Planning and Engineering Division

Dr. Jacqueline Wyland
Environmental Policy Specialist
National Marine Fisheries Service
Protected Resources Division
525 NE Oregon Street, Suite 500
Portland, Oregon 97232-2737

Dear Dr. Wyland:

Enclosed for your review is a biological assessment related to operation of Lost Creek and Applegate Dams in the Rogue Basin relative to the recent listing of coho salmon as threatened species in the Klamath Zone ESU. We look foreward to working with your staff to ensure for protection of coho and other anadromous fish in the basin. If you have any questions or need additional information, please contact Rock Peters of my staff at (503) 808-4777.

Sincerely,

Howard B. Jones P.E.
Chief, Planning and Engineering
Division

BIOLOGICAL ASSESSMENT FOR COHO SALMON AND OPERATION OF LOST CREEK AND APPLEGATE DAMS

Background

National Marine Fisheries Service (NMFS) listed coho salmon as a threatened species under the Endangered Species Act on May 6, 1997 for the Southern Oregon/Northern California Coast, Evolutionarily Significant Unit (ESU). This ESU includes the Rogue River and associated tributaries. The Portland District Corps of Engineers operates two major Dam Projects in the Rogue Basin. This biological assessment covers the operation of the Rogue River Projects.

Project Description

Populations of coho salmon (Oncorhynchus kisutch) have historically been located in the upper third of the Rogue, Applegate, and Illinois rivers and some of their tributaries. Oregon Department of Fish and Wildlife identified that few if any coho were blocked by construction of Lost Creek Dam and that for the areas above Gold Ray Dam, the primary areas for coho spawning are Big Butte, Little Butte, and Elk Creeks. Coho spawning historically did occur above Applegate Dam and mitigation by hatchery production at Cole M. Rivers Hatchery is for replacement of 500 adults for areas inundated by the dam and reservoir. Operation of Lost Creek and Applegate Dams has the potential to affect (both beneficial and negatively) coho populations downstream of the projects.

Lost Creek and Applegate Dams

Lost Creek Dam is located on the mainstem of the Rogue River at river mile 158.4. Lost Creek construction of the main dam was started in 1972 and was completed in 1976. Applegate Dam is located on the Applegate River, which is a tributary of the Rogue at river mile 45.7 (Applegate). Applegate was completed in 1980.

Description of the operation of Lost Creek and Applegate Dams.

Operation of the two projects is based on the Rogue River Projects Authorizing Document (September, 1962). The Rogue Basin Projects, including Lost Creek, Elk Creek, and Applegate Dams, were authorized to provide storage for flood control, irrigation, water supply, and fishery enhancement. Other project benefits, which would be realized through operation of the projects, include wildlife enhancement, power production (Lost Creek only), water quality control, and recreation. The authorizing document provided fisheries enhancement as primary project purposes for both Lost Creek and Applegate Projects as fisheries in the Rogue River basin were recognized as having "national significance." Within the fisheries enhancement framework, several actions were taken to ensure fisheries enhancement was achieved for long term maintenance of wild runs in the basin. Fishery provisions were established that included

water storage and temperature regulation facilities for releases to provide downstream fishery enhancement, facilities for restitution for loss of inundated spawning and rearing habitat, and facilities to mitigate losses associated with blocking of natural migration routes from anadromous fish. In addition, the authorizing document indicated that detailed fisheries studies should be conducted to ensure operation of the projects was consistent with the fisheries goals.

On the basis of the authorizing document, fisheries studies began in 1974 and have continued through the present time. It is anticipated that the fisheries evaluation will be complete in 1998. Final completion reports have been concluded for winter and summer steelhead, coho, and fall chinook related to Lost Creek, and for steelhead and fall chinook for the Applegate Project. The spring chinook final completion report is scheduled to be complete in approximately June of 1998. Enclosed is a copy of the coho final completion report (Enclosure 1). The primary focus of these studies was to evaluate effects of the projects on each of the stocks and to recommend the most effective flow and temperature operating strategy to provide fisheries enhancement for maintenance of anadromous fish runs in the Rogue Basin.

Mitigation for lost spawning and rearing areas has been provided by hatchery production for both Lost Creek and Applegate Dams. Based on a report by the U.S. Fish and Service titled Detailed report on Fish and Wildlife Resources Affected By Corps of Engineers Water Development Plan (1961) few if any coho would be impacted by construction of Lost Creek Dam. This resulted in no hatchery mitigation for coho at or above the Lost Creek Dam Site. For the Applegate River, the U.S. Fish and Wildlife report (1961) suggested that most of the coho spawn in the lower tributaries downstream of the Applegate Dam damsite. The report suggest that approximately 500 coho spawned historically above the damsite and this was the level adopted for hatchery mitigation. Based on the Applegate fisheries evaluation reports, little information was available on coho in the Applegate system.

Reservoir Storage Allocation

The seasonal streamflow regime of the Rogue River Basin is such that the same reservoir storage space can be scheduled to serve both flood control regulation and water conservation needs effectively. Flood regulation is provided by reserving storage space for flood control during the late fall, winter, and early spring (Enclosure 2). During the flood control season, pool elevations are held at minimum flood control pool elevation except during flood events. Beginning in February, the storage space reserved for winter floods is filled gradually for conservation release storage, with a goal to have the project full by April 30th of each year.

At Lost Creek Lake, 180,000 acre-feet of water is available to be released during the conservation release season in years when the project fills to maximum conservation pool elevation. Of this 180,000 acre-feet, 125,000 acre-feet of storage is allocated for fishery enhancement, 35,000 acre-feet is allocated for irrigation and 20,000 acre-feet for municipal and domestic use. At Applegate Lake, 66,000 acre-feet is available for release

during the conservation release season of which 40,000 is allocated for fisheries enhancement and 26,000 acre-feet is available for irrigation provided the project is filled.

For release of the stored water, a process was developed with state and federal resource agencies to ensure that the release of stored water provided the most efficient use of the water for fishery enhancement. In the early 1980's the State of Oregon established a policy that the Oregon Water Resources Department (OWRD) would coordinate all requests by the state agencies for special regulation from any corps reservoirs. To assist in conforming to the States policy, Portland District annually holds two meetings in the spring for all state and federal agencies to discuss the previous years flow management and to discuss the coming years forecast and potential operation. In addition, Portland District holds two public meetings to discuss the years flow management strategy. Following these meetings, Portland District finalizes the conservation release plan. Deviations from the final flow management plan occur in the summer and fall in many years depending on the amount of precipitation that occurs. The resource agencies are notified of these changes and sometimes require additional coordination to ensure intended goals are met.

General Life History

Coho are indigenous to the Rogue River Basin. It is thought that three distinct populations occur in the Rogue Basin: one in the upper Rogue, one in the Applegate River, and one which includes the largest group in the Illinois River. The upper Rogue and Applegate adult coho enter the river's mouth around mid-September and those fish bound for the upriver tributaries peak at Gold Ray Dam around mid-November.

Adult coho salmon returns above Gold Ray Dam averaged approximately 4,000 fish during the 1940's and decreased to less than 200 fish from 1964 through 1976 (ODFW, 1991). The sharp decrease in adult returns was also observed in the North Umpqua suggesting that ocean survival and ocean harvest may be the primary factors for declining stock numbers. Hatchery fish dominated the returns in the upper Rogue above Gold Ray Dam from 1977 through 1986. This was evidenced from the Gold Ray Dam counts versus the adult fish returning to Cole Rivers Hatchery which suggested that nearly equal number of coho were observed at Cole Rivers as crossed Gold Ray Dam. From 1992 to 1995, adult coho numbers ranging from 2,000 to 4,000 fish have been observed in excess of the Cole Rivers counts suggesting that coho are spawning in the upper Rogue above Gold Ray Dam. The percentage of hatchery strays to wild fish is unknown. Counts from the fish collection facility at Elk Creek Dam, also indicate increasing numbers of coho since 1992 when trap and haul was initiated.

Juvenile coho emergence occurs between late March and early June. Young of the year fish reside primarily in the tributaries unless poor water quality conditions cause them to move into the mainstem Rogue. Juvenile coho salmon migrate to the ocean as yearlings and spend two years in the ocean before returning as adults (age 3 fish). Migration timing of smolts in the middle river increased during April and May, peaks in early June and tails off through mid-July.

Potential Reasons for the Decline of Coho Salmon

Prior to the construction of dams in the Rogue Basin, coho salmon stocks had virtually collapsed, with less than 200 adults returning to areas above Gold Ray Dam in the 1960's and 70's (ODFW, 1991). The report suggested this was primarily due to poor ocean survival and ocean harvest. The authors suggested they were not able to detect any influence of Lost Creek Dam nor Cole M. Rivers Hatchery on the return of wild adults to areas upstream of Gold Ray Dam.

Potential Impacts of Lost Creek and Applegate Dams on Coho Salmon

The Oregon Department of Fish and Wildlife evaluated the effects of Lost Creek and Applegate Dams on coho salmon as well as other anadromous species in the basin. The studies were initiated in 1974 and field sampling was completed for the Applegate system in 1989 and 1995 for the Lost Creek portion. Coho salmon final completion studies were concluded in 1989 (ODFW, 1991).

Several important findings from these studies are relevant to determining the potential effects of the projects on coho salmon in the basin.

1. Operation of Lost Creek Dam increased river flow levels during the migration period which resulted in adults passing Gold Ray Dam earlier than pre-dam periods. A two percent difference was noted (60% regulated versus 58% unregulated) in passage timing past Gold Ray Dam by November 15th. The report suggested the two percent had a negligible effect on the harvest and production of coho in the upper Rogue River.
2. The authors did not detect any influence of Lost Creek Dam or Cole Rivers Hatchery on return of wild adult coho to the upper Rogue River.
3. Construction of Lost Creek blocked little if any spawning area upstream of the project.
4. Coho salmon eggs developed at a faster rate immediately downstream of Lost Creek Dam due to higher water temperatures (1.7 degrees C). The report suggested that this was a minor effect as few coho spawn in the mainstem of the Rogue and the timing of emergence was similar to other coastal streams.
5. The study could not detect any influence of Lost Creek Dam on the production of coho salmon. This was due to most of the juvenile rearing occurred in the tributaries.
6. Effects of reservoir operation on coho were minimal due to juveniles and adult salmonids migrate when reservoir operations had little influence on temperatures and flow in the system.

There is some potential for young of the year fish to be impacted due to operation of Lost Creek and Applegate Projects. Young of the year coho over-summer both in tributaries and in the mainstem Rogue. Minimum flow and temperature releases from the projects should accommodate these fish except during extremely low water years when flows drop below minimum standards. However, in all years during the mid to late summer, flow

releases from the projects are higher than natural inflows would provide. Also temperature releases are also lower than pre-dam conditions. This should provide better conditions for young of the year fish than without the projects. There is also the potential for operation effects from rate of reduction of flows and stranding young of the year fish. Criteria has been established from ODFW and will be followed as close as possible. Criteria states that "In order to minimize stranding of juvenile salmonids, limit the rate of decrease in outflow to an average of 50 cfs per hour, with individual adjustments limited to 150 cfs every 3 hours unless such action threatens flood control capabilities."

Determination of Effects

Coho salmon are present in the Rogue and Applegate Rivers year around. Adult coho salmon are present from September through January with spawning occurring during November and January. Juveniles emerge from the gravel between late March to early June and reside in tributaries or the mainstem Rogue until the following spring with outmigration occurring from late March through mid-July. Since coho salmon are present year around, flow regulation from both Lost Creek and Applegate Projects has the potential to affect coho salmon survival.

Research studies evaluating the effects of the projects on salmonid stocks including coho were conducted from 1974 through 1989. Physical factors including flow, water temperature, and turbidity were evaluated for their affects on coho production, growth rates, migration timing, pre-spawning mortality, and harvest. Based on the results of these studies, operation of Lost Creek and Applegate Dams under the current strategy for flow management, are not likely to adversely affect coho salmon or their habitat. Effects of the flow management on coho salmon were minimal due to few juveniles rear in the mainstem Rogue, adults migrate at times when reservoir operation have little effect on water temperatures and flow, and coho juveniles migrate at similar times as chinook when flows are provided for protection of juveniles of both species during their outmigration.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Northwest Region
7600 Sand Point Way NE
Bin C15700 Bldg.
Seattle, Washington 98115-0070

December 15, 1997 F/NW

U.S. Army Corps of Engineers
Planning and Engineering Division
(Attn: Rock Peters)
P.O. Box 2946
Portland, Oregon 97208-2946

Re: Consultation on operation of Lost Creek and Applegate Dams, Rogue Basin, Oregon

Dear Mr. Peters:

This responds to your August 15, 1997, letter and Biological Assessment (BA) requesting informal consultation on the effects of the Corps of Engineer's (Corps) operation of Lost Creek and Applegate Dams on coho salmon in the Rogue Basin in Southwest Oregon. The letter was received by the National Marine Fisheries Service (NMFS) on August 18, 1997. Southern Oregon/Northern California coho salmon (SONC coho) were listed as threatened under the Endangered Species Act (ESA) on May 6, 1997 (62 FR 24588, May 6, 1997) and occur in the mainstem Rogue River and in the Applegate River. Critical habitat for SONC coho was recently proposed (November 25, 1997; 62 FR 62741). Klamath Mountain Province (KMP) steelhead have been proposed for listing as threatened under the ESA by NMFS (March 16, 1995, 60 FR 14253), and the final decision whether to list this species has been deferred to February 1998 (August 18, 1997, 62 FR 43974). KMP steelhead occur throughout the Rogue River Basin.

Lost Creek Dam is located on the Rogue River, approximately 156 miles upstream from the Pacific Ocean, and forms Lost Creek Reservoir in Jackson County, Oregon. Applegate Dam is located on the Applegate River (tributary to the Rogue River), approximately 140 miles (225 km) upstream from the Pacific Ocean, and forms Applegate Reservoir in Jackson County, Oregon. In your BA, you determined that the operation of these two projects "may affect, but is not likely to adversely affect" (NLAA) SONC coho. The NLAA determination is based on minimal coho juvenile rearing in the mainstem Rogue River, adult migration occurring when reservoir operation has little effect on water temperatures and flow, and the beneficial effect of flow releases from the projects on coho juvenile outmigration. In response to this consultation request and because of the proposal to list KMP steelhead, NMFS reviewed information on the historical effects of the two dams on coho and steelhead, evaluated the effects of the current operation of the projects on coho to determine if we concur with your NLAA determination, and briefly reviewed effects of the current operation of the projects on steelhead. This information is summarized below, followed by our conclusion regarding the effects determination for SONC coho and a preliminary determination for KMP steelhead.

Historical Effects of the Projects on Coho and Steelhead

Lost Creek Dam. This dam does not have a fish passage facility, and upon completion of the barrier dam across from Cole Rivers Hatchery in 1974, blocked access to approximately 6 miles (10 km) of mainstem SONC coho habitat (see SONC coho proposed critical habitat rule, 62 FR 62741). The Rogue River runs through a narrow canyon above this project, which may have created a velocity barrier for coho at high flows about 6 miles above the damsite before the project was built (Mike Evenson, ODFW, pers. comm.). The U.S. Fish and Wildlife Service (USFWS 1956) summarized annual redd counts for coho, steelhead, and chinook done from 1949-'55. No coho redds were observed above the Lost Creek damsite, and USFWS (1961) states that "only a small number [of coho] spawn above the Lost Creek damsite." By the time this habitat was blocked in 1974, the number of wild coho adults migrating over Gold Ray Dam (30 miles downstream of Lost Creek Dam) had decreased from a ten year annual average of 3,816 (1942-1951) to 229 (1965-1974).

USFWS (1961) estimated that the steelhead spawning population above the damsite was 500 fish at the time of their survey. In the 32 years before this habitat was blocked in 1974, the number of wild steelhead adults migrating over Gold Ray Dam remained relatively stable (compared to coho), with the ten year annual average actually increasing from 13,670 (1942-1951) to 13,943 (1965-1974).

Applegate Dam. This dam does not have a fish passage facility, and upon its completion in 1980, it blocked up to 30 miles of SONC coho habitat (see SONC coho proposed critical habitat rule, 62 FR 62741). USFWS (1956) did not do any redd counts during coho spawning season in the Applegate Basin above the damsite. USFWS (1961) estimated that about 500 coho spawned above the Applegate damsite within the reservoir area, but that none spawned above the reservoir area. However, by the time passage was blocked in 1979, coho had been nearly extirpated from the entire Applegate River Basin. For example, a smolt trap operated by the Oregon Department of Fish and Wildlife (ODFW) about two miles upstream from the mouth of the Applegate River and below all major tributaries in 1979 captured 214 coho, 69,325 chinook, and 10,103 steelhead juveniles, and in 1980 captured 15 coho, 17,513 chinook, and 3,598 steelhead juveniles (Bruce Schmidt, ODFW, pers. comm.).

USFWS (1956) counted an annual maximum of 164 steelhead redds in the mainstem Applegate River between the Little Applegate and the Middle Fork (less than half of which is above the damsite). USFWS (1956) also annually counted up to several dozen steelhead redds in each of several tributaries above the damsite. USFWS (1961) estimated that the steelhead spawning population above of the damsite was 2,000 fish at the time of their survey. As indicated by the above cited ODFW trap data, the Applegate River still supported a significant steelhead population by the time the dam was completed (the contribution of the area above the damsite to this population at the time is not known).

Cole M. Rivers Hatchery. The Corps built Cole M. Rivers Hatchery (Cole Rivers) at the base of Lost Creek Dam to produce coho, steelhead, and chinook as mitigation for habitat lost due to Lost Creek, Applegate, and Elk Creek Dams. ODFW began operation of the hatchery in 1974 and it has been funded by the Corps since then. A facility was constructed at the base of Applegate Dam for steelhead broodstock collection (these fish are taken to Cole Rivers), and it began operation in 1979. The historical effects of the operation of Cole Rivers on SONC coho and KMP steelhead are described in ODFW (1997). The effects of the current operation of this hatchery on SONC coho are permitted by an ESA Section 4(d) rule issued by NMFS (62 FR 38479; July 18, 1997), and thus are not considered in this consultation on the operation of Lost Creek and Applegate Dams.

Effects of the Operation of the Projects on Coho

For consultations such as this one on the operation of existing projects, it is particularly important that the "environmental baseline" and the "effects of the action" are clearly differentiated. The environmental baseline includes the past and present impacts of all Federal, State, or private activities in the action area, and the effects of the action are those changes to this baseline caused by the action (see 50 CFR §402.02). In the case of this consultation on the effects of the operation of Lost Creek and Applegate Dams on SONC coho, the fact that the dams block access to historic habitat is part of the environmental baseline rather than the effects of the action. The past effects of Cole M. Rivers Hatchery on SONC coho are also part of the environmental baseline, and the current effects of this hatchery have been handled separately by NMFS (see above). Thus, the way the operation of the two dams currently affects SONC coho is considered the effects of the action, which are evaluated below.

Effects of Lost Creek Dam on Coho. After Lost Creek Dam was completed in 1976, the ODFW conducted a twelve year study of its effects on coho salmon (ODFW 1991). The primary results of this study were:

1. No influence of the project was detected on adult returns or production of naturally produced Rogue coho.
2. Construction of Lost Creek Dam blocked little, if any, spawning habitat used by coho.
3. Operation of Lost Creek Dam increased river flows during the coho migration which resulted in adult coho passing Gold Ray Dam slightly earlier than before the project was built (60% vs. 58% of total run by 11/15).
4. Incubating coho eggs in redds in the reach of the mainstem Rogue immediately below Lost Creek Dam develop faster than before the project was built due to higher water temperatures (average of 1.7°C higher than pre-project during Jan-Mar three km below dam). However, few coho spawn in the mainstem, and the emergence of coho eggs in this reach is still similar to other coastal stocks of Oregon coho.

The study concluded that effects of Lost Creek Dam on coho were minimal because; 1) coho spawning and rearing occurred primarily in Rogue River tributaries, and 2) migrating coho adults and juveniles used the mainstem Rogue when reservoir operations had little influence on water temperatures and flows (ODFW 1991; Tom Satterthwaite, ODFW, pers. comm.).

Effects of Applegate Dam on Coho. ODFW has conducted a study of the effects of Applegate Dam on fall chinook salmon (ODFW 1988), the results of which, together with ODFW (1991) provide some information on the likely effects of this project on coho. The primary results of this study on the effects of the project on fall chinook that may be relevant to coho were:

1. Incubating fall chinook eggs in redds in the reach of the Applegate River immediately below Applegate Dam develop faster than they did in the river before the project was built due to releasing warmer water in the fall and winter. However, this effect was less apparent than below Lost Creek Dam because few fish spawned close to Applegate Dam before the project was constructed. These warm water releases may inhibit fish from successfully spawning in the river immediately below the dam because fry may emerge too early.
2. The proportion of fall chinook spawning in the upper river increased from 10% to 33% due partly to the increased flow during their October migration (improvements in fish passage at two irrigation dams on the Applegate River, funded by the Corps as part of the Applegate Dam project, may have also helped fall chinook better utilize the upper river).
3. The size at ocean entry of Applegate River chinook juveniles increased, probably due to higher flow, lower rearing density, and lower temperature in late spring in early summer, resulting in increased growth and size of migrants as they left the Applegate system.

The study concluded that increased flows from the Applegate project have provided a benefit to fall chinook, primarily because this has allowed an upstream spread in spawning distribution, and decreased rearing densities (ODFW 1988). Unlike in the Rogue River mainstem, many coho spawn in the upper mainstem of the Applegate River and thus may be more affected by the Applegate project than coho in the Rogue are affected by the Lost Creek project. Thus the effects of the Applegate project on fall chinook reported by ODFW (1988) may also be realized by coho (Chuck Fustish, ODFW, pers. comm.).

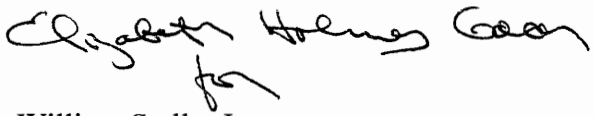
Conclusion

Based on the above summarized information on the effects of the operation of Lost Creek and Applegate Dams on SONC coho, NMFS concurs with your determination that the current operation of these projects is not likely to adversely affect this species because; 1) most coho spawn and rear in Rogue River or Applegate River tributaries and thus are not affected during this part of their life history by the projects, 2) coho spawned in tributaries that drop down to rear in the Rogue River and Applegate River mainstems are most likely beneficially affected by increased summer flows and decreased summer water temperatures from the projects, and 3)

migrating coho adults and juveniles use the Rogue River and Applegate River mainstems when project operations have little influence on water temperatures and flows. While coho that spawn in the Rogue River and Applegate River mainstems are subject to accelerated incubation due to warmer winter water temperatures from the projects, these effects are minimal because they are limited to immediately below the dams and alevin emergence timing is still similar to coho in other Oregon coastal streams. Coho redds in the Rogue River and Applegate River mainstems are rarely, if ever, dewatered by the projects because flows are stable or increasing during incubation (typically Jan-Mar).

KMP steelhead have been proposed for listing, with a final decision due from NMFS in February 1998. Because of the possibility of this species being listed in the near future, we briefly reviewed the available information on the effects of Lost Creek and Applegate Dams on this species (ODFW 1989, 1991, 1994). Our preliminary determination is that the current operation of these projects is likely to adversely affect KMP steelhead, primarily because significant numbers of steelhead spawn in the Rogue River and Applegate River mainstems, the timing of which makes their eggs and fry vulnerable to the projects' temperature and flow effects (e.g., reduced incubation rates from cold-water releases, dewatering of redds by flow reductions). In the event KMP steelhead are listed in February 1998, a formal consultation would thus be required. NMFS recognizes that the Corps has taken some steps to reduce the effects of the operation of these projects on steelhead. The purpose of this consultation would be to evaluate the effects of the current operation of the projects on this species, determine if additional measures are necessary to minimize these effects, and, if necessary, provide the Corps with an Incidental Take Permit. Questions regarding this letter should be directed to Lance Smith of my staff at (503) 231-2307.

Sincerely,



William Stelle, Jr.
Regional Administrator

cc: ODFW (Tom Satterthwaite, Chuck Fustish, Mike Evenson, Bruce Schmidt)
USFWS (Ron Garst)
Rogue River NF (Frank Lake)
Medford BLM (Dale Johnson)

Literature Cited

NMFS (National Marine Fisheries Service). 1997. Status review update for coho salmon from the Oregon and Northern California coasts. West Coast coho salmon biological review team. Northwest Fisheries Science Center, Coastal Zone & Estuarine Studies Division. Seattle, Washington. 70 p.

ODFW (Oregon Department of Fish and Wildlife). 1988. Rogue Basin Fisheries Evaluation Program; Applegate Dam EV Phase I Completion Report. Effects of Applegate Dam on the biology of anadromous salmonids in the Applegate River. 106 p.

ODFW (Oregon Department of Fish and Wildlife). 1989. Rogue Basin Fisheries Evaluation Program; Applegate Dam Completion Report. Effects of Applegate Dam on steelhead in the Applegate River and recommendations for dam operations. 52 p.

ODFW (Oregon Department of Fish and Wildlife). 1990. Rogue Basin Fisheries Evaluation; Effects of Lost Creek Dam on winter steelhead in the Rogue River. Phase II Completion Report.

ODFW (Oregon Department of Fish and Wildlife). 1991. Rogue Basin Fisheries Evaluation; Effects of Lost Creek Dam on Coho Salmon in the Rogue River. Phase II Completion Report. 58 p.

ODFW (Oregon Department of Fish and Wildlife). 1994. Rogue Basin Fisheries Evaluation; Effects of Lost Creek Dam on summer steelhead in the Rogue River. Phase II Completion Report.

ODFW (Oregon Department of Fish and Wildlife). 1997. Draft Rogue River coho hatchery program implementation plan. Cole M. Rivers Hatchery and Upper Rogue River District, ODFW. 41 p.

USFWS (U.S. Fish and Wildlife Service). 1956. Fish and wildlife resources of the Rogue River Basin. Portland, Oregon. 58 p.

USFWS (U.S. Fish and Wildlife Service). 1961. A detailed report on fish and wildlife resources affected by Corps of Engineers' Water Development Plan, Rogue River Basin, Oregon. Portland, Oregon. 35 p.

Personal Communications

Evenson, Mike. Fisheries Biologist, Oregon Department of Fish and Wildlife Upper Rogue District Office, Central Point, Oregon. TEL (541) 826-8774.

Fustish, Chuck. Fisheries Biologist, Oregon Department of Fish and Wildlife Upper Rogue District Office, Central Point, Oregon. TEL (541) 826-8774.

Satterthwaite, Tom. Research Fisheries Biologist, Oregon Department of Fish and Wildlife, Grants Pass, Oregon. TEL (541) 474-3145.

Schmidt, Bruce. Research Fisheries Biologist, Oregon Department of Fish and Wildlife, Corvallis, Oregon. TEL (541) 737-2272.