

SALMON AND STEELHEAD RUNS, 1940 TO PRESENT

INTRODUCTION

Two developments significantly affected Clackamas River salmon and steelhead runs in 1940. In 1939, the fish ladders at Faraday and River Mill dams were rebuilt, restoring passage to historic spawning and rearing habitat in the upper Clackamas River Basin. At the same time, fish propagators reduced their egg-taking operations on the Clackamas River considerably. Together, these developments ended a long period of near denial of fish to upriver spawning and rearing grounds that had seriously reduced natural fish production in the basin. Other improvements at the dams over the years further improved fish production in the Clackamas River Basin. Fish passage facilities included with North Fork Dam improved both upstream and downstream migration, though some downstream migrants bypassed the facilities in favor of the spillway.

The rebuilding of salmon and steelhead runs was met by the expansion of activities in the upper basin. Road construction accelerated in the 1940s and then took off. By 1969 about 60 percent of the upper basin's existing road network had been established. Timber harvest quickly followed the building of new roads and vast quantities of timber were harvested. Between 1950 and 1994, timber was harvested on more than 29 percent of the upper Clackamas watershed. These practices significantly reduced habitat quality in many parts of the upper basin.

Fishing pressure continued to affect the runs. While commercial fishing on the Clackamas and Willamette rivers dropped after 1950, harvest on the ocean and Columbia River began to climb again in the 1950s as declining wild runs were replaced by hatchery production. Sport fishing also increased.

Salmon and steelhead destined for the Clackamas were further affected by increasing development along the lower Willamette River. Water quality in the Willamette declined through the 1950s, despite steps initiated to reduce pollution. In 1950, the river's oxygen content had fallen to 3.6 parts per million (ppm) at Willamette Falls and to zero at the Portland Harbor (Gleeson 1972). A stream supporting healthy fish needs an oxygen content of at least 5 ppm. Water quality in the Willamette improved in the late 1960s as communities along the river adopted new ways to treat their waste. In this low water year, the river met water quality standards at all sample points above Newberg, Oregon.

FISH PRODUCTION

Records show that salmon and steelhead began returning to the upper Clackamas River soon after passage was restored at the dams. A December 19, 1939 article in the *Banner-Courier*, an Oregon City newspaper, reported that the fish had been seen going over the dam's ladder in good shape. According to workers at Cazadero Dam, the fish had appeared some days before and continued to go over and into the upper reaches of the Clackamas. The article suggests that the appearance of the fish (not battered) showed that they also mounted the River Mill Dam without trouble (*Banner-Courier 1939*).

By the 1950s, the runs had begun to rebuild mostly through natural production. Counts conducted by the U.S. Fish and Wildlife Service for five years beginning in 1950 show this improvement. The counts were gathered through use of a trap in the River Mill Dam fish ladder exit. During the period, the coho numbered 416, 741, 1,378, 1,122, and 1,155 consecutively for an average of 962 fish. Steelhead counts totaled 1,484, 1,954, 1,559, 1,616, and 950 for an average of 1,513 fish. Chinook counts totaled 366, 496, 668, 533, and 407, respectively, for an average of 494 fish. No apparent artificial production programs were initiated for steelhead and coho during this time.

The strength of the steelhead, and to a lesser extent coho, runs suggest that these stocks may have been less damaged by the long period of denial to upstream habitat. They were not taken from the stream as often as were chinook and periodically escaped past River Mill Dam to spawn. Before 1917, when the ladder at Cazadero suffered deteriorating damage from floods, it is likely that steelhead and coho sometimes escaped to upriver habitat. Thus, they may have attained the upper hand over chinook in competition for upriver spawning and rearing grounds after passage was allowed. Also, harvest and hatchery efforts continued to focus on spring chinook after 1940. By 1964, steelhead and coho runs had improved to maximums of more than 4,000 and 3,000 fish, respectively, with little help from hatchery stocking. Chinook runs increased very little during the period (Eicher 1977).

Fish propagators continued to supplement low natural spring chinook runs through hatchery production. In 1940, hatchery operators moved their operations from River Mill Dam to a hatchery on Delph Creek, an Eagle Creek tributary. From 1942 to 1954, spring chinook eggs were taken from Eagle Creek and from the Clackamas River just below the mouth of Eagle Creek to support production at the facility. Hatchery operators also took a few coho eggs in 1946 and 1947, and steelhead eggs were taken in 1947 (Wallis 1960). During this period, hatchery propagators collected about 1.3 million salmon eggs from the Clackamas River for the hatchery (Table 4) (Wallis 1960). The hatchery facility was abandoned in 1955.

In 1957, the Fish and Wildlife Service started operating a hatchery on Eagle Creek. They raised spring

chinook and released them into the Clackamas River Basin. According to one avid fisherman in the late 1950s, Earl Freeman, the spring chinook run improved after this hatchery began releasing fish into the Clackamas River. He recalls one week when he and his father caught 12 spring chinook, weighing about 30 pounds each (Freeman, personal communication 1998). Eagle Creek Hatchery is still used for production today.

Table 4. Chinook Egg-Takes at Clackamas River Hatcheries Since 1940 (Wallis 1960).

Year	River Mill Dam	Delph Creek Hatchery
1940		
1941		
1942		141,800
1943		152,800
1944		32,876
1945		126,500
1946		494,500
1947		10,000
1948		60,000
1949		13,000
1950		157,500
1951		57,500
1952		34,300
1953		22,000
1954		

Along with an increase in hatchery production came an increase in hatchery fish health and survival in the late 1950s and early 1960s. As hatchery operators learned more about fish culture, they began feeding fish better diets and improved fish rearing and release strategies. They also learned more about disease prevention and treatment. As a result, hatchery fish were healthier and had a better chance of surviving than those released in the early 1900s.

Salmon and steelhead reared at other hatcheries were also released into the Clackamas River Basin at this time to support an increasing number of sport anglers. Fish managers released tule fall chinook in the drainage from 1952 to 1981. They started releasing summer steelhead in the Clackamas River in 1968. Coho releases also began in the 1960s.

The spring chinook run improved significantly in the 1980s after the startup of an aggressive hatchery program. The Clackamas Hatchery at McIver State Park (RM 23) on the Clackamas River, began production in 1980. Before this time, the run was made up of hatchery fish from Eagle Creek Hatchery and a remnant population of about 530 native fish that spawned above North Fork Dam. The hatchery, operated by the Oregon Department of Fish and Wildlife, has been used primarily for spring chinook production. Winter steelhead have also been produced at the facility since 1986.

CURRENT RUNS

Today, the Clackamas continues to be an important producer of salmon, steelhead and resident fish (ODFW 1992). It is the heaviest producer of anadromous fish in the Mt. Hood National Forest, providing 142 miles of habitat. Besides the remaining wild runs, several new fish stocks, including a summer steelhead run, have been introduced to the basin over the years to provide more harvest opportunity. The basin also supports strong resident trout populations. Current salmon, steelhead and resident fish populations in the basin are discussed below.

Spring Chinook

The Clackamas supports both naturally and hatchery produced spring chinook. Since 1980 — the first year of substantial adult returns from releases at Clackamas Hatchery — passage at North Fork fish ladder has increased substantially, reaching an annual average of 3,700 in 1990-1993. Biologists estimated that about 60-85 percent of the fish in this run were hatchery fish. In 1995, about 24 percent of the spring chinook run entering the Willamette River returned to the Clackamas.

Presently, the native spring chinook run to the Clackamas has been proposed for Threatened species status by the National Marine Fisheries Service. The size of this native run is unknown as the river has been steadily supplemented with spring chinook from the Clackamas Hatchery since the late 1970s.

Spring chinook spawn and rear in both the lower and upper parts of the Clackamas drainage. Spawning occurs between mid-September and early October. In the lower drainage, adults spawn in Eagle Creek, below River Mill Dam and between River Mill and Faraday Diversion dams. In the upper drainage, adults spawn in the mainstem from the head of North Fork Reservoir upstream to Big Bottom (RM 64 to RM 68), in the Collawash River, Hot Springs Fork of the Collawash River, lower Fish Creek and Roaring River. Currently, several spawning areas such as Big Bottom, which contains some of the highest quality spawning habitat in the subbasin, and the Hot Springs Fork may be underutilized.

Fall Chinook

The fall chinook run is currently supported through natural production. The run usually spawns and rears in the lower mainstem below River Mill Dam and in the lower reaches of Clear Creek. Fish managers believe the run is a remnant population of tule stock that was first released in the Clackamas basin in 1952. It may also include fall chinook from other Willamette River tributaries that strayed into the Clackamas. No fall chinook have been released in the basin since 1981.

Surveys suggest that an estimated run of 840 fall chinook adults returned annually to the Clackamas River from 1981 to 1991. However, this figure may be inflated since some spring chinook spawn in the same areas and at the same time as the fall chinook, and may have been mistaken for fall chinook. Some

concern exists that the fall chinook may be interbreeding with spring chinook in the lower Clackamas. Information on the run is limited since it does not pass through a counting station before entering the Clackamas River and does not go above River Mill Dam where counting facilities exist.

Coho Salmon

The Clackamas system supports two coho stocks, an early run and a late run. The early run, which returns to the basin in August and September, is created through hatchery releases. Many of these fish return to Eagle Creek Hatchery. The basin also supports a self-sustaining early run of coho. These fish are the offspring of hatchery fish released during the 1960s and 1970s.

Wild fish make up the late run of coho. This run is the last remaining wild coho stock that sustains a substantial run to the Columbia River Basin. The wild run enters the Clackamas River from November to January. A radio tracking study conducted from 1989 through 1991 showed that more than 80 percent of the tagged fish spawned relatively close to the release site at the upper end of the North Fork Reservoir (Cramer and Merritt 1991). Today, the number of late run coho returning to the basin fluctuates widely. From 1961 to 1996, the number ranged from 50 to 3,314 fish. The average late run of coho numbered 1,047 fish from 1986-1987 through 1995-1996. It dropped to a record low in the 1993-1994 migration when only 50 late run fish were recorded at North Fork Dam (Massey and Keely 1996).

Many wild coho destined for the Clackamas have been caught in mixed-stock fisheries managed for hatchery stocks. Commercial harvest rates for ocean and Columbia River fisheries on Clackamas River late-run coho have been as high as 80 percent in recent years and exceeded 90 percent in the early 1970s (Cramer and Merritt 1991).

Winter Steelhead

The Clackamas basin supports a native winter steelhead run and two hatchery-reared stocks. The hatchery fish are released in the lower river below River Mill Dam and create an early run of winter steelhead. The native run returns to the basin in January, a few months after the hatchery-reared fish. The native run has naturally re-established itself in the upper basin.

Winter steelhead occupy more of the basin than either spring chinook or coho salmon. They also use more diverse habitat types. Juvenile steelhead often prefer faster water than salmon and will migrate high into steep and fast-flowing stream reaches. Production of steelhead smolts is closely related to the amount and quality of large pools. Primary spawning areas in the upper basin include the mainstem of the Clackamas River; Oak Grove, North and Hot Springs forks of the Clackamas; Roaring and Collawash

rivers; and Fish Creek.

After rebuilding for many years following the reopening of passage to the upper basin, the native run appears to be declining based on information collected from a photographic counter in the North Fork ladder. The counter records each fish passing through the ladder and is believed to provide the best index of run size for the native stock. Dam records show that from 1964 to 1973 approximately 2,000 wild winter steelhead passed North Fork Dam annually. From 1977 to 1988, the run dropped to about 1,600 adult winter steelhead annually (primarily wild fish, but with some hatchery fish). In 1991, only 837 fish were counted at the dam, the lowest number since 1973. The run rebounded briefly in 1992 when the count rose to 2,107 fish, the highest number in several years. Since then it has fallen steadily. The number of winter steelhead counted passing the dam dropped to 1,352 fish in 1993 and to 1,247 fish in 1994. Counts in recent years show a continuing decline in winter steelhead passage, with the number falling to 1,146, 325 and 530 fish in 1995, 1996 and 1997, respectively.

Recently, several actions have been carried out to restore the wild winter steelhead run. Each spring, about 40 wild adults are collected at the North Fork ladder to produce approximately 40,000 smolts. Early rearing occurs at the Clackamas Hatchery, followed by accelerated rearing in the warm water at Oak Springs Hatchery. The wild winter steelhead are raised at Oak Springs through the winter and then transferred to the Clackamas for release in the spring.

Fish managers have also changed harvest regulations in the basin to protect wild fish. These steps were taken after surveys showed that about 30 percent of the steelhead harvested from December to March are wild. In 1992, a late trout season was established for the entire Clackamas system. Managers also adopted a catch-and-release regulation for all unmarked adult steelhead on the Clackamas system. There are no commercial or tribal fisheries in the Clackamas system.

Summer Steelhead

Summer steelhead releases began in 1968 and provide angling opportunities within the basin from March through December. From 1981 to 1990, about 162,500 summer steelhead smolts were released annually into the subbasin from Gnat Creek Hatchery. About 75,500 pre-smolts were also released in the subbasin during three of the years. Through 1997, most summer steelhead were released in the upper subbasin.

The summer steelhead fishery in the Clackamas is extremely popular. Most of the harvest occurs in the mainstem above North Fork Dam and in the lower Clackamas. Limited fishing also occurs in the Collawash River and in Hot Springs Fork. The annual sport catch from 1985 through 1990 averaged

7,013 fish. Summer steelhead are popular with anglers because they bite well and have a reputation for being good fighters. They also have a long period of adult freshwater residency and hold their condition (brightness).

Concern exists that some summer steelhead are reproducing naturally in the upper basin. This production is not wanted as the hatchery-reared summer steelhead may compete with wild winter steelhead and coho for habitat. Nevertheless, records show that the number of naturally produced juvenile steelhead passing the Clackamas River dams has doubled since hatchery summer steelhead smolts releases began. To address these concerns, beginning in 1998 summer steelhead releases are restricted to below River Mill Dam.

Resident Fish

The Clackamas River Basin supports one of the largest trout fisheries in Oregon (ODFW 1992). It contains cutthroat trout, kokanee, rainbow trout, brook trout, brown trout, mountain whitefish, and possibly bull trout. Bull trout, cutthroat, rainbow and mountain whitefish are known to be indigenous to the basin. The other species have been introduced over the years.

Early settlers reported excellent trout fishing on the Clackamas. The stocks, however, were over-harvested as new road development improved access to the river. As a result, hatchery releases have been used for many years to supplement wild trout production and support harvest. W.L. Sharp wrote in 1936 that the Oregon State Game Commission regularly liberated large numbers of fingerling trout in the Clackamas River and tributaries above Cazadero Dam. These included a release in September 1935 of 175,000 fingerling rainbow trout in the Clackamas River near the Oak Grove Ranger Station and above the dam on the Oak Grove Fork (Sharp 1936).

The lower, middle and upper reaches of the Clackamas drainage each contain different habitat conditions and resident fish populations. Below River Mill Dam, the river supports primarily cutthroat and rainbow trout. Cutthroat reside in the Clackamas River during fall and winter months and migrate to the Willamette and Columbia rivers in the spring (ODFW 1992).

The middle reach of the Clackamas, from River Mill Dam to the head of the North Fork Reservoir, contains Estacada Lake, Faraday Lake, Faraday Reservoir and the North Fork Reservoir, all part of the Portland General Electric North Fork hydroelectric complex. The 1.5-mile stretch between Faraday Dam and the head of Estacada Lake is the only free-flowing part of the reach. Fishing pressure is heaviest on the reservoirs and on Estacada and Faraday lakes where anglers catch large number of stocked hatchery trout and a few wild rainbow and cutthroat. The small free-flowing section of river also supports rainbow and cutthroat trout.

The upper Clackamas River from the head of North Fork Reservoir to the headwaters contains an abundance of spawning habitat and consistent, cool streamflows that provide good habitat for resident trout populations. These populations include wild rainbow, wild and hatchery cutthroat, brown, brook and possibly bull trout. Fish managers also release hatchery rainbow trout below RM 70. Most trout fishing in the basin occurs along these upper reaches. A survey conducted in 1988 suggested that over 35,000 angler days were expended during the first month of the season in the reach. Harvest included more than 16,000 trout.

Tributaries in the upper and middle reaches of the Clackamas, including the North Fork, South Fork, Fish Creek, Roaring River, Oak Grove Fork and the Collawash, support good trout production. The tributaries provide a popular trout fishery. They often contain good spawning habitat and water quality for rainbow and cutthroat trout, and some brook and brown trout production. The tributaries may also support some bull trout production, though the fish have not been observed for several years. Some trout production also occurs in lower river tributaries, such as Clear Creek, Deep Creek, Rock Creek and Eagle Creek.

Stream reaches above barriers to anadromous fish provide isolated habitat for wild rainbow and cutthroat trout, and possibly some brook, brown and bull trout. Hatchery fish are not generally stocked in these areas. Fish within the upriver areas are generally smaller. The high mountain reaches usually attract anglers who want isolation and an opportunity to catch wild trout.

SUMMARY

Over the last 150 years, Clackamas River salmon and steelhead runs have persevered despite developments that severely restricted their migration and production. Their fall became noticeable by the late 1870s after spring chinook runs in the Columbia River declined due to overharvest. This drop in harvest led cannery personnel in the Pacific Northwest to start experimenting with fish culture as a means to improve the runs. The first hatchery in the Columbia River Basin began operating on the Clackamas River in 1877.

The runs continued to fall through the early 1900s, and by 1936 the basin's spring chinook run averaged between 1,500 and 2,000 spawners. As discussed throughout this document, many factors influenced this decline in salmon and steelhead production over the years. Before 1900, egg-takes linked to hatchery operations began collecting all possible would-be-spawners as brood stock. In addition, timber harvest and other developments in the lower basin — including construction of a dam across the lower Clackamas River by 1868 — degraded habitat conditions and restricted fish migration to upriver spawning and

rearing grounds. After 1900, salmon and steelhead production and migration were further confined by the development of several hydroelectric facilities. With egg-take operations, these facilities blocked fish passage to spawning and rearing areas above Estacada. The fish runs were also hit hard by fishing pressure during this time, including rampant illegal gillnetting on the lower Clackamas River.

In 1940, salmon and steelhead in the basin began to rebuild after regaining access to historical spawning and rearing habitat in the upper basin. During the ensuing years, several developments influenced efforts to rebuild the runs. Some developments — such as better techniques for rearing and releasing hatchery fish, improved fish passage at the dams, and regulations on fish harvest — enhanced salmon and steelhead production and survival. Other developments — such as escalating road construction and timber harvest in the upper basin, and gravel mining in the Clackamas River — caused new habitat degradation. Many of these practices, however, have also improved in recent years.

Today, while the runs are far below historic levels, the Clackamas River Basin remains an important producer of salmon, steelhead and resident fish. The basin supports native populations of spring chinook, late run coho, late winter steelhead, resident trout, cutthroat trout and bull trout. Large numbers of hatchery fish have been released in the basin since the 1950s and 1960s. These introduced populations include spring chinook, fall chinook, early run coho, winter steelhead and summer steelhead. Continuous efforts are under way to improve the native runs while maintaining popular sport fishing opportunities in the basin. Fish production and habitat managers are constantly working to protect and restore habitat, improve fish passage, and reduce interbreeding and competition between native and introduced stocks.

Key events that influenced the basin's salmon and steelhead runs after 1940 are shown below:

Key Events and Developments from 1940 to Present	
1940	Salmon and steelhead passage to upper basin reopened.
1940	Hatchery propagators remove egg-taking station below River Mill Dam and move activities to Delph Creek, an Eagle Creek tributary.
1940	Road construction in upper Clackamas basin intensifies.
1948	Region faces shortage of energy to meet growing demands.
1950	Pollution in Willamette River increases. Oxygen content in river drops below 3.6 ppm at Willamette Falls and to zero in Portland Harbor.
1950	Commercial fishing banned on Clackamas and Willamette rivers. Clackamas fish contribute to off-shore troll fisheries and commercial fishing on Columbia River.
1950	Salmon and steelhead runs show progress in rebuilding naturally.
1950	Road construction and timber harvest increase in upper basin. Extension of forest road 46 results in the realigning and straightening of Clackamas River.
1952	Portland General Electric initiates investigations for new projects on Oak Grove Fork leading to creation of Frog Lake forebay and dam at Timothy Meadows.
1954	Investigations begin for North Fork project.
1956	Dam on Oak Grove Fork completed, forming Timothy Lake.
1957	Fish production begins at Eagle Creek Hatchery.
1958	North Fork Hydroelectric project completed with extensive fish passage facilities.
1960	Building of 210.7 miles of additional road in upper Clackamas Basin begins.
1964	Steelhead and coho runs improve to maximums of over 4,000 and 3,000 respectively with no hatchery stocking. Chinook runs show little improvement.
1964	Flood on Clackamas River severely damages river conditions and Cazadero Dam.
1965	Non-native winter steelhead first released in basin.
1966	Faraday Dam completed, replacing Cazadero Dam.
1966	Water quality in Willamette River improves.
1968	Fish managers begin releasing summer steelhead in Clackamas basin.
1970	Work begins on construction of additional 90 miles of road in upper watershed, and paving of many existing roads.
1970	Timber harvest in upper basin escalates. Between 1970 and 1994, about 21,000 acres of timber cut in upper Clackamas basin.
1975	Portland General Electric and state of Oregon reach formal agreement on compensation package for hydro-related fish losses in Clackamas River system.
1977	Portland General Electric and National Marine Fisheries Service begin building Clackamas Hatchery.
1980	Clackamas Hatchery completed, salmon production program begins.
1980	Fish managers end release of fall chinook in basin.
1980	Spring chinook run improves significantly due to aggressive hatchery program.
1988	Mt. Hood National Forest identifies many active landslide areas in upper basin. Most of the slide risks related to timber harvest and road construction.
1992	Measures set up to protect wild steelhead run included a late trout fishing season and catch/release limits on Clackamas for all unmarked adult steelhead.
1995	About 24 percent of spring chinook that enter Willamette River return to Clackamas.

ACKNOWLEDGMENTS

Many individuals shared their professional expertise, their knowledge of fish and habitat conditions, and their stories of personal experiences in the Clackamas River Basin. They include Ray Beamesderfer, Gloria Bourne, Don Bennett, Doug Cramer, Earl Freeman, David Heintzman, Tammy Hubert, Cari Kreshak, David Kroft, Charles Mack, Marty May, Frank Schnitzer, Dan Shively and Phil Wallace. Funding for this report was provided by Portland General Electric Company.

REFERENCES

-
- Abernethy, A.S. 1886. Salmon in the Clackamas River. Bulletin of the U.S. Fish Commission, Page 332. Washington Government Printing Office. 1886.
- Banner-Courier*, Oregon City newspaper 1939. No More Fish Racks in Clackamas Is Warning Issued and Fish Now Going Over Cazadero Dam. December 19, 1939.
- Barin, L.T. 1885. Salmon in the Clackamas River. Bulletin of the U.S. Fish Commission, Page 111. Washington Government Printing Office. 1886.
- Bulletin*, Bend, Oregon newspaper 1997. Plan for ruined forest costly, unpopular. Article in the Bend Bulletin. July 21, 1997.
- Burtchard, Greg C.; Werth, Dennis R.; Snyder, Sandra L. 1993. Clackamas Wild and Scenic River Cultural Resource Inventory Project. Report for U.S.D.A. Forest Service, Mt. Hood National Forest. January 1993.
- Carter, E.N. 1901. Report from Clackamas Station, Oregon. Report of Commissioner of Fish and Fisheries, U.S. Commission of Fish and Fisheries, 1901.
- Cramer, D. and T. Merritt. 1991. Distribution of spawning late-run coho salmon in the upper Clackamas River, 1988-1991. Portland General Electric. 1991.
- Downing, S.W. 1900. Report from Clackamas Station, Oregon. Report of Commissioner of Fish and Fisheries, U.S. Commission of Fish and Fisheries, 1900.
- Eicher, George J. 1977. Clackamas Dams and Anadromous Fish. A History of Fish and Dams on the Clackamas River in Oregon. Portland General Electric Company. July 1977.
- Ellis, David V. 1997. Cultural Resources Survey of the Proposed Timber Park Trail, Estacada, Oregon. Archaeological Investigations Northwest, Inc. Report for Portland General Electric. July 2, 1997.
- Everest, et al., 1986. Abundance, behavior, and habitat utilization by coho salmon and steelhead trout in Fish Creek, Oregon, as influenced by habitat enhancement. U.S. Forest Service annual report to Bonneville Power Administration. 1986.
- Farnell, James E., Ph.D., Division of State Lands. 1979. Clackamas River Navigability Study. February 1979.
- Gleeson, George W. 1972. The Return of a River, The Willamette River, Oregon. 1972.
- Hubbard, W.F. 1889-90. Report of Commission of Fish and Fisheries from Clackamas Station, Oregon 1889-91.
- Hubbard, W.F. 1890-91. Report of Commission of Fish and Fisheries from Clackamas Station, Oregon 1889-91.

- Kipling, Rudyard. 1889. Some American Catches! Epic Story of Heroic Size Exploits in Steelhead Fishing! From American Notes for *The Pioneer*, a newspaper in Allahabad, India. 1889.
- Lichatowich, James A. and Moband, Lars E. 1995. Analysis of Chinook Salmon in the Columbia River from an Ecosystem Perspective. Prepared for Bonneville Power Administration. January 1995.
- Lynch, Vera Martin. 1973. Free Land for Free Men; A Story of Clackamas County. Artline Print, Portland, Oregon. 1973
- Massey, Jay and Keeley, Pat. 1996. Fish Management Review, Columbia Region. Lower Willamette Fish District, ODFW. April 3, 1996.
- Mattson, Chester R. 1950 (est). Abstracts and notes from reports of U.S. Commission of Fish and Fisheries and Successors Regarding Operations on Clackamas, 1877-1902.
- McGuire. 1894. Second annual report of the fish and game protector to the Governor.
- Northwest Power Planning Council. 1987. Compilation of Information on Salmon and Steelhead Losses in the Columbia River Basin, Appendix D of the 1987 Columbia River Basin Fish and Wildlife Program. March 1987.
- ODFW (Oregon Department of Fish and Wildlife). 1992. Clackamas Subbasin Fish Management Plan. January 1992.
- Oregon Department of Fisheries. 1909. Annual Report of Master Fish Warden for 1907 and 1908.
- Oregon Fish Commission. 1889-1890. Third and Fourth Annual Reports to the Governor of Oregon.
- Oregon Fish Commission. 1892. Annual Report to the Governor of Oregon.
- Oregon Game Commission. 1951.
- The Oregonian*, 1940. Article in Portland, Oregon newspaper on Cazadero Dam fishway January 14, 1940.
- PGE (Portland General Electric). 1982. History of Portland General Electric Company 1889-1981. March 1982.
- Seaman, N.G. 1946. Indian Relics of the Pacific Northwest.
- Sharp, W.L. 1936. Clackamas River Fish Ladders. June 23, 1936.
- Smith, Max. 1974. Memos to Larry Korn, notes on the early history of Clackamas River spring chinook runs. October 14, 1974; corrections october 18, 1974.
- U.S. Commission of Fish and Fisheries. 1877. Report of Commissioner of Fish and Fisheries. 1877.
- U.S. Commission of Fish and Fisheries. 1878. Report of Commissioner of Fish and Fisheries. 1878.
- U.S. Commission of Fish and Fisheries. 1890-91. Report on Clackamas Station.
- U.S. Commission of Fish and Fisheries. 1892. Report of Commissioner of Fish and Fisheries. 1892.

U.S. Commission of Fish and Fisheries. 1895. Report on Clackamas County, Fisheries of the Pacific Coast in 1895. Report of Commissioner of Fish and Fisheries. 1895.

U.S. Fish Commission. 1877. Bulletin of the U.S. Fish Commission, 1877.

U.S. Fish Commission. 1894. Salmon in the Willamette and Clackamas rivers, Bulletin of the U.S. Fish Commission, 1894.

USFS (U.S. Forest Service, Mt. Hood National Forest). 1988. Draft Environmental Impact Statement and Proposed Land and Resource Management Plan for Mt. Hood National Forest. 1988.

USFS. 1992. Clackamas National Wild and Scenic River and State Scenic Waterway, Environmental Assessment and Management Plan. Prepared in cooperation with Oregon Parks and Recreation Department. 1992.

USFS. 1993. Upper Sandy National Wild and Scenic River, Environmental Assessment. December 1993.

USFS. 1995. Draft Watershed Analysis Upper Clackamas Watershed. Mt. Hood National Forest. January 1995.

USFWS (U.S. Fish and Wildlife Service). 1950. Preliminary Draft of Clackamas River subbasin Report. December 1950.

USGS (U.S. Geological Survey). 1996. Geological Survey-Water Data Report. OR-96-1.

Wallis, Joe. 1960. A Brief History of Hatchery Operations on the Clackamas River. Oregon Fish Commission 1960.

Wisner, J.N. 1902. Report from Clackamas Station, Oregon. Report of Commissioner of Fish and Fisheries, U.S. Commission of Fish and Fisheries, 1902.

PERSONAL COMMUNICATIONS

Earl Freeman, long-time fisherman on the Clackamas River.

Charles Mack, long-time fisherman on the Clackamas River.