STATE OF CALIFORNIA--RESOURCES AGENCY

DEPARTMENT OF FISH AND GAME

AN ASSESSMENT OF FEDERAL WATER PROJECTS ADVERSELY AFFECTING CALIFORNIA'S SALMON AND STEELHEAD RESOURCES

3. Trinity River Division, Central Valley Project

September 1974

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INTRODUCTION

Senate Concurrent Resolution No. 64, passed in the 1971 session of the California State Legislature, directs the California Department of Fish and Game to prepare a series of reports regarding Federal water projects in California. These reports are to: (1) identify those developments which have had an adverse effect on salmon and steelhead populations, (2) assess the numbers of salmon and steelhead lost, (3) assess the damage to the environment, and (4) estimate the cost of mitigating the damage.

This is the third report by the Department in response to SCR 64, and deals with the United States Bureau of Reclamation's Trinity River Division, Central Valley Project located in Trinity and Shasta Counties.

DESCRIPTION OF THE TRINITY PROJECT

The Trinity River Division is a major element of the U. S. Bureau of Reclamation's Central Valley Project. It was designed and constructed primarily to provide water for hydroelectric generation and for agricultural uses in service areas in the Central Valley. The project additionally provides recreation benefits and some incidental flood control benefits. The Trinity Project represents the first major development of California's north coast water for export.

Construction of Trinity Dam and the associated features comprising the Trinity Division began in 1955. The project was completed and the export of Trinity River water to the Sacramento Valley was begun in 1963.

Since that time, an average of 1.2 million acre-feet of water has been diverted annually from the upper Trinity River basin to the Sacramento Valley. This average annual diversion has been possible because precipitation and runoff in the watershed above Trinity Dam has been above normal during this period. During a series of dry years, which will occur periodically, the average annual diversion would be substantially less.

Principal project features include Trinity Dam which impounds Clair Engle Lake, Lewiston Dam and Lake, and Trinity River Salmon and Steelhead Hatchery on the upper Trinity River; and Whiskeytown Dam and Lake on Clear Creek, a tributary of the Sacramento River. The project also includes the Spring Creek Debris Dam and Reservoir on Spring Creek, a tributary to Keswick Lake, two transmountain tunnels and four hydroelectric plants.

Runoff from the upper Trinity River basin is stored behind Trinity Dam. Releases from this dam are utilized by a power plant and re-regulated by Lewiston Dam, located approximately 7 miles downstream. Lewiston Dam, with its associated power plant, regulates downstream flows in the Trinity River. A portion of the water released to the river by Lewiston Dam passes through Trinity River Hatchery, which is located at its base. The hatchery was constructed to compensate for the loss of historic salmon and steelhead spawning and nursery grounds upstream from Lewiston Dam.

Water not released to the Trinity is diverted by Lewiston Dam through the Clear Creek Tunnel and Judge Francis Carr Powerhouse to Whiskeytown Lake where it is combined with runoff from the upper Clear Creek basin. Part of the water stored behind Whiskeytown Dam is released to lower Clear Creek. The balance is diverted through the Spring Creek Tunnel and Powerhouse to Keswick Reservoir on the Sacramento River.

The Spring Creek Debris Dam serves to contain debris which would otherwise enter the Spring Creek Power Plant tailrace and Keswick Reservoir.

ASSESSMENT OF TRINITY PROJECT IMPACT ON SALMON AND STEELHEAD RESOURCES

Trinity River Basin

Impact on the Resource

Available data do not fully describe salmon and steelhead losses in the Trinity basin. To date the causes for declines have not been fully determined. However, they are believed due in significant measure to construction and operation of the Trinity Project.

In March 1959 the Bureau of Reclamation and the Department of Fish and Came signed an operating agreement providing for year-around water releases ranging from 150 to 250 cfs for fish maintenance downstream from Lewiston Dam. Scheduled releases under this agreement were modified in 1968 to better accommodate spawning king salmon. The total amount of water called for under the 1968 modification (120,300 acre-feet) is approximately 10 percent of the historic (1911-60) annual flow of 1,188,000 acre-feet.

Since construction of the project, the numbers of adult steelhead entering the Trinity River have declined dramatically. Whereas an estimated annual average of 10,000 steelhead ascended the Trinity past Lewiston Dam before its construction, the total number of adults returning to Trinity Hatchery each year during its 11 years of operation has ranged from 67 to 6,941 fish. Runs the last few years have been much reduced from those in earlier years; the five-year (1970-74) average has been 197 fish.

Steelhead declines in the basin are also reflected in decreased angler harvest. The estimated annual angler catch of steelhead in the river during the period 1956-58 was 8,800 fish. The estimated annual catch a decade later (1968-69) was only 1,062, this despite increased fishing effort.

Declines, though not as great as those observed for steelhead, have also occurred among fall-run king salmon since construction of the project. Annual counts of king salmon entering Trinity River Hatchery from 1958 through 1973 have ranged from 2,586 to 11,381. The 16-year average has been 6,021 fish, or about half the number estimated to have spawned above Lewiston before construction of the dams. A general downward trend in total numbers of king salmon returning to the hatchery has been reversed in the last four years (1970-73). This was due mainly to significant increases in the numbers of spring-run fish returning to the hatchery during these years. Total numbers of fall-run fish entering the hatchery in recent years have been well below preproject totals and those recorded in earlier years at the hatchery.

Increasing angler effort, coupled with a downward trend in total king salmon harvest since project construction indicate that the increases in spring-run numbers have been insufficient to offset fall-run declines.

Impact on the Environment

Construction of Lewiston Dam resulted in the upstream loss of 59 miles of king salmon habitat, 109 miles of steelhend habitat plus an undetermined amount of silver salmon habitat.

Since construction of the Trinity Project, a number of major environmental changes affecting anadromous fish populations have occurred in the main Trinity River downstream from Lewiston Dam. The most obvious of these has been the approximate 90 percent reduction (except for occasional uncontrolled spills) in average annual preproject runoff past Lewiston. Peak discharges have been reduced significantly. Periods when the river is turbid have been prolonged, in some years by several months, as a result of storing and later releasing silt-laden winter runoff from Trinity Dam. The temperature regime in the river below the dam has also been altered. Reduced flows now result in earlier and more rapid warming of downstream areas in the spring than occurred before construction of the project.

The impact earlier warming of downstream areas is having on salmon and steelhead populations in unknown. However, it is suspected that it may be interfering with the orderly emigration of a significant portion of the smolts destined to go to sea each spring, thereby reducing ultimate adult returns.

Problems of sediment (decomposed granite sand and silt) accumulation and growth of riparian vegetation have jointly developed in the 40 miles of river between Lewiston Dam and the North Fork Trinity confluence since construction of the project. Sediments have filled pools and compacted spawning gravels. Vegetation encroaching on the stream channel has narrowed it in many places, causing changes in flow patterns that have resulted in erosion of riffles. Natural gravel recruitment to the river immediately below Lewiston Dam was halted by construction of the project; subsequent erosion and scouring have resulted in further spawning habitat losses in this section

of the river. King salmon spawning habitat surveys conducted in the Trinity before (1945) and after (1969-70) construction of the dams indicate 44 percent of the available preproject spawning habitat between the North Fork and the dam has been lost. An undetermined amount of juvenile salmon and steelhead rearing habitat and adult resting habitat has also been lost. Habitat degradation from these causes is continuing.

Fishability of much of the river between Lewiston Dam and the North Fork confluence has been significantly impaired by the development of riparian vegetation and the filling of pools with sediment. The impact has not been quantified.

Sacramento River Drainage

Impact on the Resource

The overall impact of annually importing over 1 million acre-feet of Trinity River water to the Sacramento Valley on salmon and steelhead populations in the upper Sacramento River basin is unknown. No damage to Sacramento River steelhead populations has been attributed to the Trinity Project. Present information suggests that, with present operating conditions, there may be both beneficial and harmful effects to the king salmon resource.

A result of diverting Trinity water to the Central Valley has been to increase flows in the upper Sacramento River below Keswick Dam during the months of October and November (when fall-run king salmon are spawning) from a preproject range of 4,000-6,000 cfs to a present range of 6,000-8,000 cfs. In the months of December through February, flood control operations at Keswick Dam occasionally result in reductions in these flows (to as little as 3,000 cfs) and subsequent dewatering of salmon redds in the reach below the dam. The greater flow fluctuations occurring under post-Trinity Project

operations have increased this problem. Resulting losses have not been quantified, but may be substantial at times.

In the fall of some years, addition of colder Trinity water to warmer water being released from Shasta Dam has reduced temperatures of Keswick Dam releases, alleviating potential problems for salmon. Increasing future water demands and associated increasing reservoir drawdowns may result in releases of water warm enough to adversely affect fall spawning salmon resources in the Sacramento and Trinity Rivers.

Construction and operation of the Spring Creek Debris Dam has helped alleviate a recurring pollution problem affecting fish, including salmon and steelhead, in the Sacramento River. Prior to construction of the dam, acid mine waste effluent coming for the Spring Creek drainage would periodically result in creation of conditions toxic to fish in Keswick Lake and the river below. Now, except during periods of heavy runoff when it fills and spills, the dam contains the runoff so that it can be released into Keswick Lake at a rate such that dilution by Shasta Dam releases keeps the mine waste effluent concentrations below acute toxic levels.

Ecological changes resulting from construction and operation of Whiskeytown Dam have definitely affected Clear Creek salmon and steelhead populations. However, lack of detailed information on the population prevents assignment of specific detriments or benefits to the project.

An operating agreement, calling for annual releases of 24,700 acre-feet of water from Whiskeytown Dam for fish maintenance in Clear Creek, was signed by both Agencies in March 1960. This agreement provides flows ranging

from 10 to 100 cfs during the months October through May. Releases for irrigation and other purposes provide flows in Clear Creek between Whiskeytown and Saeltzer Dams during the remaining four months (June-September). No minimum flows are assured in the lower 7 miles of stream between Saeltzer Dam and the Sacramento River during this period.

Impact on the Environment

The diversion of Trinity River water to the Sacramento River has caused a number of changes in salmon and steelhead habitat in the Sacramento drainage, particularly Clear Creek. Increased fluctuations in winter releases from Keswick Dam and alterations in upper Sacramento River water temperatures have already been discussed. Diversion of sediment-laden water from the Trinity basin has resulted in lengthened periods of turbid flows in Clear Creek and the Sacramento River below Keswick Dam.

Trinity Project construction and operation have substantially altered the characteristics of the Clear Creek basin. Since construction of Whiskeytown Dam, the average annual flow in lower Clear Creek has been reduced by approximately 60 percent, from about 296,000 acre-feet (years 1940-63), to about 115,000 acre-feet (years 1964-71)[1/]. Project operation has altered preproject flow patterns; high winter flows have been greatly reduced. Higher water temperatures and turbidity levels, adversely affecting water quality, have resulted since project construction. As on the Trinity, riparian vegetation has encroached on the streambed in may areas below the dam.

Salmon spawning habitat in lower Clear Creek has deteriorated significantly since completion of the project. In 1956, the 11.4-mile stream

[1/] Calculations made by the U.S. Bureau of Reclamation, based on available hydrologic data for the period 1922-73, indicate the long-term pre- and post-project average annual flows in Clear Creek to be 241,500 acre-feet and 42,250 acre-feet, respectively.

between Whiskeytown and Saeltzer Dams held an estimated 347,000 square feet of suitable spawning gravels; in 1970 an estimated 29,000 square feet (8.4 percent) remained. The reduction is partly attributed to buildups of decomposed granite sand caused by Clear Creek's reduced sediment-transport capacity, coupled with accelerated erosion and continuing sediment delivery by tributaries below the dam. Encroachment of riparian vegetation and channel erosion below Whiskeytown Dam, due to the dam's blocking natural recruitment of upstream gravels, have also contributed to the decreases. Gravel mining operations have drastically reduced salmon spawning habitat between Saeltzer Dam and the Sacramento River.

COST OF MITIGATING THE DAMAGE

Reduced outflow, particularly during the spring emigration period, is currently considered the key to steelhead problems in the Trinity River. The Department has requested that the Bureau of Reclamation increase the annual releases from Lewiston Dam from 120,000 acre-feet to 315,000 acre-feet. The Bureau has estimated that to do this would cost the Central Valley Project about $2 .5 million per year in potential power revenues. They have also estimated that in the future (when the water is needed) it would cost the Project another $0.9 to $2.2 million annually for reductions in the available firm irrigation water supply. They estimated that capital outlay costs of over $200 million would be needed to replace this water.

Estimates of costs to rehabilitate salmon and steelhead habitat affected by the Trinity Project both inside and out of the Trinity basin are not available. However, it is anticipated that such costs could be considerable, and without significant changes in Project operations, much of the rehabilita-

tion work would be of relatively short-term benefit. It has been determined that a program to identify the causes for steelhead and salmon declines in the Trinity River and to develop methods for correcting the problems would cost approximately $1.8 million.

COMMENT

The Trinity Project represents California's first experience with transbasin diversion of a significant part of the runoff in a major river basin. Since its construction, extensive modification of salmon and steelhead habitat both within and outside the Trinity basin, and significant declines in anadromous fishery resources, particularly steelhead, have occurred. The causes of the declines have not been fully identified. The factors responsible must be clearly and rapidly defined if perpetuation of these resources there is to be insured. It is particularly important that the factors adversely affecting the populations in the Trinity be identified if they have been brought about by the water export features of the Trinity Project. If the project is responsible, the ramifications are great, especially when one considers the potential impact of similar water export developments proposed for the Eel River. In the event that the causes of the declines lie with the construction and operation of the Trinity Project, it will be imperative that methods for overcoming the present difficulties and preventing similar problems from arising in association with possible future projects be developed now on the Trinity.