



JDSF Newsletter
Jackson Demonstration State Forest
State of California Dept. of Forestry P.O. Box 1185 Fort Bragg, CA. 95437

No. 32

January 1989

COHO SALMON AND STEELHEAD TROUT OF JDSF

Peter Cafferata, Karen Walton and Weldon Jones¹

Spawning and rearing habitat for anadromous fish is the dominant use of Jackson Demonstration State Forest's (JDSF) many miles of streams. Both coho (silver) salmon and steelhead migrate from the ocean up our rivers in the fall and winter to spawn (fig. 1). About 90 miles of the Forest's streams have been classified as habitat for these fish. The majority of these waters are located within two drainage basins. Approximately 30 percent of the Forest is within the Noyo River drainage, while almost 45 percent provides runoff for Big River. The remaining 25 percent of JDSF is made up of land in the small coastal watersheds of Hare Creek, Caspar Creek and Jughandle Creek.

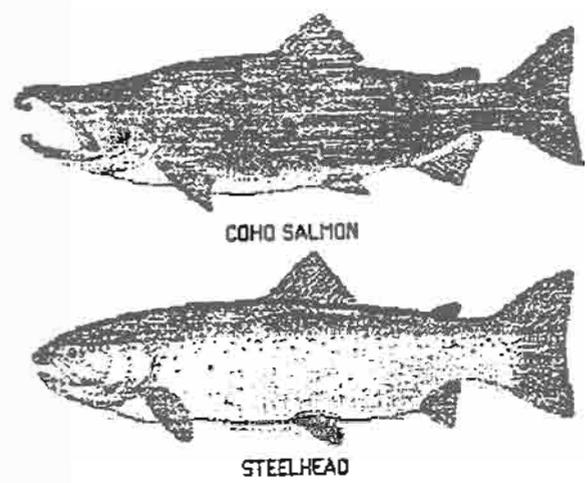


Fig. 1. Salmonids of JDSF.

¹Forester/Hydrologist, JDSF; Hydrologic Technician, US Forest Service Pacific Southwest Station, Fort Bragg, formerly Scientific Aide, California Department of Fish and Game (DF&G); and Mendocino Unit Fishery Biologist, DF&G, respectively.

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION
Richard J. Ernest, Acting Director

George Deukmejian
Governor
State of California

Gordon K. Van Vleck
Secretary for Resources
The Resources Agency

The life cycles of the anadromous species on JDSF are keyed to the hydrologic regime of these stream systems on the central Mendocino County coast. Ninety percent of the rainfall occurs between October and March. Usually the rain comes from low intensity, long duration cyclonic storms generated in the Gulf of Alaska. Annually, these storms provide about 40 inches of precipitation to the Fort Bragg coastal plain and over 80 inches 20 miles inland. This precipitation provides the stream flows the salmon and steelhead require for migration, spawning, incubation and nursery purposes.

LIFE HISTORIES OF SALMONIDS

Coho Salmon

In North America, coho salmon range from the Aleutian Islands to Monterey Bay. Historical reports indicate that as late as the 1950's, coho used all but the smallest of the Mendocino County coastal streams (Baker and Reynolds 1986). Recent studies in Mendocino County, however, have found that only 30 percent of the 70 major streams surveyed still contain coho (Jones 1986). On a brighter note, all the major streams in JDSF continue to support runs of salmon.

Coho salmon are anadromous, meaning they spend part of their life in the ocean, and then return to freshwater to spawn. Normally they return back to the specific stream and area in which they were reared. In the small coastal streams and rivers found on JDSF, most coho migrate upstream to spawn from mid-November to mid-January. The majority of these returning fish are three years of age. However, about one-third of the males return as two-year-old fish called grilse (or jacks). Grilse are characteristically short, often being less than 22 inches long. The biological reason for the occurrence of grilse is not clear, but does provide an important source of males for the spawning process when the number of older males is low.

Each spawning female produces about 2,500 eggs. It is the female which excavates the egg nest or "redd," using her broad tail fin to hydraulically lift gravel and hollow out a depression in which the eggs are deposited. The male occupies himself during this critical period with keeping would-be competitors and/or egg-eating predators away from the redd. Following the egg laying and fertilization, the female moves upstream a few feet, repeating the digging process to lift gravel and bury the eggs. After closing the redd, both parents slowly deteriorate and die, a characteristic of all Pacific salmon.

As a rule of thumb, the incubation period for coho salmon eggs takes 50 days at 50°F. For every degree more the period is shortened about one day and for every degree less the period is lengthened about one day. When the eggs hatch the juveniles, called alevins, remain under the gravel another two to seven weeks absorbing their yoke sacks. Following absorption of the sack they work their way up through the gravel to emerge in the stream as fry.

During the incubation period the eggs are extremely sensitive to vibration, light and a number of other factors. Under favorable conditions, only 65 to 85 percent hatch. High flows can scour or modify the gravel containing the eggs, destroying all. Also, sediments generated in the watershed can cover the redd, smothering the eggs by

depriving them of oxygen, and making it impossible for the young fish to emerge. In addition, redds are often destroyed by other fish using the same site for their spawning activities.

Juvenile coho normally remain in the stream where they were hatched for a period of one year before migrating downstream to the ocean. Soon after emergence from the gravel, the fry pushed by population pressure, availability of food, and suitable habitat, spread throughout the stream. Quiet waters along the margins of the stream are the first places one can observe the small weak fry. As they gain strength and increase in size, they begin feeding in the faster waters. Optimum coho nursery habitat can be characterized as a mixture of pools and riffles, undercut banks, in-stream object cover, including substantial amounts of wood material, and an abundance of overhanging vegetation and canopy. The Department of Fish and Game's (DF&G) axiom for coho habitat is the "3 D's: deep, dark and dense."

In the spring of the fish's second year, one year after the eggs were deposited in the stream, smoltification occurs. This is a physiological change which allows fresh water salmonids to survive in salt water. Physically, smolts can be recognized as silvery in appearance, with their spots no longer visible and many developing a dark line along the trailing edge of their tail or caudal fin. Often smolts are slender, as most apparently do not feed during this period. Generally, wild coho smolts are 4 to 5 inches long when they enter the ocean. Once the coho reach the ocean they move into the deeper waters where the vast majority spend two years feeding and growing. The grilse spend only one year at sea before returning to their ancestral stream.

Steelhead

Steelhead are the anadromous form of the rainbow trout. They range along the western coast of North America from Alaska to the Ventura River in Los Angeles County. In general they have much in common with the coho salmon; the juveniles are spawned and grow in much the same way. They smolt and migrate to the ocean to mature into adult fish before returning to spawn.

The juvenile steelhead differ in appearance from the coho in a number of subtle ways which can be seen by those who are observant and quick. The large spots on the side of the steelhead are circular, whereas those on the coho are lense shaped, longer than they are wide. In addition the juvenile steelhead have spots on their dorsal fin and the coho does not. Furthermore, the juvenile steelhead spend two years instead of one in fresh water before smolting and the adults generally do not die after spawning. The majority swim back down to the ocean and live long enough to spawn a second time. Although juveniles of both species often occupy the same stream, the steelhead is the more tolerant of warmer and more open waters. Overall, the steelhead are the more abundant of the two species on JDSF.

FISHERIES ACTIVITIES ON JDSF

During the past five years, various DF&G and U.S. Forest Service personnel have conducted a considerable amount of work on JDSF streams. Studies have included surveys to document salmon and steelhead range, distribution, abundance, and to determine annual trends. This work has

been ongoing and involves three distinct parts of the life cycle. Adult carcass surveys have been conducted on Caspar Creek during the winter period. Downstream juvenile migration studies have been conducted on Caspar Creek during the spring and standing crop surveys have been conducted annually in Caspar Creek during the late summer. In addition, on the South Fork of the Noyo River, DF&G operates an egg-taking station where coho salmon are trapped and stripped of eggs for restoration programs. Finally, surveys have also been conducted on all JDSF streams to identify fish barriers and habitat restoration problems. Projects were developed and have largely been completed. Brief summaries of all these activities follow.

Downstream Migrant Studies on Caspar Creek

During the spring of 1986 through 1988, the DF&G conducted downstream migrant studies on two small coastal streams in Mendocino County: Caspar Creek in JDSF, and Little River in Van Damme State Park. All downstream migrant fish were trapped at these facilities. The objective of this work was to determine the timing, population, fish size and age structure of downstream salmonid migrants in small Mendocino coastal streams. In addition, annual trend information was obtained.

Sampling was conducted on Caspar Creek from March 3 to June 12 during 1988. The traps were serviced daily throughout the study. All the fish were caught, identified to species, counted and released below the trap. For this sampling period, the following results were obtained: 1,175 coho yearling + (i.e., fish one or more years old), 34,691 coho young of the year, 300 steelhead trout yearling +, and 10 steelhead trout young of the year (Walton 1988). The overall trend for the yearling + coho was a migration extending from mid-March through May, with peaks in mid-April and early May. The steelhead migration pattern was of a lesser magnitude than that of the coho, with only one sharp increase occurring from mid-April through the first week of May (fig. 2).

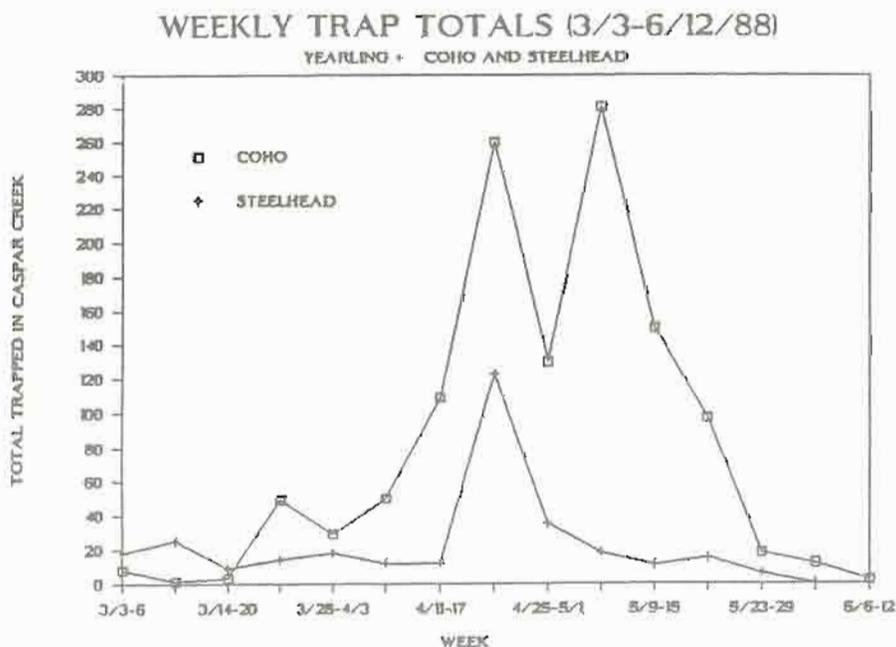


Fig. 2. Weekly totals of yearling + coho and steelhead, Caspar Cr.

The relatively large number of coho young of the year fry trapped indicated a successful spawn and hatch during the 1987/88 season. The high incidence of these fish also reflects population pressures forcing them to seek available food and space downstream of the trap. Some of the young of the year fry may have been on their way to the sea. The

literature indicates that coho have been found by some researchers to constitute a large portion of downstream migrants, but their ability to survive in high salinities and return as adults has been extremely low.

The DF&G hopes to continue to monitor downstream migrations of salmonids in Caspar Creek in an effort to learn more about effective management tools for all those who work with this resource and/or their habitat.

Standing Crop Surveys on Caspar and Hare Creeks

Electroshocking surveys have been conducted in Caspar Creek since 1984 and in Hare Creek in 1988. By passing an electrical current through the water, the juvenile fish in a 30-meter section of stream were stunned and captured. Following species identification and length measurement, the fish were quickly released back into the stream below the block nets confining each station. Thus, losses were minimized. Three passes through the station permitted biological evaluations which had a relatively high degree of accuracy.

The Caspar Creek standing crop studies revealed both coho salmon and steelhead-trout were present throughout all five years of observation. The densities of the respective species, however, varied considerably from year to year. The densities of the juvenile coho were higher than that of the steelhead-trout on three of the five years, averaging an overall 64% of the total salmonids found (fig. 3).

The reasons for fluctuations in salmonid densities probably center around yearly differences in quantity and quality of summer habitat. While it is recognized that optimum in-stream habitat includes a mixture of pools and riffles, with undercut banks, lots of in-stream woody cover, overhanging vegetation and canopy, resource managers often neglect the importance of cool water. The coho salmon appear to be more sensitive to higher temperatures and open stream conditions than the steelhead-trout. Thus, while the steelhead appear to dominate the eastern side of JDSF, coho are most numerous on the coastal plain, where the nearby ocean moderates the temperature. Furthermore, the need for cool water is particularly important to coho salmon in Mendocino County because of the warmer summer temperatures at this latitude and location in the southern part of the species range. The salmonids also appear to

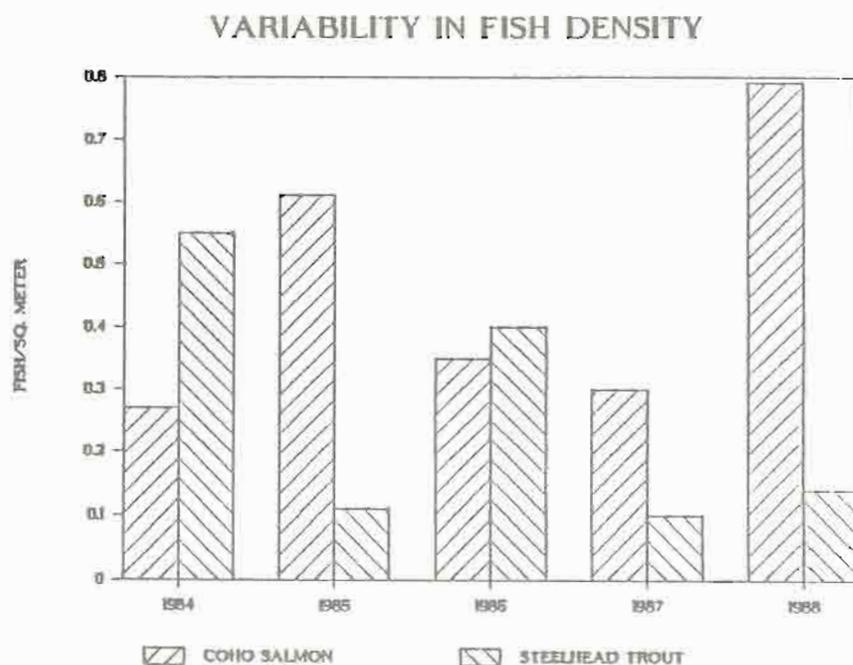


Fig. 3. Variability in salmonid densities, Caspar Creek.

have more acute temperature problems during periods of drought, when low summer water flows have less capacity to buffer the heat.

Although it's relatively easy to go out to measure low flows which usually persist for long periods, the impact on the fish from constantly changing temperatures is more difficult to sample and evaluate. Often the only temperature data available is obtained from instantaneous readings or information provided by researchers working in other areas.

In the absence of specific fish temperature studies on JDSF, a review of literature relative to juvenile coho salmon and steelhead habitat preferences may help us understand their general in-stream nursery needs. The coho salmon requires the lower temperature of the two species. McMahon (1982) indicates that optimum water temperatures for juvenile coho occur between 48.2°F and 55.4°F, with highest growth rates occurring in this range. Below 48.2°F, fry become less active. Temperatures of 59°F to 62.6°F are considered average for summer growth, but at temperatures above 68.0°F coho may be expected to exhibit increased mortality from disease. The incipient lethal temperature for coho occurs between 73.2°F and 77°F.

Noyo River Egg Collecting Station

On the South Fork of the Noyo River, the DF&G operates an egg taking station where coho salmon are trapped and artificially stripped of eggs. The facility was constructed and is maintained to establish a permanent egg source for short run coho salmon. It is the only facility of its kind in the county and was first operated during the winter of 1962-63. The juveniles are reared at Mad River and other fish hatcheries before being brought back to be "imprinted" and released to migrate downstream to the sea. The process of imprinting is one in which the fish are detained long enough, in the stream which fisheries biologists want them to migrate up, to "memorize" the mineral content of the water prior to smolting and heading to sea.

Recently a new management plan was adopted and the facility is expected to be in full production in 1989-90. Management goals for the station include: 1) maintain a sustained adult escapement of 1500 coho salmon, 2) annually spawn 1 million coho eggs, 3) rear and return 150,000 yearling coho smolts to the South Fork Noyo River for imprinting and release to maintain the adult escapement, and 4) stock the remaining fish in streams which have lost runs and have undergone rehabilitation.

Fisheries Habitat Restoration on JDSF

Fisheries habitat restoration projects have been conducted on JDSF for many years. These projects have resulted in the removal of barriers to fish passage on all the major streams of the Forest. This work has mainly been accomplished by the Department of Forestry and Fire Protection's Fire Crews at Chamberlain Creek and Parlin Fork. In addition to the removal of barriers for spawning, many miles of nursery habitat have also been improved. Fisheries restoration work on JDSF has been quite extensive and a more specific report on the respective projects, miles of stream improved, and costs will be the topic of a future article.

USES OF STATE FOREST FISHERIES

The lower portion of the Noyo River and Big River are open to angling year round and salmon and steelhead are fished for in their respective seasons. However, the headwaters of these drainages and their tributaries, as well as the other small drainages on JDSF, are designated spawning and rearing habitat and are closed to fishing. The DF&G has placed the angling emphasis on adults, rather than on juveniles, in closing these smaller streams.

Salmon produced on JDSF contribute to both commercial and sport fisheries on the ocean and a sport fishery in the Noyo and Big River. The commercial ocean fishery for coho salmon extends along the California coast up into southern Oregon. However, JDSF's production is not expected to contribute extensive numbers to the catch.

Commercial salmon landings in California amounted to 43,800 coho in 1987 and 51,000 in 1988. The economic values of these landings, including a 2.5 percent multiplier for fish house handling, was \$1.2 million in 1987 and \$1.8 million in 1988. Fort Bragg's percentage of these landings was a significant 51 and 53 percent for 1987 and 1988, respectively. The ocean sport fishery for coho salmon along the west coast are extensive, equaling that for chinook salmon. In 1987 the coho sport catch accounted for 2,515 fish and in 1988 the catch was 3,148 fish. With an ocean fishery recreation day valued at \$50.00, the 90,000 angler days of effort expended in 1988 were worth \$6.26 million. No data is available on the instream sports fishery.

Literature Cited:

- Baker, P. and F. Reynolds. 1986. Life history, habitat requirements, and status of coho salmon in California. CDF&G unpublished report submitted to the California Fish and Game Commission. 31 pp.
- Jones, W. 1986. Coho salmon resources of Mendocino County. CDF&G unpublished report. 8 pp.
- McMahon, T. 1982. Habitat suitability index models: coho salmon. Habitat Evaluation Procedures Group, Western Energy and Land Use Team, U.S. Dept. Int., Fish & Wildl. Serv. FW/OBS-82/10.49. 29 pp.
- Walton, K. 1988. Downstream migrant trapping on Caspar Creek and Little River, March-June, 1988. CDF&G unpublished report. 8 pp.

* * * * *

CORRECTION ON REDWOOD SEEDLING STUDY RESULTS

In the July issue of this newsletter (No. 30), a mistake was made in reporting the results of a study being conducted on JDSF to evaluate three different types of redwood seedlings. The survival one year after planting for the one-year-old bare root and two-year-old bare root seedlings was reversed. **The correct survival percentages for all three types should read: container stock- 81%, two-year-old bare root-70%, and one-year-old bare root- 38%.** The editor takes full responsibility for this error and apologizes for the confusion this mistake generated!

JACKSON DEMONSTRATION STATE FOREST
802 N. MAIN STREET
P.O. BOX 1185
FORT BRAGG, CA 95437