Steelhead HGMP, p. 33)
- Eggs are treated 5 times weekly with 1,667 ppm formalin for fifteen (15) minutes to control fungus. The formalin is dispensed using a delivery system ensuring proper dilution and timing. (ECNFH Steelhead HGMP, p. 33-34)
- At eye-up, after shocking and picking, live eyed-eggs are randomly selected from each tray to maximize a genetic cross-section of the entire run. (ECNFH Steelhead HGMP, p. 40)
- Eyed eggs are enumerated at 9,000 per tray for a total of twenty (20) trays. (ECNFH Steelhead HGMP, p. 40)

6. Ponding

a) Protocols

- Rearing of winter steelhead begins inside the hatchery building in 3' x 16' x 3' fiberglass nursery tanks with a 30 gpm flow of filtered Eagle Creek water. (ECNFH Steelhead HGMP, p. 33)

- Swim-up fry are transferred from the incubation trays into inside fiberglass 3' x 16' x 3' hatchery nursery tanks. Two (2) trays are placed into each tank (10 tanks total) for a total of approximately 18,000 fry per tank (180,000 feeding fry). (ECNFH Steelhead HGMP, p. 40)

b) Number of fry ponded each year, including % hatch each year

- Steelhead program is currently undergoing a density evaluation

- Initially ponded in 3'x3'x16' fibreglass tanks at 16,500 per tank (according to BMP document) OR 16,373 to 21,134 (according to numbers from Steve Turner)

- 3 raceways at 7,500 to 7,700 per raceway, 3 raceways at 10,978 to 15,030 per raceway, and 3 raceways at 22,470 to 22,497 per Raceway

7. Rearing/feeding protocols

- When the steelhead attain a size of 250-300 fish/lb, they are moved to the outside 8' x 80' x 2' raceways for rearing. (ECNFH Steelhead HGMP, p. 33)

- When the fish attain a size of 250-300 fish per pound, they are transferred to the outside raceways (two tanks per raceway). (ECNFH Steelhead HGMP, p. 40)

- When the fish are mass marked during the summer or early fall, the raceway inventory is established at 16,000 fish per raceway. (ECNFH Steelhead HGMP, p. 40)

- Temperature readings are taken using thermograph probes which take readings continuously. Temperatures in the raceways range from 32 o F to 65 o F for the containment of winter steelhead trout. (ECNFH Steelhead HGMP, p. 41)

- Mortalities are removed daily, recorded, and deducted from raceway inventory. (ECNFH Steelhead HGMP, p. 41)

- Raceways are cleaned with a broom while effluent water is drained to a pollution abatement pond. Cleaning is performed as needed but no less than once a week. (ECNFH Steelhead HGMP, p. 41)

- Dissolved oxygen, carbon dioxide and total gas pressure have not been regularly monitored, are not considered a problem, but are measured periodically, as necessary. (ECNFH Steelhead HGMP, p. 41)

- Fish are reared on creek gravity flow water. (ECNFH Steelhead HGMP, p. 41)

- The fish are held in the raceways until late March when the pond screens are removed allowing the fish to volitionally migrate downstream. (ECNFH Steelhead HGMP, p. 33)

- Steelhead fry are placed in fiberglass tanks and initially fed Bio Oregon's Starter Diet #1 and #2 by hand. (ECNFH Steelhead HGMP, p. 42)

- When they begin actively feeding, they are fed Bio Starter #3, Bio Dry 1000 1.0 mm and 1.3 mm pellets via overhead automatic feeders. (ECNFH Steelhead HGMP, p. 42)

- When they attain a size of 250-300 fish per pound, the fish are moved to outside raceways where they are fed Bio Dry 1000 1.3 mm, Bio Dry 500 1.5 mm and 2.0 mm by hand until early September. (ECNFH Steelhead HGMP, p. 42)

- During the summer months, the fish are also fed during the evening hours to maximize growth. (ECNFH Steelhead HGMP, p. 42)

- In early September, the fish are fed Bio Dry 500 in 2.5 mm, 3.0 mm and 4.0 mm pellet utilizing demand feeders (two per raceway) until volitional release the following April. (ECNFH Steelhead HGMP, p. 42)

8. Fish growth profiles

- Current production goals are to have a final density index of below 0.54 and a flow index of no higher than 1.5 (Piper et al., 1982, Banks et al 1992). Maximum density and loading criteria are for maximum loadings of 8 lbs/gpm or 3.25 lbs/cu. ft. (ECNFH Steelhead HGMP, p. 40)

End of Month Growth Parameters for Eagle Creek NFH Winter Steelhead, Brood Year 2000. (ECNFH Steelhead HGMP, p. 42)

Month	Total Length	#/lb	Conversion	Density Index	Flow Index
April	1.20	1666		0.14	0.40
May	1.85	449	0.66	0.27	0.75
June	2.57	168	0.98	0.08	0.20
July	3.37	75		0.10	0.28
Aug.	4.41	33	1.68	0.11	0.29
Sept.	5.29	19	1.38	0.15	0.42
Oct.	5.70	15	3.86	0.18	0.49
Nov.	6.60	10	0.39	0.24	0.65
Dec.	6.60	10		0.24	0.65
Jan.	7.22	7.6	0.92	0.29	0.78
Feb.	7.22	7.6		0.29	0.78
Mar.	7.61	6.5	1.10	0.32	0.87
April	7.91	5.8	1.31	0.33	0.91

Fish were volitionally released by May 15th.
Data extrapolated from Lot History Production, CRiS 12/05/02.

9. Fish health protocols and issues

- Personnel from the Lower Columbia River Fish Health Center test for the listed pathogens as defined by USFWS Fish Health Policy and Implementation Guidelines (infectious hematopoietic necrosis virus (IHNV), infectious pancreatic necrosis virus (IPNV), viral hemorrhagic septicemia virus (VHSV), *Renibacterium salmoninarum* (BKD), *Aeromonas salmonicida, and Yersinia ruckeri*, and *Myxobolis cerebralis*) and for *Ceratomyxa shasta* and erythrocytic inclusion body syndrome. (ECNFH Steelhead HGMP, p. 36-37)

- Samples are taken from 150 female and 60 male adults throughout the spawning period to ascertain the health profile. (ECNFH Steelhead HGMP, p. 36-37)

- As defined by the USFWS Fish Health Policy, Eagle Creek NFH is classified as a virus-free facility so adult fish from facilities with a history of virus are not allowed on station:
    - The steelhead are remarkably healthy with only two findings of virus in over 30 years and a very low incidence of the reportable bacterial pathogens that plague other hatcheries (Fish Health Inspection Reports, 1970 to present, Lower Columbia River Fish Health Center). (ECNFH Steelhead HGMP, p. 27-28)
    - Adults return with no virus and low levels of two bacterial pathogens so there is little or no vertical transmission of disease to their offspring. (ECNFH Steelhead HGMP, p. 28)
    - Juvenile fish are rarely affected by more than dorsal fin erosion. (ECNFH Steelhead HGMP, p. 28)
    - Because Eagle Creek juveniles are downstream of the major dams en route to the ocean, there is reduced potential for transmission of pathogens to other populations. (ECNFH Steelhead HGMP, p. 28)

10. Chemotherapeutant use

Chemotherapeutants are used as deemed necessary to control bacterial or parasitic problems.

- Generally, the steelhead at Eagle Creek are disease-free and do not require chemotherapeutant treatments. The exceptions have occurred when rough handling or nursery tank modifications caused physical injuries. These injuries may have been exacerbated by the dorsal fin erosion syndrome, normally not a cause of concern, which occurs in this stock (LCRFHC Fish Health reports).
    - Oxytetracycline medicated feed used one time, in 2005, to control coldwater disease in two nursery tanks of steelhead. It was determined that water piping modifications induced jumping behavior and subsequent injury to dorsal fin area.
    - To control an unusual outbreak of Costia and mortality in one nursery tank of fry, a formalin treatment was done in 2002.
    - In 1990 & 1991, hyamine treatment was recommended to control mortality resulting from infections in deep cuts due to poor adipose fin clipping techniques.
    - In the BY86 steelhead, roccal and formalin treatments were used to control furunculosis and Ichthyophthirius, respective.

11. Tagging and marking of juveniles

- The states of Washington, Oregon and Idaho are implementing selective sport fisheries on marked hatchery fish. This selective fisheries management strategy requires that all hatchery produced fish targeted for harvest be mass marked. (ECNFH Steelhead HGMP, p. 9)

- All on-station releases of winter steelhead are mass marked (adipose and right ventral fin clipped) for the purpose of selective fisheries and brood stock management. Brood years 1989 through 1993 were also coded-wire tagged but few fishery recoveries were observed (Pastor 1998 and Pastor 2000). Most coded-wire tagged fish were recovered at the hatchery, a very low percent were reported in freshwater sport fisheries, and none were recovered in ocean fisheries. (ECNFH Steelhead HGMP, p. 23)

- All hatchery releases from Eagle Creek are externally marked with a unique fin clip, currently adipose and right ventral fins are clipped. (ECNFH Steelhead HGMP, p. 36)

- All winter steelhead released into Eagle Creek are 100% marked with an adipose and right ventral fin clip. (ECNFH Steelhead HGMP, p. 45)

12. Fish Release

a) Protocols

- Smolt development indices (e.g. gill ATPase activity), if applicable --Not measured. (ECNFH Steelhead HGMP, p. 43)

- Use of "natural" rearing methods as applied in the program--None applied other than volitional release ponds. (ECNFH Steelhead HGMP, p. 43)

- Winter steelhead yearlings are volitionally released on-station April and May at approximately 5 to 6 fish/lb. Those remaining at the end of the volitional release period are forced out (generally less than 2% of total production). (ECNFH Steelhead HGMP, p. 43)

Proposed fish release levels. (ECNFH Steelhead HGMP, p. 44)

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling				
Yearling	150,000 on-station	5 to 6 fpp	April – May	Eagle Creek

- Specific location(s) of proposed release(s). (ECNFH Steelhead HGMP, p. 43)

Stream, river, or watercourse: On-Station Release into Eagle Creek
Release point: Eagle Creek, Rkm 16, 46°16'34" N Lat. And 122°12'04" W Long.
Major watershed: Clackamas, Oregon
Basin or Region: Lower Willamette and Columbia Rivers

b) Number of fish released each year (subyearlings?; yearlings?; other?)

Actual numbers and sizes of fish released by age class through the program. Eagle Creek NFH winter steelhead releases in Eagle Creek. (ECNFH Steelhead HGMP, p. 44-45)

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1990							169,000	6/lb.
1991							167,000	7/lb.
1992							151,000	7/lb.
1993							188,000	7/lb.
1994							176,000	6/lb.
1995							178,000	5/lb.
1996							176,000	5/lb.
1997							207,000	5/lb.
1998							206,000	5/lb.
1999							205,000	6/lb.
2000							205,000	6/lb
2001							113,000	6/lb.
2002							142,000	8/lb.
Average							176,000	6/lb.

Data source: USFWS Columbia River information System (CRiS), Vancouver, WA 09/19/02

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns (need data for the past 10-20 years)

- Refer to table below in section *c) Smolt to adult return rates*

- Eagle Creek NFH adult winter steelhead returns to the hatchery have varied considerably. For years 1980 to 2002, the average escapement to the hatchery is 805 per year (range=251 – 3,671), and the average return rate is 0.46%.(CRiS database)

b) Return timing and age-class structure of adults

- Age at return for broodyears 1987 to 2001 was 68.4% age 3, 31.3% age 4 and less than 1% returned at age 5 (refer to table below in section *c) Smolt to adult return rates*). (CRiS database)

- Run timing: the collection ladder is open December to mid-March, but run is strongest mid-February to mid-March. (ECNFH Steelhead HGM, p. 46)

c) Smolt-to-adult return rates

Returns to Eagle Creek NFH from Winter Steelhead released in Eagle Creek as yearlings

CRiS\SM
07/19/2

BY	Number Released	Returns to the Hatchery Age 2	Age 3	Age 4	Age 5	Age 6	Total	% Return
87	155,422		355	405	8		768	0.494
88	148,800		38	76	9		123	0.083
89	171,334		1,272	607	2	3	1,884	1.100
90	167,040		307	213	12		532	0.318
91	150,844		36	157			193	0.128
92	188,106		854	91	4		949	0.505
93	175,669		162	75	4		241	0.137
94	179,499		1,036	343			1,379	0.768
95	175,765		271	256	1		528	0.300
96	206,735		819	207			1,026	0.496
97	206,051		463	114			577	0.280
98	204,931		674	1,119			1,793	0.875
99	205,447		2,552	501			3,053	1.486
00	112,717		618	203			821	0.728
01	141,904		592	235			827	0.583
02	157,810		87	107			194	0.123
03	149,078		440				440	0.295
(age 4 > 0)								
Number			634	294	3	0		
Average %			61%	38%	1%	0%		0.525

d) Stock productivity (e.g. recruits per spawner)

- The mean number of adult recruits per hatchery-spawned adult has averaged seven recruits per spawner, consistently meeting broodstock and harvest objectives.

2. Contributions to harvest and utilization (e.g. food banks)

- Eagle Creek winter steelhead, contribute significantly to recreational fisheries in the lower Columbia, Willamette, Clackamas Rivers and Eagle Creek. Past studies have indicated that for every fish returning to the hatchery another one to two fish are caught in the sport fishery.

- An average of 1,023 steelhead were harvested in Eagle Creek, 1999-2003 (sport catch data from ODFW). Hatchery fish are also harvested in sport fisheries in the lower Clackamas and Willamette Rivers.

Expanded Steelhead Catch Records in Eagle Creek of the Clackamas River Watershed, 1999-2003. Data from Todd Alsbury, ODFW

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1999	430	197	71	28	8	0	8	0	0	20	12	67	841
2000	347	296	114	24	0	4	4	0	0	28	0	67	884
2001	114	173	146	28	0	0	0	8	8	158	4	493	1132
2002	434	977	240	16	4	4	16	16	8	4	4	95	1818
2003	169	154	16	4	0	4	8	12	0	0	0	75	442
5-year ave.	299	359	117	20	2	2	7	7	3	42	4	159	1023

Sport fisheries also occur in the Clackamas and lower Willamette Rivers and may account for another 500 fish harvested annually (Doug Olson pers. comm.).

3. Contributions to conservation

NA

4. Other benefits

No additional benefits.

E. Research, monitoring, and evaluation programs

- The Service has developed monitoring and evaluation programs to determine the extent of ecological interactions between fish released from the hatchery and wild fish populations in the Eagle Creek subbasin. For example, the migration timing of hatchery juveniles released volitionally in the spring was determined using radio-telemetry. A monitoring program is in

place to (1) determine the movement and behavior of adult hatchery fish using radio telemetry; and (2) estimate the reproductive success and contribution to smolt production of hatchery fish using genetic analyses. (ECNFH Update, p. 2)

- A proportion of returning adults are sampled at the hatchery for biological information. Sex and length are recorded and scales are collected so that age can be determined. Fish are also sampled for coded-wire tags implanted in the snouts of fish during juvenile rearing. By using sample information and the number of returning fish, it is possible to calculate the number of returning fish for each age group and, consequently, the number of fish returning from each brood year or release year. (ECNFH Update, p. 2)

- A three year density study has been initiated to determine which rearing density will maximize survival and adult yield of winter steelhead at Eagle Creek NFH. The results of this study may be applicable to other hatchery programs that support recreational and Tribal fisheries. (ECNFH Update, p. 2)

- Reports on various hatchery evaluations and monitoring programs can be found on the web at: http://www.fws.gov/pacific/columbiariver/ (ECNFH Update, p. 2)

F. Program conflicts

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

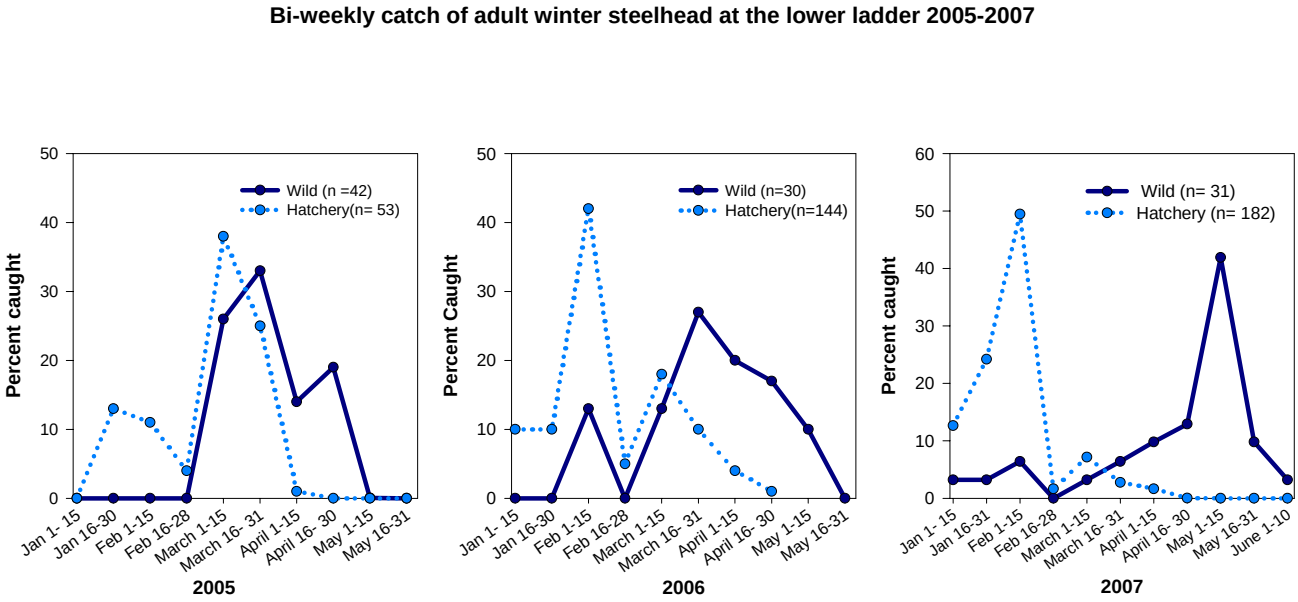
- More research is needed to assess the impacts of both hatchery releases and natural spawning coho and winter steelhead on wild steelhead in Eagle Creek. To help guide hatchery operations. (ECNFH Update, p. 2)

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

- The number of fish returning from a hatchery release is influenced by early rearing at the hatchery, downstream migration, ocean conditions, and the harvest rate in the various fisheries. (ECNFH Update, p. 2)

- Hatchery fish are externally marked.

- Hatchery fish from Eagle Creek also have an earlier-shifted run timing as compared to wild fish (see following figure). (ECNFH Steelhead HGMP, p. 9 and Kavanagh et al 2006)



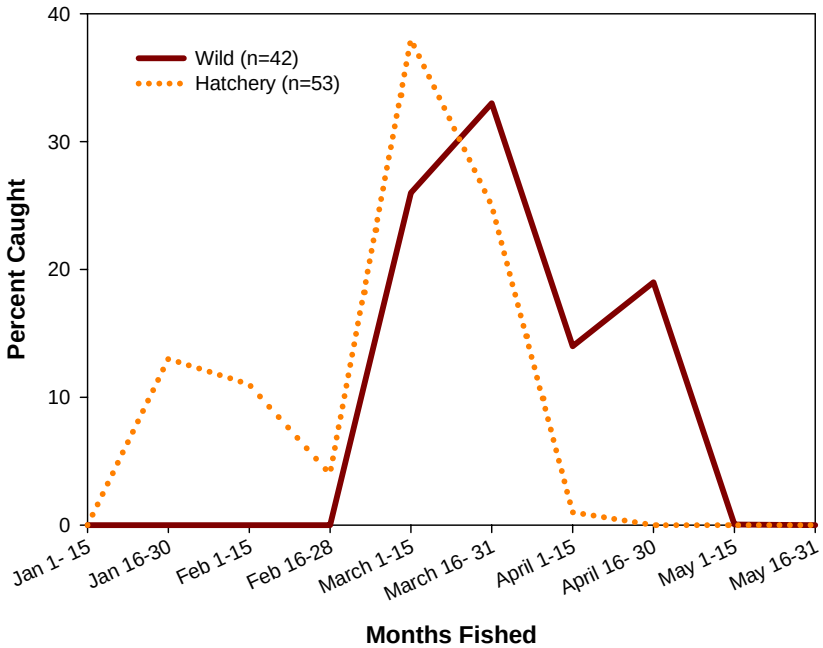


Figure 3: Biweekly catch of adult winter steelhead trapped in the lower ladder on Eagle Creek in 2005

- 53 hatchery and 42 wild adult winter steelhead were trapped at the lower ladder on Eagle Creek from January through May 2005. Hatchery steelhead began migrating upstream through the lower ladder in January, and the peak of the hatchery run occurred between March 1-15. Natural origin steelhead began migrating through the lower ladder in late February, and the peak of the wild run was between March 16-31. (Figure 3 from Kavanagh et al. 2006)

- All wild, unmarked winter steelhead are regulated by a catch & release fishery. Fishery impacts on wild steelhead were estimated as 0.5% to 2.5% exploitation as catch & release mortality. (ODFW HGMP 2006)

3. Conservation conflicts and risks

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

- Eagle Creek supports a run of naturally produced steelhead, however most wild winter steelhead are produced in the upper Clackamas watershed, upstream of North Fork Dam. The area upstream of North Fork Dam is managed for natural production, and the area downstream of the dam is managed for a hatchery harvest area, which includes Eagle Creek. (ODFW 1992)

- Eagle Creek hatchery winter steelhead are not known to contribute to a significant straying problem outside of Eagle Creek. (ECNFH Steelhead HGMP, p. 27)

- Assessing risk from straying is monitored by externally marking all hatchery steelhead at Eagle Creek prior to release. Fish are uniquely marked with an adipose fin clip plus right ventral fin clip. (ECNFH Steelhead HGMP, p. 6)

- Studies are currently underway to determine the contribution of hatchery fish to natural production of juvenile fish in Eagle Creek and the North Fork of Eagle Creek. Preliminary data indicates some potential for hatchery contribution to the North Fork of Eagle Creek juvenile natural production (Matala et al. 2005)

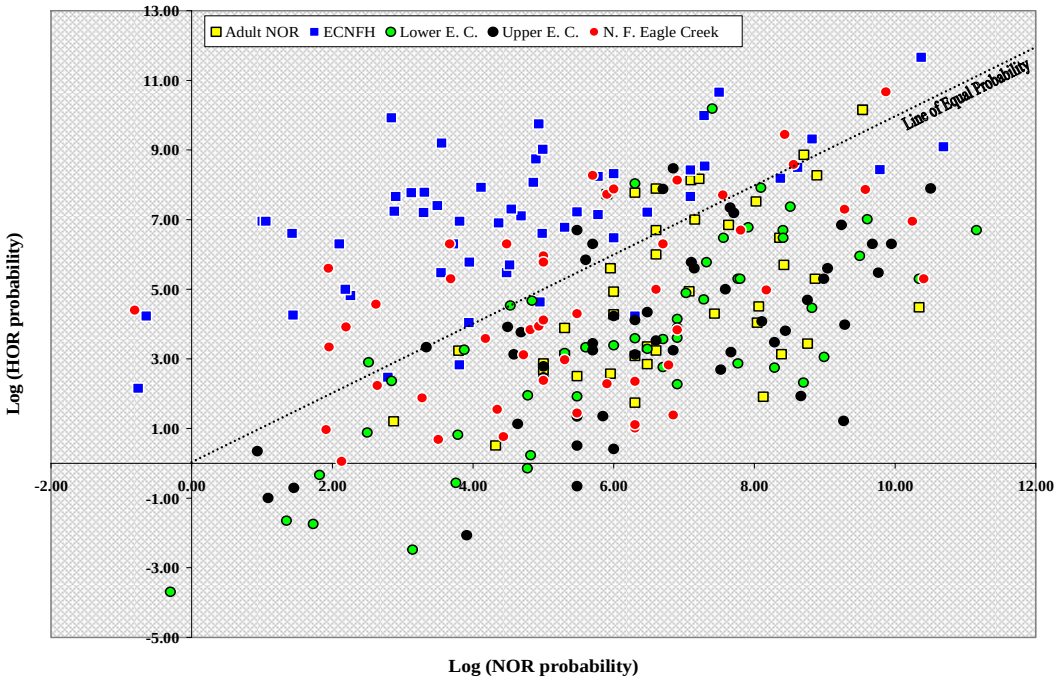


Figure x. Plot of population assignment probabilities for individuals of each group. The trend-line delineates where an individual is equally likely to be of NOR origin as HOR origin (Figure taken from Matala et al. 2005).

- Adult fish are sorted at North Fork Dam on the Clackamas River and only unmarked, wild fish are passed upstream for spawning escapement, starting in 2000. Prior to 2000, hatchery steelhead were passed upstream, up to 50% in some years (ODFW HGMP 2006, p. 20). This was primarily a problem with hatchery summer steelhead, not winter steelhead from Eagle Creek hatchery

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

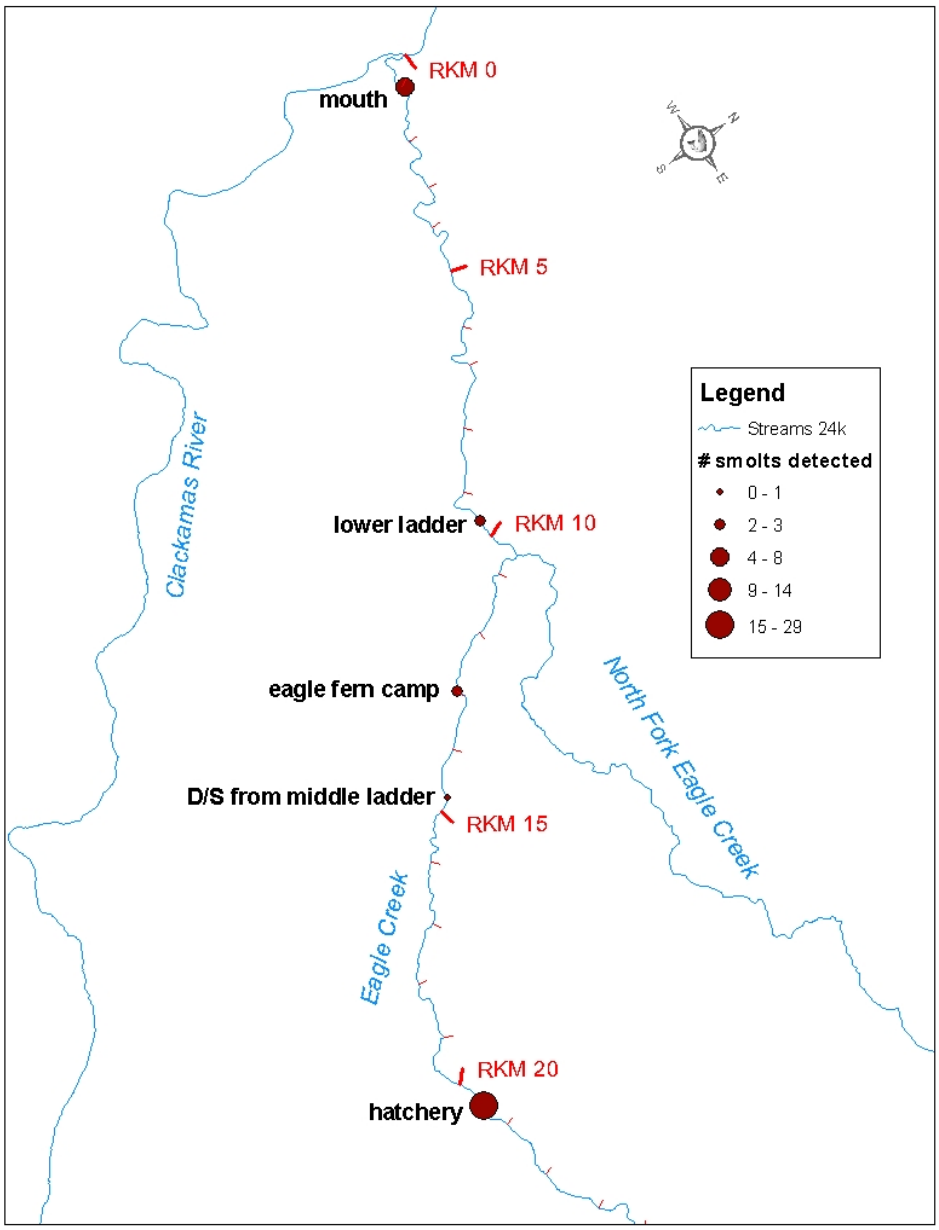
- Wild steelhead in Eagle Creek are part of the Lower Columbia River population listed as threatened under the Endangered Species Act (ESA). (ECNFH Update, p. 1)

- More research is needed to assess the impacts of both hatchery releases and natural spawning coho and winter steelhead on wild steelhead in Eagle Creek. (ECNFH Update, p. 2)

- Recent studies on downstream migration timing indicate some potential for residualism or delayed migration of hatchery steelhead in Eagle Creek (Kavanagh et al. 2006). The following describes the last mobile and fixed telemetry detections for hatchery steelhead smolts following volitional release from Eagle Creek National Fish Hatchery in 2005:

  "In March 2005, 75 juvenile hatchery steelhead were surgically implanted with coded radio-transmitters (Lotek Wireless, model NTC-4-2L) weighing 2.1 grams and having an estimated operational life of 90 days. Eight to nine

juvenile steelhead were randomly selected with a dip-net from 9 raceways representing three density groups (low, medium, high). Fish were anesthetized with MS-222, measured for length and weight, radio-tagged, and allowed to recover before being placed in their respective raceway. Volitional release of juvenile steelhead from the hatchery began in April. A data logging receiver was set up on Eagle Creek just below the volitional release pond to detect smolts as they left the hatchery. 29 radio-tagged steelhead smolts were detected at the fixed station receiver located at the hatchery. Three smolts were detected at Eagle Fern Camp (Rkm 12.8), 3 were detected at the lower ladder (Rkm 9.7), 1 smolt was detected just downstream from the middle ladder (Rkm 14.66), and 14 were detected upstream of the hatchery and below the upper falls (Rkm21) (Figure x). Five smolts were not detected at the fixed station receivers or through mobile tracking. 8 radio-tagged hatchery steelhead smolts were detected at the fixed telemetry station located near the mouth of Eagle Creek." (Kavanagh et al. 2006)



Last mobile and fixed telemetry detections for hatchery steelhead smolts following volitional release from Eagle Creek National Fish Hatchery (Kavanagh et al. 2006).

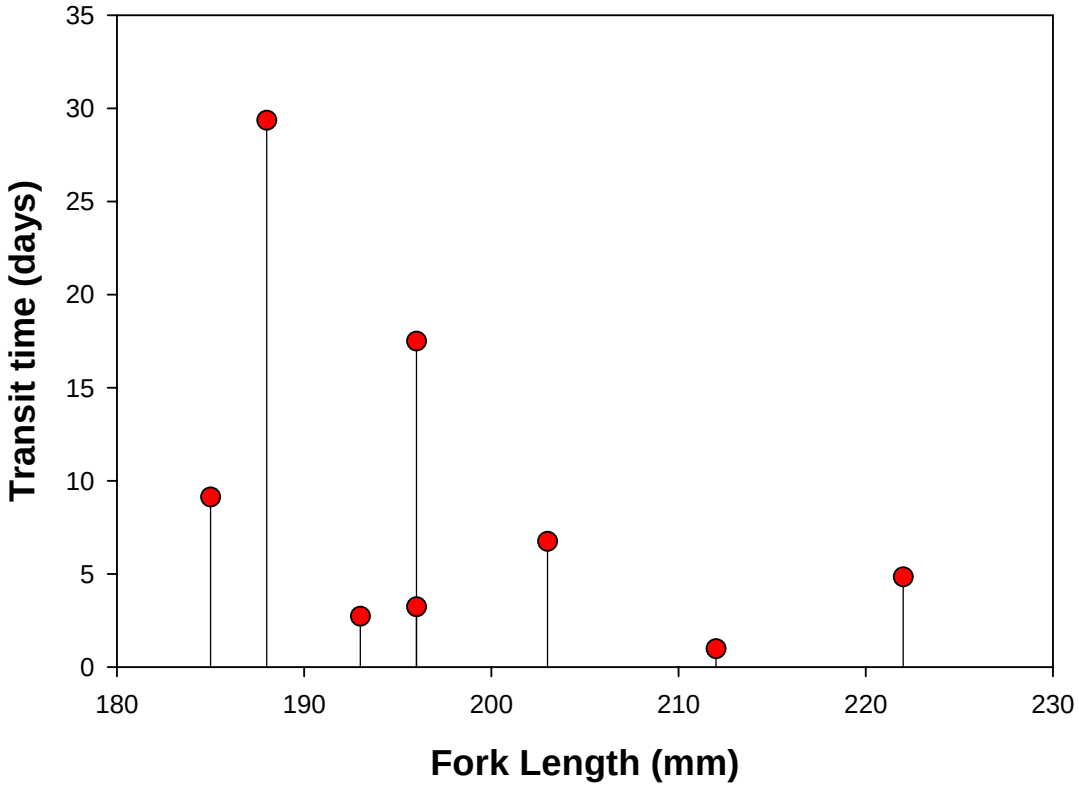


Figure 11: Fork length of winter steelhead smolts volitionally released from Eagle Creek National Fish Hatchery (Rkm 20) and detected at the fixed telemetry station at the mouth of Eagle Creek (Rkm 1.1). No relationship between smolt length at release and emmigration time from the hatchery to the mouth of Eagle Creek was detected.

- Larger hatchery steelhead at release may be at a competitive advantage over juvenile steelhead naturally produced in the stream. Hatchery releases target a release size of 5 to 6/lb. (180-250mm), whereas naturally produced smolts averaged 158 mm in 1999 and 156 mm in 2000. The hatchery release size was based on the premise that the larger hatchery steelhead would have a faster downstream migration rate, thus reducing competition . (ECNFH Steelhead HGMP, p. 29).

- Continued studies (as described by Kavanagh et al. 2006) associated with the on-going rearing density study will help address survival rates and downstream migration rates of hatchery releases in Eagle Creek (see Table x).

Mean fork length, condition factor, biomass, and density for brood year 2004 hatchery juvenile steelhead in the rearing density study. Fish were sampled in March 2005 and volitionally released in April 2005. The number of fish released from each raceway is in parentheses.

Sample Date	Pond Concentration	# Sampled	Mean fork length (mm)	*S.D.*	Condition factor	Fish bio-mass (kg)	Density (kg/m^3)	Density Index
March		117		22.4			14.9	0.13
2005	Low *(7,471)*		194		1.00	550.3		
	Low *(7,481)*	142	186	20.4	1.00	477.9	12.9	0.12
	Low *(7,464)*	141	189	18.8	0.96	485.0	13.7	0.12
	Medium *(14,980)*	128	183	20.2	1.07	987.4	26.7	0.25
	Medium *(14,980)*	125	186	17.8	1.01	976.1	26.4	0.24
	Medium *(15,032)*	129	184	19.8	1.07	993.7	26.9	0.25
	High *(22,426)*	125	181	20.2	1.00	1334.6	36.1	0.34
	High *(22,246)*	130	179	16.6	1.04	1327.3	35.9	0.34
	High *(22,514)*	132	181	16.6	1.08	1431.3	38.7	0.36

- Juvenile steelhead released from the hatchery could potentially prey on naturally produced fish, particularly listed steelhead juveniles in Eagle Creek and the lower Clackamas River. However, the general hypothesis is that predation by hatchery fish is not a major source of mortality to naturally produced populations. (ECNFH Steelhead HGMP, p. 30)

- Eagle Creek hatchery releases also have the potential to attract predators (fish, birds, mammals) or provide a forage base to sustain predator populations. (ECNFH Steelhead HGMP, p.31)

- A total of 149 adult hatchery steelhead were bio-sampled during spawning operations at Eagle Creek National Fish Hatchery in 2005. 74% (111 of 149) of returning hatchery adults were age 4 fish, and 26% (38 of 149) were age 3 fish. Mean length of age 3 and 4 hatchery steelhead was 62 and 75 cm (Kavanagh et al. 2006).

- Scale samples collected from the 42 natural origin steelhead trapped at the lower ladder indicate twenty three fish were age 3, sixteen were age 4, and samples for three fish were from regenerated scales and unable to be read. Mean length of age 3 and 4 natural origin steelhead was 68 and 78 cm. Natural origin steelhead returning to Eagle Creek were significantly larger than hatchery steelhead for both year classes observed. (Kavanagh et al. 2006).

- During the 2005 trapping at the lower ladder, 76 steelhead (52 hatchery and 24 wild) were radio-tagged and released back into Eagle Creek. Average migration time from the lower ladder to the hatchery receiver for radio-tagged fish was 202 hours or approximately 8.5 days. (Kavanagh et al. 2006)

- Adult steelhead movement was distributed throughout upper (above the North Fork), and lower (below the North Fork) Eagle Creek and North Fork Eagle Creek (Table 3). (Kavanagh et al. 2006)

- For radio-tagged wild steelhead, 33% (8 of 24) were last detected in upper Eagle Creek, 17% (4 of 24) in North Fork Eagle Creek, and 29% (7 of 24) at the mouth of Eagle Creek (Table 4). Two wild steelhead were not detected at any of the fixed station receivers or through mobile tracking efforts. Radio-tags from three wild steelhead were detected only at the lower ladder after tagging; indicating these fish regurgitated the tags after release. Two of these radio-tags were later recovered near the lower ladder through snorkeling. (Kavanagh et al. 2006)

- For hatchery steelhead, 18 were detected near the hatchery receiver, but only 13% (7 of 52) entered the fish ladder at the hatchery and were recovered during spawning (Table 4). 31% (16 of 52) of hatchery steelhead were last detected in upper Eagle Creek, and 25% (13 of 52) were last detected at the mouth (Figure 6). 23% (12 of 52) of radio-tagged hatchery steelhead were detected only at the lower ladder, and it is assumed these tags were regurgitated by the fish post tagging. (Kavanagh et al. 2006)

Table 3: The number of radio-tagged adult winter steelhead detected at the hatchery, North Fork, and mouth receivers from January through June 2005. (Kavanagh et al. 2006)

	Number tagged at lower ladder	Passed hatchery receiver	Passed North Fork receiver	Passed mouth receiver
Hatchery origin	52	32	1	16
Natural origin	24	10	5	9

*Table 4: The number of radio-tagged adult winter steelhead last detected at the hatchery, North Fork, and mouth receivers from January through June 2005. Tag recoveries include tags collected from fish during spawning, by anglers, and through snorkeling efforts. Steelhead not detected at a fixed telemetry station or through mobile tracking were classif*ied as not detected. (Kavanagh et al. 2006)

	Last detection Hatchery receiver *	Last detection North Fork receiver	Last detection Mouth receiver	Last detection Lower Ladder	Last detection above Lower Ladder **	Tags Not Detected
Hatchery	18	0	13	12	5	1
Natural	6	4	7	3	2	2

* Hatchery receiver is located approximately 100' downstream of hatchery fish ladder
** Mobile tracking events that occurred between lower ladder and middle ladder of Eagle Creek

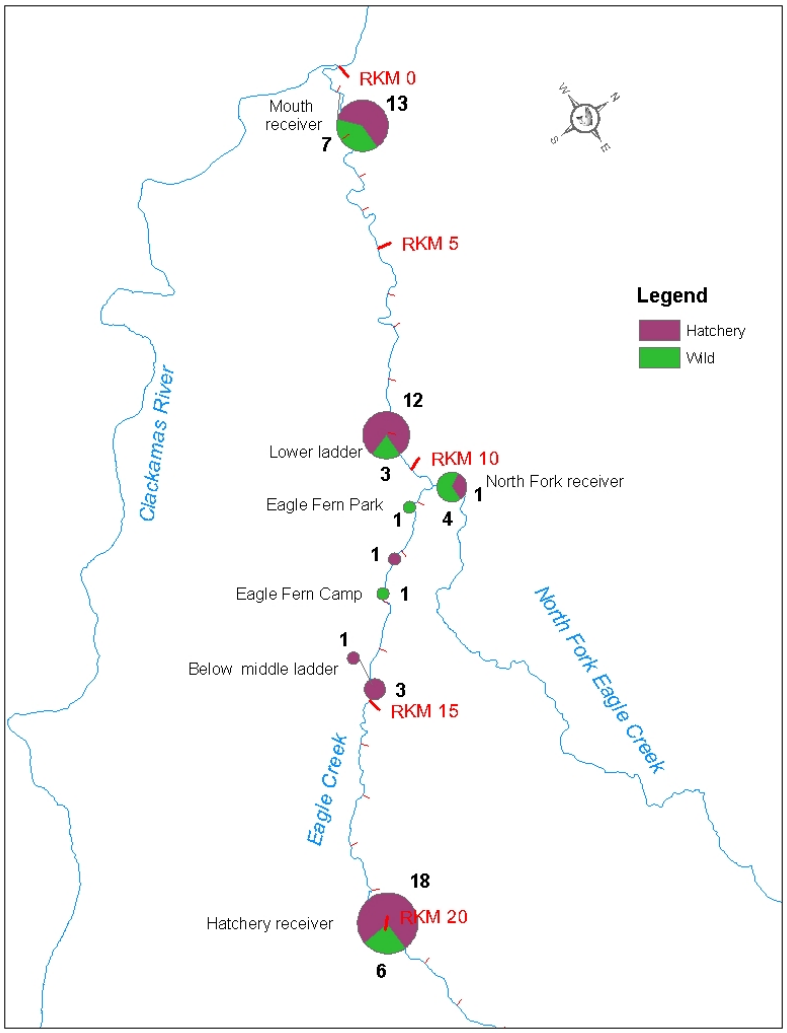
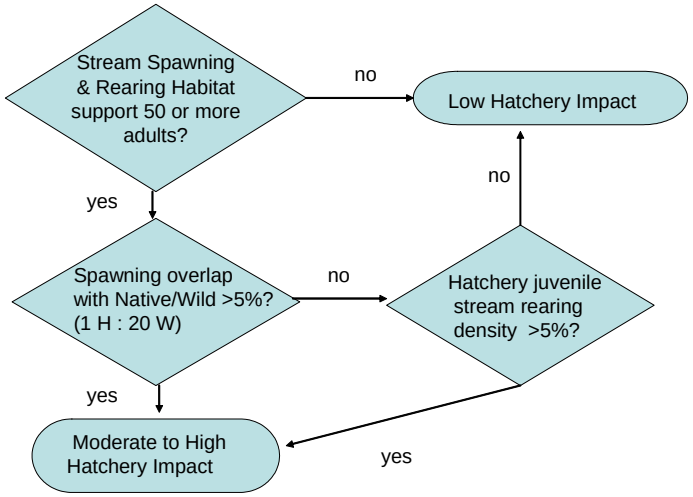


Figure 6: Last mobile and/or fixed station detections for radio-tagged adult winter steelhead. The number of hatchery and wild steelhead detected at each site is indicated in bold text next to the pie chart. Tag recoveries by anglers are not included on the map. Two wild steelhead and one hatchery steelhead were not detected post tagging. (Kavanagh et al. 2006)

- The USFWS Hatchery Review Team developed the following decision matrix to help determine the level of impact a segregated hatchery stock may have on its wild counterpart in the watershed.



Decision Matrix for Determining Impact to Wild Fish from Segregated Hatchery Program

Decision Key for Determining Impact to Wild Fish from Segregated Hatchery Program

1. Stream habitat can support natural spawning and rearing?
   50 or more adult spawning fish can be sustained in the stream…….. 2
   Less than 50 adult spawning fish can be sustained in the stream……5

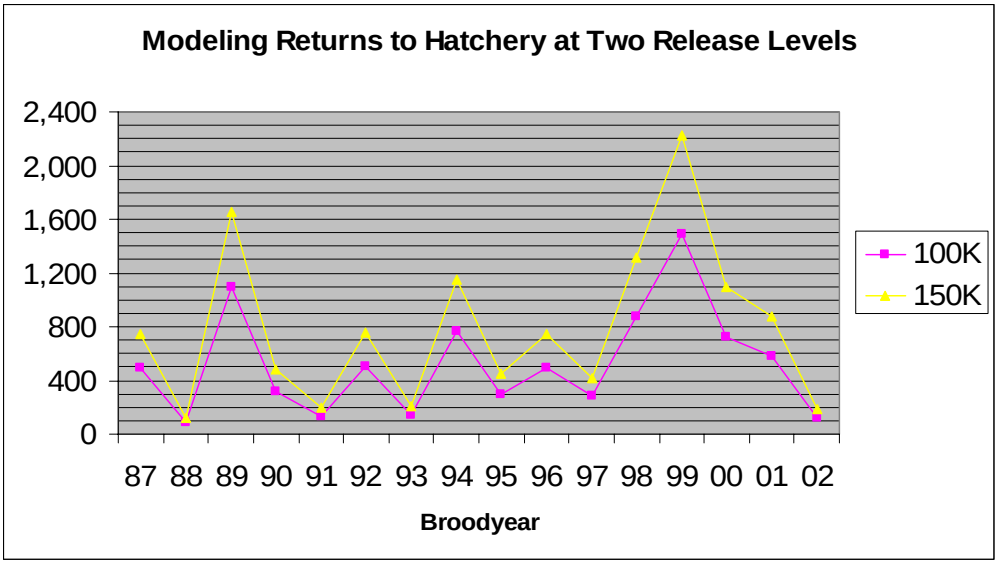
2. Proportion of hatchery and wild fish that spawn in the stream?
   Hatchery fish represent < 5% of the stream spawning population.....3
   Hatchery fish represent 5% or more of the stream spawning population…….…..….4

3. Proportion of hatchery and wild juvenile fish stream rearing?
   Hatchery juveniles are 5% or more of stream's summer rearing density……4
   Hatchery juveniles are < 5% of stream's summer rearing density…….…….5

4. Moderate to High Hatchery Impact

5. Low Hatchery Impact

- Reducing the number of smolts released from the hatchery would reduce ecological interactions in the stream. The USFWS Hatchery Review Team developed a model to determine if this could be accomplished while still meeting broodstock goals. Smolt to adult return rates back to the hatchery were reviewed over a 16-year period (broodyears 1987-2002) (see figure below). Years of low broodyear return are often bounded by years of higher return. In addition, steelhead return at multiple year classes (age 3, age 4, with an occasional 5 year old). The broodstock goal of approximately 300 fish was met eight out of ten years for both the 100,000 and 150,000 smolt release level (USFWS Hatchery Review Team 2007).



Modeled return rates for ECNFH winter steelhead at a 150,000 and 100,000 release level.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

None identified

III. Cooperative Programs

Yakima Coho Project[16]

A. Goals

The Yakima Coho Project is planned in two phases. The first phase is the "feasibility phase" and the second, the "implementation phase." The goal of Yakima Coho Project feasibility studies is to determine the feasibility of re-establishing a naturally spawning coho population and a significant fall fishery for coho within the Yakima River Basin, while keeping adverse ecological impacts within specified limits.

The project proposes to continue feasibility studies through at least 2007 and to revise the goals and objectives to help answer those questions. In effect, the feasibility studies will be divided into **Phase 1A** (ending in 2003) and **Phase 1B** (ending in approximately 2010). When warranted by the results of feasibility studies, the Yakama Nation's Policy Group will determine whether to propose an implementation phase and, if so, whether it should consist of supplementation of naturalized populations, harvest augmentation, or some other kind of production program that is consistent with their goals. The decision in the case of *U.S. v. Oregon* and its associated Columbia River Fisheries Management Plan (CRFMP) also provide over-arching guidance to Yakima Coho Project activities (p. 4, 7).

- *Harvest goal*: Through 1995, the coho program changed from harvest augmentation to a feasibility study for the purpose of re-establishing coho populations and fishery.
- *Broodstock escapement goal*: Produce one million coho smolts that are released each year from in-basin fish.
- *Conservation goal:* Establish naturally producing coho populations in the upper and lower Yakima River and tributaries, and in the Naches River and tributaries.
- *Escapement goal for natural-origin adults:* The total natural escapement goal is 2540 to 4033 fish (consisting of the natural escapement of natural origin and hatchery origin adults, 462 each of female and male broodstock) to produce 1 million smolts. (Appendix A, p. 1)
- *Research, education, and outreach goals:* Objectives and strategies address research and monitoring as well as public information and education programs.

[16] *Unless otherwise referenced, section text from Hubble et. al. "Yakima Coho Master Plan" 2004. Page locations referenced (p. X).*

B. Objectives[17]

Describe program objectives, such as broodstock collection, spawning, and release numbers. Include transfers, contributions to other programs, etc., if applicable.

Objective 1. Attempt to establish naturally producing coho populations in the upper and lower Yakima River and tributaries, and in the Naches River and tributaries.

Strategy 1a. Continue acclimated smolt releases in the mainstem of the upper Yakima and Naches rivers, including early-run and late-run stocks.

Strategy 1b. Test survival of smolts released in upper Yakima tributaries.

Strategy 1c. Test over-winter survival (parr-smolt survival) by releasing coho parr in selected tributaries to the Yakima and Naches rivers.

Strategy 1d. Test egg-fry survival, adult productivity, and interactions with NTTOC by releasing adult coho in selected tributaries to the Yakima and Naches rivers.

Strategy 1e. Transition from use of hatchery/Lower Columbia origin coho to natural/ Yakima origin coho broodstock as quickly as possible.

Strategy 1f. Monitor and evaluate factors that will determine when a self-sustaining and naturally producing population of coho is re-established in each subbasin, including adult productivity, egg-fry survival, over-winter (parr-smolt) survival, smolt-smolt survival, and smolt-adult survival.

Objective 2. Continue to investigate the coho life history in the Yakima basin.

Strategy 2a. Conduct spawner surveys throughout the Yakima basin.

Strategy 2b. Determine, in general terms, where coho currently are found in the basin and their abundance.

Strategy 2c. Determine life history timing (i.e., summer and fall parr and smolt out-migrants).

Objective 3. Assess ecological interactions.

Strategy 3a. Study coho residualism in release locations where steelhead also are found.

Strategy 3b. Study interactions between natural-origin coho or surrogates and other salmonids.

Objective 4. Develop and test use of additional culturing, acclimation and monitoring sites.

Strategy 4a. Develop additional acclimation sites in the upper Yakima River subbasin (Holmes, Boone Pond, and Taneum Creek).

Strategy 4b. Establish additional monitoring sites in the Yakima and Naches subbasins.

[17] *p. 7-8.*

Strategy 4c. Test use of a small-scale fish culturing facility (La Salle High School on Ahtanum Creek).

Objective 5. Determine long-term facility needs.

Strategy 5a. Investigate potential permanent spawning and incubation/rearing sites more suitable than Prosser for coho.

Strategy 5b. Investigate the feasibility/desirability of establishing permanent, fixed acclimation sites in the upper Yakima, Naches, or other subbasins.

Table 1. Activities Proposed for Yakima Coho Project (YKFP), Phase 1B (p9-10)

Activity	Location, Numbers, Timing
Hatchery broodstock development - existing	- Prosser Hatchery: 0 - 500,000 smolts - Lower Columbia River hatcheries: 500,000 – 1 million fry/smolts
Small-scale culturing (eyed-summer parr) - new	- Ahtanum: LaSalle High School (RM 2); 30,000; to summer parr
Acclimated volitional smolt releases from mainstem sites (smolt-smolt survival studies)	1,200,000 annually • Early run 450,000 Upper Yakima • Early run 450,000 Naches • Late run 100,000 Upper Yakima • Late run 100,000 Naches
Acclimated volitional smolt releases from new tributary sites (smolt-smolt survival, late-run/early-run survival studies)	42,000 annually • 40,000 Taneum Cr. • 1,250 Keechelus-Easton Reach Beginning late March
Parr releases – scatter plant (over-winter survival studies)	3,000 each site, 24,000 total annually, in July[18] - Upper and lower Yakima • Crystal Springs/Easton-Keechelus Reach • Big Cr. • Wilson Cr. • Toppenish Cr. • Ahtanum Cr. - Naches • N. Fork Little Naches • Salmon Falls-S. Fork • Nile Cr. • Little Rattlesnake Cr.
Adult releases	20 pairs each site, except Taneum Cr. (see Table 2), in fall

[18] *All parr releases would be PIT tagged. If numbers prove too small for reliable estimates of survival, releases would be increased, probably to no larger than 5,000 per group.*

(egg-fry survival, adult productivity, and NTTOC studies)	- Upper and lower Yakima • Taneum Cr. • Wilson Cr. • Reecer Cr. • Ahtanum Cr. • Toppenish Cr. - Naches • Pileup Cr. • Nile Cr.
Acclimation sites – existing	- Upper Yakima: Easton Ponds (RM 201); Clark Flat (RM 164) (use only as alternatives to new upper Yakima mainstem sites) - Naches: Lost Creek Pond (RM 39) and Stiles Pond (RM 9)
Acclimation sites - new mainstem	- Upper Yakima: Holmes site (RM 160) and Boone Pond (RM 180.5) Roza Dam (RM 128) (use as alternate only)
Broodstock collection – existing sites	Prosser, Roza, and Cowiche dams. Collect no more than 50% natural origin, 75% hatchery origin returns. See Appendix A. Oct 1–Dec 15
Radio-telemetry	Tag up to 100 adults and track from jet boats and autos and at fixed dam sites (Prosser 50, Cowiche 25, Roza 25). Mid-Sep through Nov
Spawning surveys (foot/boat)	- Mainstem Yakima (Keechelus Dam to Granger) - Mainstem Naches (Little Naches to confluence) - Release tributaries Sep 15–Nov 30
Juvenile collection/rotary trapping - existing traps	- Roza Dam juvenile trap: Up to 3,000 Yakima River naturally produced winter migrants will be PIT tagged (Nov-Mar) - CJMF: Count, measure, PIT tag up to 3,000 coho (Nov 15–Jul 15) - Ahtanum Cr. rotary trap (RM 0.75) Nov 1–Jun 30 - Toppenish Cr. rotary trap (RM 26.5) Nov 1–Jun 30
Juvenile collection/rotary trapping - new traps	- Naches R. (Selah-Naches Diversion Canal, RM 18.4) - Wilson Cr. irrigation dam (RM 2) - Taneum Cr. (RM 4)
Snorkeling – coho distribution, habitat use	Preferred habitat (side channel areas and mainstem pools) in the following streams: - Upper Yakima: systematic sampling (10%) of preferred habitat from Easton to Ellensburg - Naches mainstem: systematic sampling (10%) of preferred habitat from Little Naches R. to confluence - Release tributaries (Taneum, Ahtanum, Toppenish, Pileup, Nile) - systematic sampling of preferred habitat. Specific reach generally will coincide with release reaches. Summer, 3 days for each major subbasin, 1-2 days each for tributaries
Juvenile electro-fishing surveys (boat)	Yakima mainstem: systematic sampling of preferred habitat, 10 half-mile reaches between Roza Dam (RM 128) and Granger (RM 83). One in summer, one in fall/winter
Juvenile electro-fishing surveys (backpack)	**Distribution surveys** Backwater channel areas in the following rivers:

	- Upper Yakima mainstem (Easton Dam to Wilson Cr.) - Naches mainstem: confluence to the Little Naches R. - Little Naches R.: confluence to North Fork and lower half mile of tributaries (based on presence of redds) - Tributaries near adult and parr release areas Nov-Feb, 5-10 days/month, not every area annually **NTTOC surveys** - Upper Yakima: Taneum Cr. (treatment), Swauk Cr. (control) - Naches: Pileup Cr. (treatment), Quartz Cr. (control)
Snorkeling - residualism	Spot checks downstream of new release site in Taneum Creek. 1 survey in early summer.

- Prosser Hatchery can culture a maximum of 500,000 smolts based on its current water and rearing space constraints. However, should enough local returns be collected to produce more than 500,000 Yakima-origin smolts, some could be reared at lower Columbia River hatcheries. In that case, depending on how many Yakima-origin smolts were produced at hatcheries both in-basin and out-of-basin, more than 250,000 Yakima-origin smolts might be acclimated at the upstream ponds designated for in-basin fish. If the project began to approach its goal of producing all one million smolts from Yakima-origin stock, the Lower Columbia smolts could be replaced in both acclimation ponds in each subbasin. (p.11)

C. Program Description

Provide a general overview of program, including details such as broodstock origin and source, adult collection, spawning, rearing, release and monitoring and evaluation strategies.

The Yakima Coho Project is a component of the Yakima/Klickitat Fisheries Project (YKFP). The YKFP is a project designed to use artificial propagation in an attempt to re-establish, supplement, or increase natural production and harvest opportunities of anadromous salmonids while maintaining the long-term fitness of the target population and keeping the ecological and genetic impacts on non-target species within specified limits. The YKFP endorses an adaptive management policy, which allows for Project objectives and strategies to change as new information becomes available from Project experiments, monitoring and evaluation, and literature reviews. (p.1)

- Efforts to restore coho within the Yakima basin rely largely upon releases of hatchery coho derived from Lower Columbia River stocks. The Yakama Nation has released between 85,000 and 1.4 million coho smolts in the Yakima basin annually since 1985. Before 1995, the primary purpose of these releases was harvest augmentation; after 1995, the primary purpose became a test of the feasibility of re-establishing natural production. (p.14)

- Approximately 500,000 Yakima and 500,000 Lower Columbia hatchery smolts[19] from early-run stocks would be released into the Yakima basin each year. Each of four sites (two in the

[19] *The 2005 – 2007 Interim Management Agreement for Upriver Chinook, Sockeye, Steelhead, Coho and White Sturgeon for maintaining the Columbia River Fish Management Plan (expired 1999) states that Oregon, Washington and the United States shall manage lower river hatchery programs such that upriver release levels will meet the coho release goals of 500,000 smolts to be reared at Prosser Hatchery for release in the upper*

Yakima and two in the Naches) would contain approximately 250,000 early-run fish. Yakima-origin fish would be acclimated in the upstream site in each subbasin; the downstream sites would be used for Lower Columbia-origin fish. (p. 40)

- Researchers for the Yakama Nation also propose to test the possibility of establishing late-run stocks of coho. Because low water in the fall due to irrigation withdrawals may reduce adult returns, late-run fish, which could be returning in December, might have better rates of return. The Yakama Nation proposes to release 100,000 late-run smolts, which would be out-of-basin fish, from the downstream acclimation site in each subbasin. However, if space proves too limited in the downstream sites, late-run fish might also be acclimated and released from the upstream sites[20]. (p. 41)

- Prior to acclimation (usually in fall or late winter), all hatchery fish will be coded wire tagged in the snout, but not adipose clipped. Each group and acclimation/release site will have its unique CWT code. In addition, 1,250 fish from each group and acclimation/release site will be PIT tagged at the Prosser Hatchery by Yakama Nation personnel. Coded wire tagging will be subcontracted to USFWS and conducted at Prosser Hatchery for the Yakima stock fish and at the appropriate Lower Columbia River Hatchery for the lower Columbia River stock fish[21]. (p. 51)

- Broodstock is collected at Prosser Dam, at the Roza Adult Monitoring Facility on the upper Yakima (RM 128), and at Cowiche Dam on the Naches (RM 3.6). Broodstock should be collected randomly and in proportion to the projected run size past each collection site. Based on the pre-season run forecast and the number of experimental and broodstock fish required, the total number of fish to be collected is proportioned in weekly increments throughout the run. This results in a pre-season, weekly collection target number (low in the tails of the run, higher in the peak). All fish would be scanned with a coded wire tag detector (wand) to determine origin (hatchery or natural). Annual fluctuation in run size and the run composition of wild to hatchery adults will dictate how quickly and consistently in-basin and natural-origin broodstock numbers increase. (p. 49)

    - Collect natural-origin returns (NORs) as a first priority, and hatchery-origin returns (HORs) as a second priority.

    - Collect only 50% of the NORs each year and 75% of HORs.

- All adults collected in the Yakima basin for broodstock are trucked to the holding ponds at Prosser Hatchery. They are treated with formalin and checked weekly for ripeness. When ripe, they are spawned at Prosser Hatchery. Spawned-out carcasses would be returned primarily to tributary sites and possibly to mainstem areas near the acclimation sites. (p. 49)

Yakima River for a supplementation program.

[20] *Since 200x, eggs from the Washougal (WA) late run coho stock have been reared at Prosser Hatchery and released as smolts from acclimation sites (personal communication, Todd Newsome, Yakama Nation)*

[21] *Early in the program, coho came from Cascade Hatchery, OR, as cited in the 2004 Yakima Coho Master Plan. However, from 199x-2002, the 500,000 coho smolts were derived from the Willard/Little White Salmon NFH stock and since the demise of that stock(due to Mitchell Act funding cuts), from the Eagle Creek NFH stock (S. Gutenberger, Lower Columbia River Fish Health Ctr).*

- Adult salmon, regardless of stock origin, are integrated at spawning. (PAR Meeting, January 10-11, 2007, T. Newsome).

- All broodstock and juveniles are inspected by the USFWS Lower Columbia River Fish Health Center, in accordance to US Fish & Wildlife Service Fish Health Policy.

Table 14. Mainstem Coho Smolt Release Sites, Phase 1B (p. 40)

Location	Release #	Life Stage	PIT Tag #	Stock	Purpose	Study Method
Yakima River						
Easton	Alternate site	Smolt	1,250	Yakima origin	Smolt-smolt survival	PIT detector at release location, CJMF, McNary
Roza Dam	Alternate site	Smolt	1,250	L. Columbia origin	Smolt-smolt survival	PIT detector at release location, CJMF, McNary
Clark Flat	Alternate site	Smolt	1,250	L. Columbia origin	Smolt-smolt survival	PIT detector at release location. CJMF, McNary
Holmes	250,000 early 100,000 late	Smolt	1,250	L. Columbia origin	Smolt-smolt survival	PIT detector at release location, CJMF, McNary
Boone Pond	250,000	Smolt	1,250	Yakima origin	Smolt-smolt survival	PIT detector at release location, CJMF, McNary
Naches River						
Lost Cr.	250,000	Smolt	1,250	Yakima origin	Smolt-smolt survival	PIT detector at release location, Selah-Naches diversion, CJMF, McNary
Stiles Pond	250,000 early 100,000 late	Smolt	1,250	L. Columbia origin	Smolt-smolt survival	PIT detector at release location, CJMF, McNary

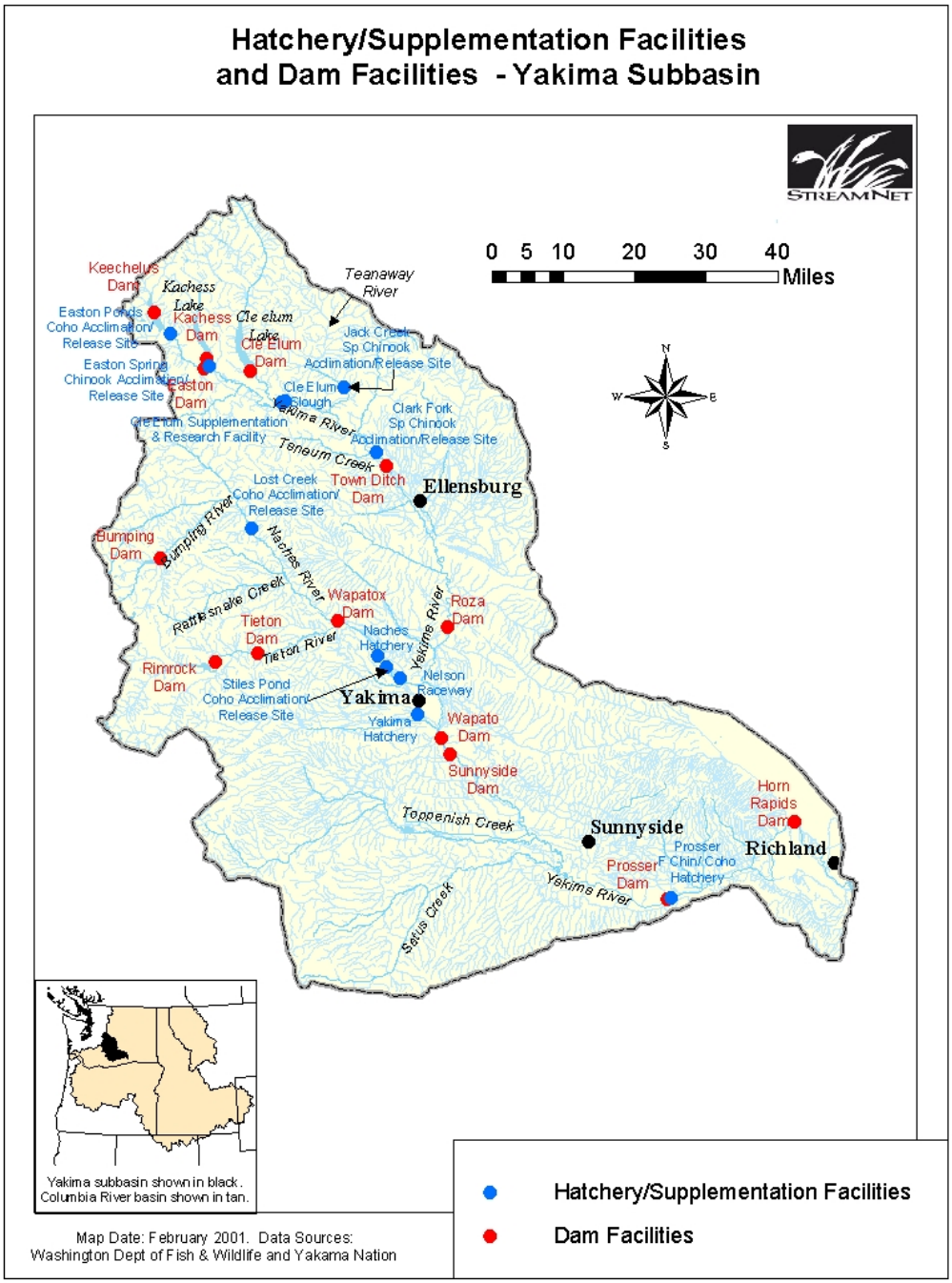


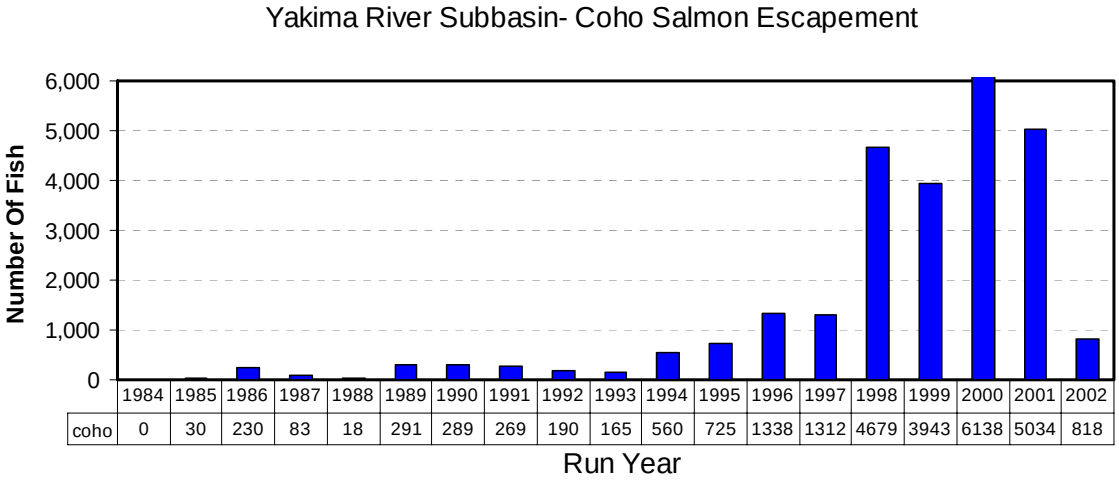
Figure 9. Existing YKFP Facilities (p. 4)

D. Program Benefits

Provide a brief description of program benefits, including adult return numbers over a ten year period, contribution to harvest, contribution to conservation and any other benefits (ceremonial, subsistence, education, research, uniqueness of stock, etc).

The benefits include restoring, maintaining, and enhancing fish and wildlife populations to sustainable levels and also, when applicable, harvestable levels. This implies supplementation of wild stocks that are declining and in danger of extinction, and reintroduction of salmon and steelhead to areas they once occupied. The objectives and strategies address research and monitoring as well as public information and education programs for increasing the information and knowledge needed to restore and manage fish, wildlife and their habitats. The maintenance of genetic diversity is also emphasized. (p. 27)

- Figure 2 shows the estimated coho run size for the years 1984-2002. Coho returns since regular out-planting began in 1985 have increased steadily, climbing from 0 in 1984 to a peak of 6,138 in 2000 (Figure 2). The poor 2002 returns reflect low juvenile survival in their release year—the drought year of 2001. Because few of the out-planted coho smolts were marked until 2000, the proportion of natural-origin recruits in returns before 2001 is unknown (Berg and Fast 2001). Natural-origin adults comprised 30.8% of the 2001 adult return and 69% of the 2003 adult return (p.14).



	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
coho	0	30	230	83	18	291	289	269	190	165	560	725	1338	1312	4679	3943	6138	5034	818

Figure 2. Annual Adult Coho Run Size Over Prosser Dam, 1984-2002

Yakima Coho Master Plan, 2003, p. 13[22]

[22] *This table is copied from the 2003 Yakima Coho Master Plan. The 2004 Master Plan (pdf file) shows 2003 numbers of 2192.*

- Adult coho passage at Prosser Dam, from 1995 to 2005, averaged 2789 adults. Numbers of coho at the dam were: 4335 in 2006, 2890 in 2005, 2325 in 2004 and 2192 in 2003. (Columbia River DART Adult Passage All Species Composite Report website, June 2007)

- Numbers of coho adults passing the Roza Dam (RM 128), were significantly lower at 1.4 fish in 10 year average, 1995 – 2005. (Columbia River DART Adult Passage All Species Composite Report website, June 2007)

- The hatchery smolt-to-all adult return rates increased beginning with the 1998 return (0.448%) and averaged 0.456% for 1998 -2001. Prior to this period, rates didn't exceed 0.142%. (p. 43)

- Hatchery-reared coho, out-planted as smolts, are now reproducing in both the Yakima and Naches Rivers (Figure 3). Natural reproduction is evident from the increasing number of zero-aged coho parr in samples taken at numerous points in the basin (YN, unpublished data, 2000 [in] Berg and Fast 2001). The naturalized run spawns in reaches downstream of the historical areas because, until 1999, the vast majority of hatchery smolts were acclimated and/or released well downstream of historical spawning areas. As was evident from the monitoring of radio-tagged adult coho in the fall of 1999, most coho spawned near their acclimation and release points, primarily in the middle Yakima below Sunnyside Dam (from RM 95 - RM 104). (p. 13)

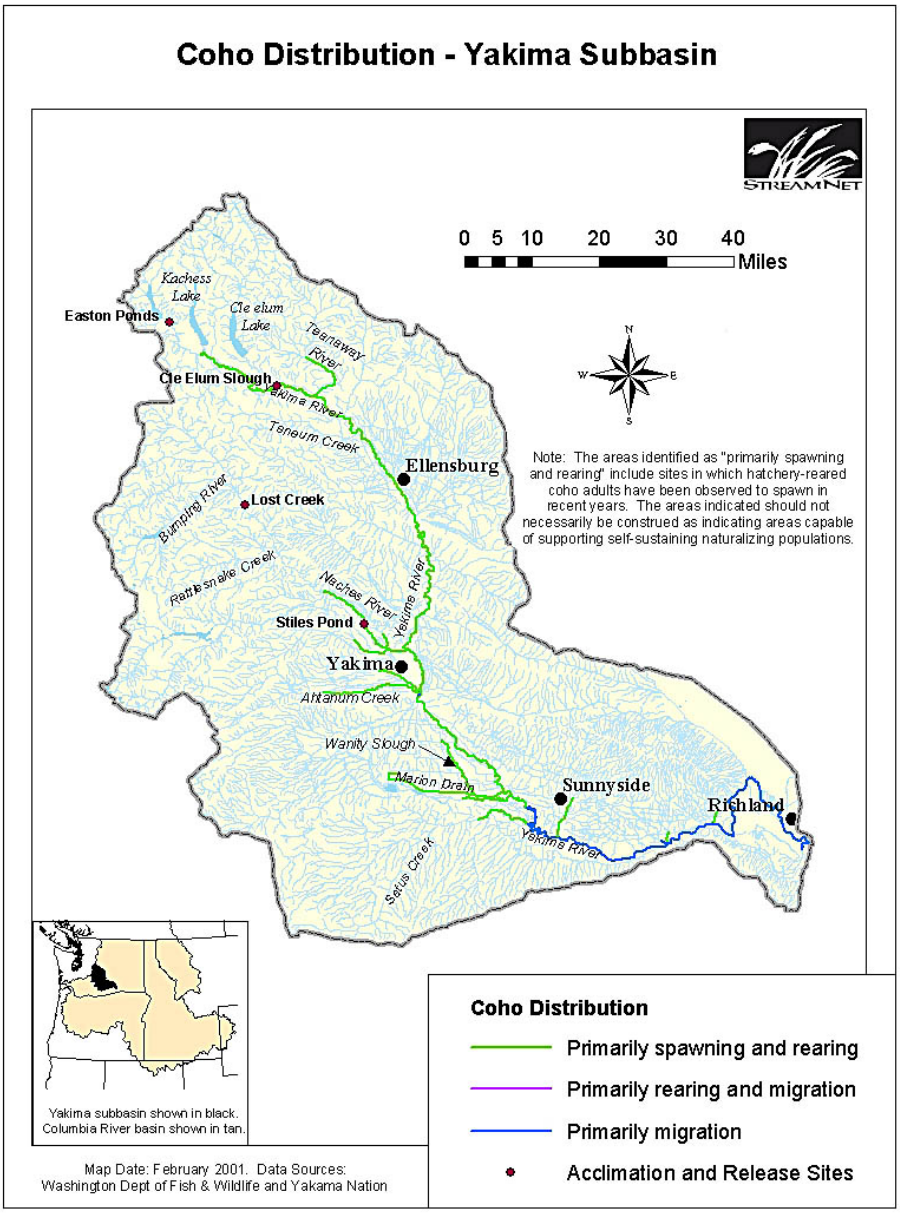


Figure 3. Current Coho Distribution in the Yakima Subbasin (p. 15)

- Total harvest rates for all upriver, early coho (marked and unmarked) average about 20% in ocean fisheries and 15% in mainstem Columbia River fisheries, for a total of about 35%. Harvest rates on marked coho (hatchery released) are estimated to average 30% in ocean fisheries and 20% in river fisheries, for a total harvest rate of 50%. Harvest rates on unmarked coho (natural-origin or unmarked hatchery smolts) are estimated to average 12% in ocean fisheries and 11% in river fisheries for a total harvest rate of 23%. (p. 16)

- Currently non-Indian fisheries are managed to assure that at least 50% of the total upriver coho return escapes above Bonneville Dam. (These are combined early and late stocks—late stocks return to the Klickitat River) (Blodgett and Dunnigan 2001a). Harvest in the Yakima basin is minimal. In 2001, no coho were caught in the Tribal fishery, 50 coho in the sport fishery. (p. 16)

E. Program Conflicts

Provide a brief description of program conflicts if any. This could include biological, harvest or conservation conflicts, such as conflicts with other harvest or conservation objectives, genetic, demographic or ecological conflicts with other stocks or species in the watershed or region, or conflicts within the program itself.

The Supplement Analysis found that volitional releases of up to one million smolts in May each year from two existing sites in the Naches and upper Yakima basins would pose a low risk of predation on or competition with other fish species, including listed steelhead and bull trout. Steelhead fry emerge from the gravel after the coho have migrated through the Yakima system, and yearling rainbow/steelhead are too large to be readily consumed by coho smolts (BPA 1999). The risk to bull trout is especially low due to the limited spatial overlap between coho smolt emigration corridors and bull trout spawning areas (WDFW 1998). Subsequent studies, including residualism studies and a study of predation on spring chinook in Easton Reach, generally support these conclusions (Dunnigan 1999 in Yakama Coho Master Plan, 2004). Despite these studies and previous findings, concerns and questions remain. For that reason, WDFW and YN undertook an interactions risk assessment which showed that coho interactions with steelhead are not expected to pose a high risk. For example, the highest risk level projected for coho/steelhead interactions was under 18 (when 100 represents maximum risk) in the upper Yakima basin, and 12 in the Naches. c are expected to be even lower. (p.43)

Of particular concern are the effects of interactions between natural-origin coho and other species. These interactions are expected to be low for at least a few years due to the low number of natural-origin spawners (an estimated 1,530 adults in 2001). As of 2002, adult returns still are concentrated in the lower reaches of the mainstem Yakima River (downstream of Union Gap) (Dunnigan et al. 2002), most of which is not spawning or rearing habitat for listed species or those in the "no impact" section of the NTTOC list. Although some life cycle activities of late-run stocks would take place a few weeks later than those of early-run fish (i.e., primarily spawning and fry emergence), the effects on other fish of releasing late-run coho would not be noticeably different from those of early-run coho. (p. 43)

However, the number of coho adult returns has been increasing steadily. The hatchery smolt-to-all adult return rates increased beginning with the 1998 return (0.448%) and averaged 0.456% for 1998-2001. Prior to this period, rates didn't exceed 0.142%. Thus, numbers of possible natural-origin returns (NORs) comprising the adult run probably began to increase beginning with the 2001 return. Because all smolts released in 2000 were coded wire tagged, 2001 was the first year NORs could be distinguished from hatchery-origin returns (HORs). In 2001, 2,209 coho (44%) of the 5,034 coho enumerated at Prosser Dam passed via the denil trap and were sampled. Of the sampled fish, 1,517 coho were enumerated as hatchery (68.7%) and 692 were enumerated as wild (31.3%). Using these proportions and adjusting for coded wire tag (CWT) retention, estimates of total hatchery and wild coho passage at Prosser Dam in 2001 were 3,464 hatchery and 1,502 wild

adults and 47 hatchery and 21 wild jacks (Dunnigan et al. 2002). The preliminary 2002 return composition was 88.9% NORs and 11.1% HORs. (pp. 43-44)

If the trend continues, and if coho begin to populate the upper reaches of the basin, density-dependent competition effects might become a concern. To study the potential for such effects in advance of large numbers of naturally produced coho occupying parts of the basin, the project proposes controlled studies in paired streams in the Naches and upper Yakima. Habitat use and residualism surveys will help identify general species associations, habitat overlaps with steelhead and other species of concern, and whether coho appear to be displacing these species in areas where they overlap. (p44)

There is a low risk of adverse ecological interactions between adult coho and their progeny and other fish species. As is the case for parr releases in some streams, adult releases are not risk-free, but due to the nature of some of the studies (interaction studies), some risk must be imposed in order to accomplish the research. (p. 48)

Nez Perce Tribe Clearwater River Coho Reintroduction Program

A. Goals

Provide a brief description of program goals in the subsections below. Put "this program has no xxx goal" if a subsection does not apply to the program.

- *Harvest goal:* Reintroduce and restore coho salmon to the Clearwater River Subbasin at levels of abundance and productivity sufficient to support sustainable runs and harvest at an annual escapement of 14,000 coho salmon to the basin. (NPT Coho Master Plan Clearwater River Basin 2004, p. ii)

  Incidental harvest of Clearwater River Subbasin coho in ocean and mainstem Columbia river fisheries is expected to occur. Targeted Clearwater River Subbasin harvest opportunities are expected to arise under two circumstances:

  1. The abundance of natural origin adults allows for ample escapement for natural spawning while simultaneously provide for some of the broodstock needs. Using a fraction of natural origin adults for broodstock should result in a surplus of hatchery origin adults that could be targeted in a fishery.

  2. If supplementation activities successfully establish highly productive naturally spawning coho salmon aggregates, the number of locations and size of supplementation release groups could be scaled down. If this occurs, production from the expanded NPTH facility could provide a targeted fishery. (NPT Coho Master Plan Clearwater River Basin 2004, p. 29)

- *Broodstock escapement goal*: (Phase 1) Sustainable return of 954 Clearwater Localized stock (CLS) adult coho salmon to fulfill broodstock needs for existing Clearwater River Subbasin facilities (452 for Clearwater Fish Hatchery and 502 for Dworshak National Fish Hatchery). (Phase 2) Sustainable return of an additional 1,404 adults to ensure that broodstock will be available for an expansion of the Nez Perce Tribal Hatchery should Phase II be implemented. (NPT Coho Master Plan Clearwater River Basin 2004, p. 23)

- *Conservation goal*: Reintroduce and restore coho salmon to the Clearwater River Subbasin at levels of abundance and productivity sufficient to support sustainable runs and harvest at an annual escapement of 14,000 coho salmon to the basin. (NPT Coho Master Plan Clearwater River Basin 2004, p. ii)

- *Escapement goal for natural-origin adults*: The ultimate goal of the coho reintroduction program is the establishment of substantial coho natural production within the Clearwater River Subbasin that in concert with hatchery production can sustain tribal and recreational fisheries. While the primary goal of Phase I is acquisition of a CLS broodstock, a comprehensive evaluation of natural production is planned in order to determine whether CLS coho salmon are capable of spawning under natural conditions. If natural production is documented in a limited set of streams, managers could more confidently implement Phase II,

wherein the reestablishment of natural production is the primary goal. (NPT Coho Master Plan Clearwater River Basin 2004, p24)

- *Research, education, and outreach goals*: A number of indicators of success and failure have been compiled that are amenable to evaluation using the RM&E program. (Phase I) Establishment of baseline production and productivity estimates for naturally spawning coho in Clear and Lolo creeks and establishment of measures of competition between coho and spring chinook salmon and steelhead in Clear and Lolo creek. (Phase II) Achieving all Phase I indicators of success (establishment of 100% CLS broodstocks at Clearwater Fish Hatchery and Dworshak National Fish Hatchery within nine years of the implementation of Phase I will indicate success, failure to achieve this goal within the this time period will indicate failure (p.35)), establishing that competition has not surpassed acceptable limits due to reintroduction of coho salmon, and confirming that the availability of LCR coho smolts for a minimum of six years (two coho generations) following completion of the Nez Perce Tribal Hatchery expansion. (NPT Coho Master Plan Clearwater River Basin 2004, p. 35-37)

B. Objectives

Describe program objectives, such as broodstock collection, spawning, and release numbers. Include transfers, contributions to other programs, etc., if applicable.

- The Nez Perce developed management objectives (these should be measurable and time-limited) aimed at achieving the overall goal of the program.
- Establish a localized Clearwater River coho salmon broodstock.
- Establish natural spawning populations of coho salmon in the Clearwater River Subbasin.
- Utilize hatchery production to achieve optimal production effectiveness while meeting the management objectives for natural production enhancement, diversity, and impacts to non-targeted populations.
- Restore and maintain treaty-reserved tribal and recreational fisheries.
- Monitor and evaluate program activities and communicate program findings to resource managers.

(NPT Coho Master Plan Clearwater River Basin 2004, p. 15)

C. Program Description

Provide a general overview of program, including details such as broodstock origin and source, adult collection, spawning, rearing, release and monitoring and evaluation strategies.

The Nez Perce Tribe proposes to utilize a two-phased approach to coho reintroductions. Phase I of the coho reintroduction program will focus on the establishment of a localized coho salmon stock capable of enduring the migration to the Clearwater River Subbasin. To test achieving this goal, the Nez Perce Tribe proposes to utilize space at existing Clearwater River Subbasin hatchery

facilities in concert with the construction of two low-tech acclimation facilities, to capitalize on the higher survival observed for acclimated versus direct released coho. In addition, Phase I will document the natural productivity of localized coho salmon released in two targeted tributaries within the Clearwater River Subbasin. If Phase I is successful at establishing a localized coho salmon stock in an abundance capable of filling existing hatchery space, and the rates of natural productivity are promising, and the inner-specific interactions between coho and sympatric resident and anadromous salmonids are deemed acceptable, then Phase II will be triggered. (NPT Coho Master Plan Clearwater River Basin 2004, p. ii-iii)

The primary tasks identified in Phase I were to continue the shipment of 550,000 smolts from Eagle Creek National Fish Hatchery for acclimation and release from the North Lapwai Valley Satellite, establish a sustainable return of 954 CLS adult coho salmon to fulfill broodstock needs for Clearwater Fish Hatchery (452 adults to produce 270,000 presmolts for acclimation and release in Lolo Creek) and 502 for Dworshak National Fish Hatchery (502 adults to produce 280,000 smolts for acclimation at Kooskia National Fish Hatchery and release into Clear Creek), establish a sustainable return of an additional 1,404 CLS adults to ensure that broodstock would be available for an expansion of NPTH facility should Phase II be implemented, conduct tests of supplementation aimed at determining whether returning adult coho can spawn under natural conditions and produce viable progeny, and Implement a RM&E program capable of providing information necessary to inform management, quantitatively track progress toward meeting Phase I goals, Phase II triggers, and determine the optimal size3 release groups for establishing natural production. (NPT Coho Master Plan Clearwater River Basin 2004, p. 23)

The Nez Perce Tribe identified in the 2007 Clearwater Annual Operating Plan that in 2007, due to funding cuts in the Pacific Coastal Salmon Recovery Fund, the Nez Perce Tribe was forced to discontinue coho salmon production at Clearwater Hatchery (452 adults to produce 270,000 pre-smolts for acclimation and release in Lolo Creek) and that there would be insufficient funds to operate weirs on the Potlatch River and Lapwai Creek for monitoring and broodstock collection; therefore, the Potlatch smolt release will be transferred to Clear Creek to facilitate future broodstock collection at Kooskia NFH.

Smolts from Eagle Creek NFH will be released into Clear and Lapwai Creeks in mid-March 2007/08. Approximately 550,000 (275,000 each stream) will be direct stream released. Approximately 25,000 will be CWT/AD, and 25,000 will be CWT only per release site. There will be 1,500 PIT in each release group.

Adult coho returning to the Snake River basin and Clearwater River are a priority for use as BY2007 broodstock (502 adults to produce 280,000 smolts for rearing at Dworshak National Fish Hatchery, acclimation at Kooskia National Fish Hatchery, and release into Clear Creek. 100,000 CWT and 1,500 PIT). Fish will be collected at fish ladders at Dworshak NFH, Kooskia NFH, Lyons Ferry FH, Nez Perce Tribal Hatchery, and two weirs. (2007 Clearwater Annual Operations Plan, p. 19-21)

Phase II of the coho reintroduction plan will focus on establishing natural production in a number of Clearwater River Subbasin tributaries. To accomplish this goal, Phase II will utilize existing Clearwater River Subbasin hatchery facilities, and expand facilities at the Nez Perce tribal Hatchery Site 1705 facility to rear approximately 687,700 smolts annually for use in a rotating supplementation schedule. (NPT Coho Master Plan Clearwater River Basin 2004, p. ii-iii)

The primary tasks identified in Phase II were to Continue development of a Clearwater River Subbasin localized coho salmon stock, construct facilities at Nez Perce Tribal Hatchery to accommodate holding and spawning 1,404 adults and rearing 687,000 smolts, increase supplementation using a rotating release schedule, and provide harvest opportunities for tribal and recreational anglers. (NPT Coho Master Plan Clearwater River Basin 2004, p. 25)

D. Program Benefits[23]

Provide a brief description of program benefits, including adult return numbers over a ten year period, contribution to harvest, contribution to conservation and any other benefits (ceremonial, subsistence, education, research, uniqueness of stock, etc).

Preliminary Reintroduction Results

Short-term Clearwater River Subbasin coho reintroduction plans were developed for the *U.S. v Oregon* Production Advisory Committee in 1996 (Ashe and Johnson 1996) and amended in 1997 (Johnson and Ashe 1997). The Clearwater River Subbasin coho reintroduction program has been adopted as part of the Fall Fisheries Agreement developed through *U.S. v Oregon*. The program was authorized by NOAA Fisheries in their Snake River Basin Hatchery Biological Opinion (NOAA 1999).

The NPT coho reintroduction began in 1995 with the release of 622,227 parr originating from Cascade National Fish Hatchery (CNFH; Table 6-1). The program is ongoing and continues to derive the majority of its production from juveniles reared at LCR hatcheries. However, a progressively larger component of Clearwater River Subbasin coho production is obtained using adults returning to the Clearwater River Subbasin collected from Clear Creek at the Kooskia National Fish Hatchery (KNFH). These adults are spawned at the Dworshak National Fish Hatchery (DNFH) where progeny are reared to the smolt stage for acclimation at KNFH and release into Clear Creek. In addition, adults collected at temporary weirs located on Lapwai Creek, the Potlatch River, Meadow Creek (Selway River drainage), and Lolo Creek are spawned at the DNFH, and their progeny are reared for release into Lolo Creek. In recent years production at DNFH has produced 280,000 smolts for release into Clear Creek, while production at CAFH will allow the release of 270,000 presmolts into Lolo Creek in 2004. Hence, the transition from LCR stock coho salmon to CLS coho has already been initiated.

Preliminary results from NPT coho reintroduction efforts indicate that a substantial survival benefit can be realized by acclimating juveniles prior to release and/or using CLS stock as a brood source (Table 6-2). Acclimation, and/or use of CLS broodstock (or some combination of these factors) appears to increase post-release survival to Lower Granite Dam (LGD). Unfortunately, data are insufficient to determine whether the observed survival benefit results primarily from acclimation or from using CLS broodstock. The preliminary results do show a clear survival advantage for smolt versus parr releases. Finally, adult collection facilities that are located lower in the Clearwater River Subbasin appear to decrease losses due to "drop out" between LGD and capture facilities.

To date, the primary focus of preliminary reintroduction efforts has been the formation of a Clearwater Localized Stock (CLS) of coho salmon. Hence, substantial effort has been expended

[23] *Section text from NPT Coho Master Plan Clearwater River Basin 2004, p. 86-90.*

in attempting to capture all returning adult coho salmon. However, weirs on the Potlatch River and Lolo Creek are not 100% efficient, and redd surveys have documented coho salmon redds in these locations (Table 6-3). The presence of these redds suggests that adult coho salmon returning from the release of lower Columbia River hatchery origin juvenile coho salmon can construct redds. However, since the number of adults that constructed the redds is unknown, and since juvenile trapping activities for coho salmon are opportunistic, it is impossible to estimate productivity.

Finally, the number of adult coho passing Lower Granite Dam (LGD) has been increasing steadily since 1997 (Table 6-4; http://www.cbr.washington.edu/dart/dart.html), suggesting that preliminary reintroduction efforts have successful at stimulating adult returns.

Table 6-1. Summary of NPT juvenile coho releases in the Clearwater River subbasin.

Release Year	Life Stage	Brood Source[1]/Hatchery[2]	Number Released	Release Location
1995	Parr	LCR/CNFH	142,456	Potlatch River
	Parr	LCR/CNFH	49,849	Orofino Creek
	Parr	LCR/CNFH	94,777	Eldorado Creek
	Parr	LCR/CNFH	335,145	Meadow Creek (SR[3])
			622,227	
1998	Parr	LCR/BFH	175,000	Potlatch River
	Parr	LCR/BFH	125,000	Eldorado Creek
	Parr	LCR/BFH	150,000	Meadow Creek (SR)
			450,000	
	Smolt	LCR/WNFH, LCR/BFH	244,640	Lapwai Creek
	Smolt	LCR/WNFH, LCR/BFH	231,076	Potlatch River
	Smolt	LCR/WNFH, LCR/BFH	218,501	Clear Creek
			694,217	
1999	Parr	LCR/BFH	175,000	Potlatch River
	Parr	LCR/BFH	125,000	Eldorado Creek
	Parr	LCR/BFH	150,000	Meadow Creek (SR)
			450,000	
	Smolt	LCR/WNFH, LCR/BFH	290,176	Lapwai Creek
	Smolt	LCR/WNFH, LCR/BFH	276,682	Potlatch River
	Smolt	LCR/WNFH, LCR/BFH	245,168	Clear Creek
			812,026	
2000	Parr	LCR/ECNFH, LCR/WNFH	124,470	Eldorado Creek
	Parr	LCR/ECNFH, LCR/WNFH	148,578	Meadow Creek (SFCR4)
	Parr	LCR/ECNFH, LCR/WNFH	149,300	Meadow Creek (SR)
			422,348	
	Smolt	LCR/WNFH	267,102	Lapwai Creek
	Smolt	LCR/WNFH	267,166	Potlatch River

	Smolt	CLS/DNFH	280,750	Clear Creek
			815,018	
2001	Fry	LCR/ECNFH	**23,000**	Mission Creek
	Parr	CLS/CAFH, LCR/ECNFH	140,000	Eldorado Creek
	Parr	LCR/ECNFH	120,000	Meadow Creek (SFCR[4])
	Parr	LCR/ECNFH	85,000	Meadow Creek (SR)
			345,000	
	Smolt	LCR/WNFH, LCR/ECNFH	286,504	Lapwai Creek
	Smolt	LCR/WNFH, LCR/ECNFH	275,688	Potlatch River
	Smolt	CLS/DNFH	30,191	Clear Creek
			629,283	
2002	Fry	LCR/ECNFH	**25,000**	Mission Creek
	Parr	CLS/CAFH, LCR/ECNFH	140,000	Eldorado Creek
	Parr	LCR/ECNFH	120,000	Meadow Creek (SFCR)
	Parr	LCR/ECNFH	85,000	Meadow Creek (SR)
			345,000	
	Smolt	LCR/ECNFH	275,000	Lapwai Creek
	Smolt	LCR/ECNFH	552,298	Potlatch River
	Smolt	CLS/DNFH	236,692	Clear Creek
			1,063,990	
2003	Parr	LCR/CAFH	157,012	O'Hara Creek
	Parr	LCR/CAFH	121,920	Eldorado (Lolo) Creek
	Parr	LCR/CAFH	135,500	Meadow Creek (SFCR)
			414,432	
	Smolt	LCR/ECNFH	274,125	Potlatch River
	Smolt	LCR/ECNFH	279,500	Lapwai Creek
	Smolt	CLS/DNFH	293,879	Clear Creek
			847,504	
2004	Parr	LCR/ECNFH	150,000	Eldorado (Lolo) Creek
	Parr	LCR/ECNFH	75,000	Lolo Creek
	Parr	LCR/ECNFH	75,000	Musselshell Creek
			300,000	
	Smolt	LCR/ECNFH	297,271	Potlatch River
	Smolt	LCR/ECNFH	299,084	Lapwai Creek
	Smolt	CLS/CAFH, LCR/ECNFH	356,323	Clear Creek
			952,678	
2005	Smolt	LCR/ECNFH	275,000	Potlatch River
	Smolt	LCR/ECNFH	275,000	Lapwai Creek
	Smolt	CLS/CAFH, LCR/ECNFH	280,000	Clear Creek
			830,000	

[1]Refers to progeny from Lower Columbia River (LCR) origin adults, or Clearwater River localized stock (CLS).
[2]Refers to the hatchery facility that reared the juveniles:

CNFH = Cascade National Fish Hatchery
BFH = Bonneville Fish Hatchery
WNFH = Willard National Fish Hatchery
ECNFH = Eagle Creek National Fish Hatchery
DNFH = Dworshak National Fish Hatchery
CAFH = Clearwater Fish Hatchery

[3]SR refers to the Selway River watershed.

[4]SFCR refers to the South Fork Clearwater River watershed.

Table 6-2. Summary of observed survival rates of NPT coho release groups.

Stream	Stock	Life Stage	Survival to LGR (%)[1]	SAR LGR to LGR (%)	Dropout LGR to Trap (%)
Clear Creek	CLS	Smolt	56.2 - 75.0	0.5 - 0.6	49.1
Potlatch River	LCR	Smolt	8.6	1.1	60.0
Lapwai Creek	LCR	Smolt	24.2	0.2	51.5
Meadow Creek SR	CLS	Parr	2.4 - 10.4	NS[2]	100.0
Eldorado Creek	CLS	Parr	5.9 - 8.0	NS[2]	92.0

[1]Calculated using SURPH 2.1 (Lady *et al.* 2001)

[2]Sample size was insufficient for calculation.

Table 6-3. Number of coho salmon redds enumerated in the Potlatch River and Lolo Creek from 1999 through 2003.

Year	Redds		
	Potlatch River	Lolo Creek	Total
1999	11	N/A	11
2000	14	N/A	14
2001	32	0	32
2002	20	0	20
2003	15	1	16

N/A - Redd counts were not conducted in Lolo Creek in 1999 and 2000.

Table 6-4. Counts of adult and jack coho salmon passing LGD from preliminary NPT coho salmon reintroduction efforts.

Year	Adult Coho	Jack Coho	Total
1997	84	10	94
1998	10	1	11
1999	250	42	292
2000	883	35	918
2001	937	111	1,048
2002	247	149	396
2003	1,129	130	1,259
2004*	3,291	97	3,388

*Adult returns as 27 October 2004.

E. Program Conflicts

Provide a brief description of program conflicts if any. This could include biological, harvest or conservation conflicts, such as conflicts with other harvest or conservation objectives, genetic, demographic or ecological conflicts with other stocks or species in the watershed or region, or conflicts within the program itself.

The Nez Perce Tribe developed an extensive RM&E plan to monitor and evaluate the results of the coho restoration program so that operations could be adaptively managed to optimize hatchery and natural production, and minimize deleterious ecological impacts. (NPT Coho Master Plan Clearwater River Basin 2004, p. 39-41)

Funding limitations have resulted in changes to the proposed program and the RM&E program has not currently been fully funded.

IV. References

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July 2007