Gary R. Stern
43 Crescent Way
Arcata, CA 95521

June 2, 1986

Mr. Lester Kaufman
U.S. Bureau of Reclamation
2800 Cottage Way
Sacramento, CA 95825

Dear Mr. Kaufman:

Thank you for taking the time out to speak with me and answer some of my questions concerning the Trinity River Basin Fish and Wildlife Task Force last November. I am enclosing a copy of my paper on Trinity River mitigation efforts. I think I have successfully compiled from various state and federal documents an accurate account of the TRD mitigation process. Please feel free to duplicate copies for others to read (especially Task Force members). I can be contacted through the California Cooperative Fisheries Research Unit at Humboldt State University, Arcata, CA 95521.

Sincerely,

Gary Stern

Gary Stern

Enclosure

MITIGATION
ON THE
TRINITY RIVER, CALIFORNIA

by

Gary R. Stern

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Western Water Politics

Political Science 250

Bruce Haston

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INTRODUCTION AND BACKGROUND

Since the completion of the Trinity River Division (TRD) of the Central Valley Project (CVP) in 1963, salmon and steelhead runs in the Trinity River Basin have undergone severe declines; approximately 80 percent in the case of chinook salmon (from 50,000+ spawners to 11,000), and 60 percent for steelhead (from 24,000+ spawners to 10,000) (USFWS 1980a). This decline has occurred despite provisions of the TRD to protect prime spawning and rearing habitat below Lewiston Dam, the primary diversion structure, with flow releases to the Trinity River and the operation of a hatchery to compensate for loss of upstream anadromous fish habitat blocked by the dams.

The Trinity River of northwestern California is the largest of the Klamath River tributaries (Figure 1). It drains an area of approximately 2,950 square miles of mountainous terrain in Trinity and Humboldt counties. The river flows 130 miles west-northwest from the Salmon-Trinity Mountains to the Klamath River near Weitchpec.

As early as the 1920's, plans for the diversion of Trinity River water were formulated and published as part of an early state water plan (Calif. Dept. Public Works 1927). This proposal became an integral component of the California State Water Plan in 1951 (DWR 1951). During the late 1940's and early 1950's, a series of extensive factual surveys investigated the fishery resources of the Trinity River (Moffett and Smith 1950) as well as the geologic, hydrologic, and economic concerns of the proposed development (USFWS 1951).

In 1955, water development on the Trinity River was initiated by Congressional authorization of the Trinity River Division (TRD) of Central Valley Project (CVP) (Trinity River Act, P.L. 84-386). This

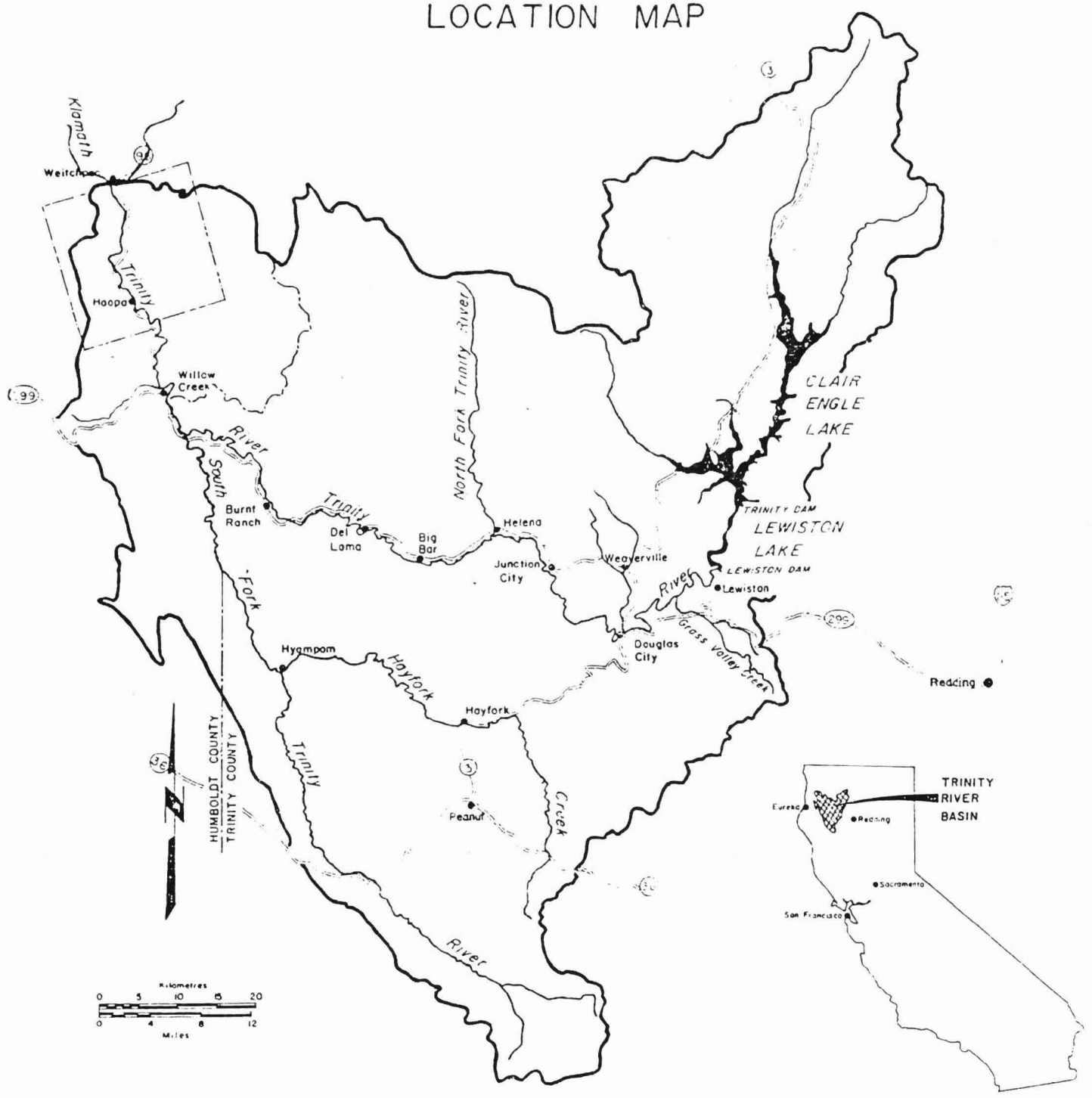

Figure 1. Trinity River Basin, California.
From: Trinity River Basin Fish and Wildlife Task Force. 1977. Framework guide; Trinity River Basin management program.

Act called for development of a series of water storage and transmission facilities in the transfer of "surplus" Trinity River water to the Sacramento River Basin (Figure 2). The Act also provided for a series of hydropower facilities to generate electricity during the 1800-foot drop to the Sacramento River. Trinity Dam and its reservoir, Clair Engle Lake, are the major features of the TRD. Trinity Dam is a 537-foot high earth-filled structure which controls the runoff of 728 square miles in the upper Trinity Basin. Water released from Trinity Dam passes through a 105,000 kilowatt (kw) powerplant before reaching Lewiston Reservoir a few miles downstream. The 91-foot high Lewiston Dam serves to regulate flows into the diversion facilities as well as the Trinity River. Water diverted at Lewiston passes through the 10.8-mile long Clear Creek Tunnel to a 141,000 kw powerhouse before reaching Whiskeytown Reservoir in the Sacramento River Basin.

MITIGATION MEASURES

The construction of Trinity and Lewiston Dams resulted in the loss of access to significant areas of anadromous fish habitat in the upper Trinity River watershed. The formation of Clair Engle Lake and Lewiston Reservoir resulted in the inundation of important deer wintering range and migration routes. Efforts to compensate for these project-induced losses were addressed in the original plans for the TRD, but mitigation measures were not completely successful.

In addition to the predicted losses of fish and wildlife habitat above Lewiston Dam, extensive habitat changes began occurring in the Trinity River downstream of the TRD soon after project completion. The operation of the diversion facilities, in combination with abusive

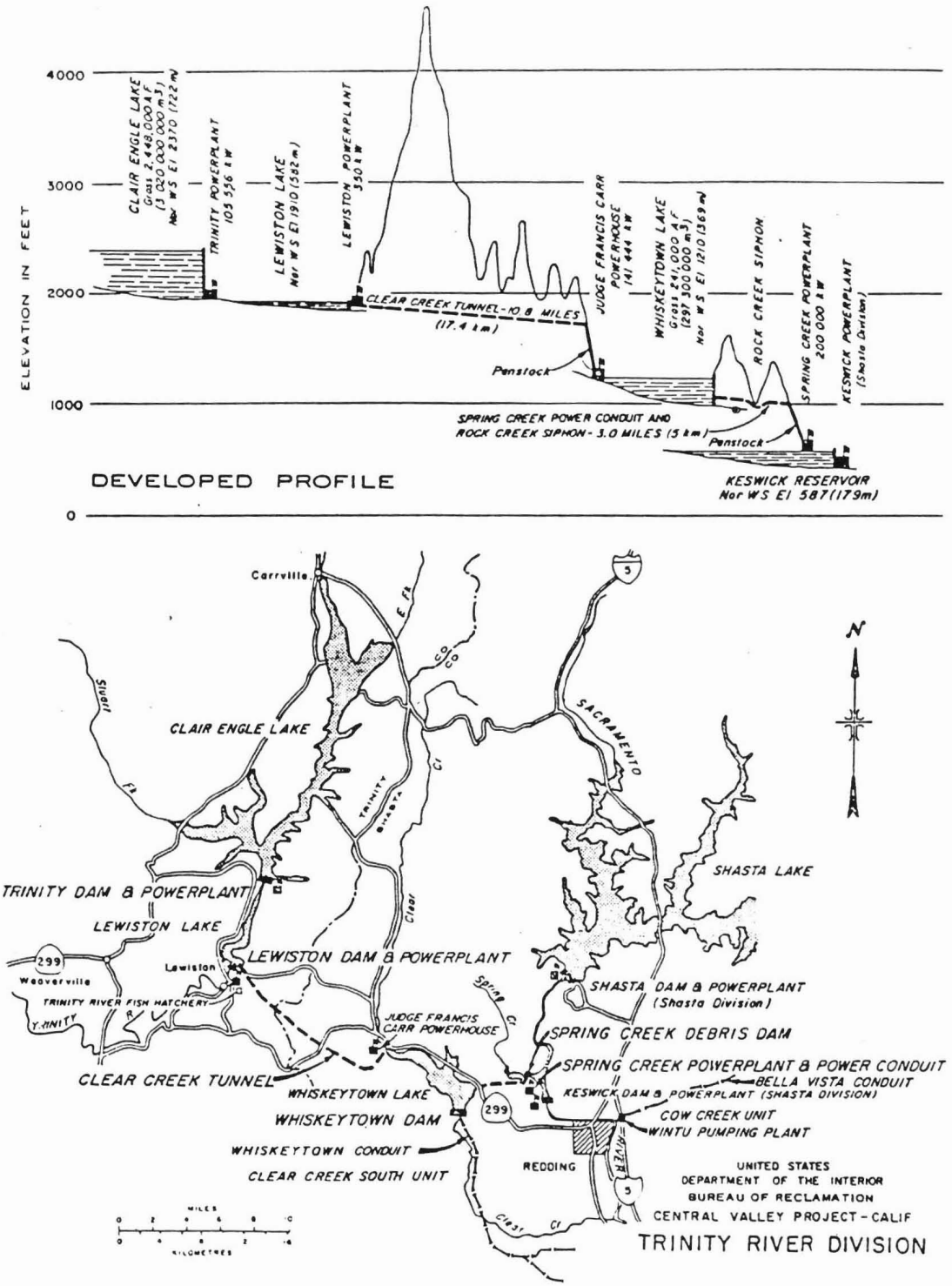

Figure 2. Trinity River Division, Central Valley Project.

logging practices, improper road construction, and floodplain development, progressively deteriorated aquatic habitat in the stream channel below Lewiston. The 40-mile segment of stream immediately below Lewiston Dam, once considered the most productive spawning and rearing habitat for salmon and steelhead in the mainstem, is now characterized by sediment-filled pools and riffles, compacted river gravels, and a channel choked with willows, cattails, and alders.

Only a few years after the TRD began operation, it became apparent that the project's mitigation measures alone would not be sufficient to protect the fish and wildlife resources of the Trinity Basin. The State of California began to research the problems of the Trinity River channel below Lewiston in 1967 and it was at their request that the Trinity River Basin Fish and Wildlife Task Force (TRBF&WTF) was created in 1971. The main objectives of the TRBF&WTF from 1971 to 1982 were to prepare a comprehensive action program for rehabilitation of the Trinity River Basin and to obtain funding to carry out the program. Since 1971, the TRBF&WTF has played an instrumental role in virtually all post-project mitigation efforts in the watershed. Therefore, much of the story of mitigation on the Trinity River is that of the TRBF&WTF.

Mitigation issue

Mitigation of the impacts on fish and wildlife from the TRD is the responsibility of the U.S. Department of Interior (DOI). Section 2 of the Trinity River Act (P.L. 84-386) states "the Secretary is authorized and directed to adopt appropriate measures to insure the preservation and propagation of fish and wildlife...". Mitigation efforts on the Trinity were initially mandated by the Act because

Congress acknowledged the "fisheries resources of the Trinity River are an asset to the Trinity River Basin as well as to the whole north coast area." (H. Doc. 416). In more recent years, the DOI has also recognized their obligation to Native Americans of the Hoopa Valley Indian Reservation. Several court rulings during the 1970's established that an important "Indian purpose" for the creation of the reservation on the lower Trinity and Klamath rivers was to reserve the tribes' right to fish for salmon and steelhead.

The multitude of mitigation plans that have been developed for the Trinity River Basin (USFWS 1951, 1964, 1975, 1983; USFWS and CDFG 1956; Dunway 1964, 1966; Fredriksen, Kamine & Assoc. 1980; Gordon 1975; Trinity River Work Group 1971; Trinity River Basin Fish and Wildlife Task Force 1971, 1975, 1982; CDFG 1970; Price 1979; U.S. Forest Service 1956; VTN Environmental Sciences 1979) have been largely ineffective to date. However, the legal authority and requirement of the DOI as well as a moral obligation to public to maintain a healthy and productive Trinity River have permitted mitigation planning, programs and actions to continue. Recent mitigation actions include the creation of the TRBF&WTF, two pieces of federal legislation (P.L. 96-335 and P.L. 98-541), and various efforts by citizen groups to rectify conditions in the basin.

INITIAL MITIGATION PLANS

The original plans for the protection and maintenance of fish and wildlife resources affected by the TRD identified three major areas of concern: 1) Lewiston Dam will block the migration of chinook salmon, coho salmon, and steelhead from portions of their historic spawning and nursery areas, 2) impoundment of the river's waters behind dams

and the subsequent diversions will greatly reduce streamflows below Lewiston, and 3) Clair Engle Lake and Lewiston Reservoir will inundate important deer wintering grounds and migration routes (USFWS and CDFG 1956). Some mitigation measures were provided to minimize these project-induced damages to fish and wildlife, but the success of the actions has been limited.

Anadromous fish

Project construction resulted in the loss of 59 miles of chinook salmon spawning and nursery habitat, 109 miles of steelhead spawning and nursery habitat, and an undetermined amount of coho salmon habitat (Smith 1976). These river miles blocked off to anadromous salmonids amounted to 50 percent of the Trinity River above the North Fork historically utilized by chinook salmon and steelhead (Moffett and Smith 1950). Three methods of maintaining the anadromous fish runs were recommended by Moffett and Smith (1950):

1) Additional spawning area might be developed by increasing the river flow above normal during the spawning period.
2) Suitable tributary streams might be developed into spawning areas.
3) Fish hatcheries could be constructed.

Only the third consideration was implemented by TRD planners. The U.S. Bureau of Reclamation (BOR) constructed the Trinity River Salmon and Steelhead Hatchery at the base of Lewiston Dam. Since its completion in 1963, the hatchery has been operated by the California Department of Fish and Game (CDFG) under contract with BOR. It was designed to maintain a run of 12,000 chinook salmon and 10,000

steelhead which would have spawned above the project. The hatchery has an overall capacity to rear 31,000,000 chinook, 4,000,000 coho, and 5,000,000 steelhead. The majority of these fish must be released as fingerlings, but the hatchery also has the capacity of rearing 2,000,000 fish to yearling size. To date, the Trinity River hatchery has been plagued by problems and, thus, has been unsuccessful in offsetting TRD losses in terms of numbers.

Since construction of the TRD began in 1958 and the hatchery was not operational until 1963, an interim installation, the Lewiston Fish Trapping Facilities, was placed approximately one mile below the Lewiston Dam site. From 1958 to 1963, upstream migrating adult salmon and steelhead were captured at the temporary hatchery and either released above the construction site or artificially spawned. Eggs taken from fish at the Lewiston interim facilities were fertilized, hatched, and released directly back to the Trinity River as swim-up fry. Handling and transportation stress, as well as an inability to capture a sufficient number of migrant adults, resulted in serious population losses during the interim program (Hubbell 1973).

In May 1963, the Trinity River Salmon and Steelhead Hatchery was completed and put into operation. During the first few years at the new hatchery, severe losses of eggs and young fish occurred. Losses were attributed to low hatchery water temperatures, dietary problems, gill bacteria, and outbreaks of "white spot" and "gas bubble" diseases (Hubbell 1973). Many of these problems were corrected as hatchery operations continued, but new problems emerged. Overcrowding,

predation by birds and mammals, and low adult returns contributed to the overall downward trend of the hatchery's ability to compensate for TRD-induced damage.

Prior to the construction of the dams, an estimated annual average of 10,000 steelhead ascended the Trinity River above Lewiston (Moffett and Smith 1950). Since the completion of the TRD, the total number of steelhead returns to the hatchery has varied widely, from 13 fish in 1976-77 to 6,941 fish in 1964-65 (Table 1). The 26-year average for steelhead returns is 1,169 fish, about 12 percent of the historic run. Chinook salmon have also experienced a severe decline, however, not as great as observed for steelhead. Annual chinook salmon returns have ranged from 2,580 fish in 1969-70 to 11,381 fish in 1972-73 (Table 1). The 26-year average for chinook salmon returns is 6,442 fish, about 54 percent of the historic run above Lewiston. These statistics clearly illustrate TRD's keystone to compensation for anadromous fishery losses has not been entirely successful.

Wildlife

Construction of the TRD and the subsequent filling of Clair Engle Lake, and Lewiston and Whiskeytown reservoirs resulted in the inundation of approximately 20,460 acres of wildlife habitat. The impacts of this action were predicted in very general terms by pre-project investigations (USFWS 1951; USFWS and CDFG 1956; BOR 1957; USFWS 1956). The general consensus of these studies was that project construction would destroy a sizable portion of critical wintering range and traditional migratory routes of the Trinity Basin black-tailed deer herd. Although the U.S. Forest Service (USFS) correctly predicted 35 to 40 percent of the deer wintering habitat

	Chinook salmon			Coho salmon				
	Males	Females	Grilse	Males	Females	Grilse	Steelhead	Brown trout
1958-59	1,269	1,744	878	240	343	33	2,880	80
1959-60	1,716	2,833	2,701	49	44	26	2,071	52
1960-61	1,493	1,287	4,130	84	54	70	3,526	82
1961-62	885	1,613	2,899	158	160	37	3,243	35
1962-63	1,308	1,608	6,535	7	0	9	1,687	49
1963-64	1,569	2,627	2,539	32	40	11	894	34
1964-65	1,974	3,042	1,287	23	25	2	6,941	145
1965-66	477	1,077	1,521	2	1	9	992	100
1966-67	1,052	1,002	2,876	45	173	807	135	152
1967-68	1,620	1,250	1,746	287	519	59	232	231
1968-69	1,797	2,102	873	3	1	34	554	170
1969-70	624	832	1,130	153	132	1,711	241	70
1970-71	773	725	2,946	1,410	1,396	341	67	23
1971-72	3,648	4,645	928	28	11	8	242	7
1972-73	5,217	5,825	339	28	30	2,612	271	111
1973-74	2,483	1,152	1,577	3,808	3,787	486	162	39
1974-75	4,547	2,840	677	33	22	40	372	32
1975-76	2,958	3,405	860	68	109	2,060	175	24
1976-77	2,845	1,901	2,878	1,171	1,414	223	13	49
1977-78	1,841	1,318	2,562	381	317	1,230	285	0
1978-79	4,478	5,131	1,287	580	995	2,080	683	0
1979-80	1,138	1,480	1,452	1,241	1,547	1,253	382	0
1980-81	2,745	2,271	2,242	753	1,070	1,500	2,019	0
1981-82	2,214	2,514	1,146	830	1,164	2,529	1,007	0
1982-83	1,874	1,683	4,112	1,686	2,112	1,000	715	0
1983-84	2,764	3,256	903	223	256	227	603	0

Table 1. Summary of adult salmonid returns to Trinity River Salmon and Steelhead Hatchery.

From: Bedell, G.W. 1984. Trinity River Salmon and Steelhead Hatchery: annual report, 1983-84. Calif. Dept. Fish Game. Anadromous Fish. Branch Admin. Report No. 84-05.

would be lost, they greatly underestimated the size of the herd. With the USFS estimation of 2,300 animals in the upper Trinity Basin, only 800 deer would be lost by the TRD (USFS 1956).

Wildlife mitigation measures were not incorporated into the pre-TRD plans, but shortly following project completion in 1964, CDFG in cooperation with BOR, USFS and the Bureau of Land Management (BLM) prepared the Habitat Replacement Report, Trinity River Division, Central Valley Project, California (CDFG 1964). The plan called for improving deer habitat on 7,445 acres of public land surrounding Clair Engle Lake through clearing of trees and brush, fertilization, and reseeding. In 1964, the BOR provided funds for deer habitat manipulation. However, by 1966, only 1,669 acres or 22 percent had been treated, since no other areas were judged suitable for enhancement.

It was not until 1975, when the U.S. Fish and Wildlife Service (USFWS) published the results of a 1972 investigation, that it was realized more deer inhabited the upper Trinity Basin than first reported. The USFWS report entitled Deer Loss Compensation Program Resulting from Trinity River Division concluded the inundation of critical wintering habitat resulted in the loss of 6,650 migrant deer and 1,850 resident deer (USFWS 1975).

Flow releases for fish

In addition to the Trinity River Salmon and Steelhead Hatchery, the original project plans provided for mitigation of damage to fishery resources through water releases at Lewiston Dam. Early studies by Moffett and Smith (1950) indicated a minimum flow of 300 cfs would be required to maintain anadromous fish runs. This

recommendation was subsequently modified by BOR and CDFG, and in March 1959, the two agencies signed an operating agreement providing for a minimum flow of 150 cfs below Lewiston Dam. This agreement was the minimum flow release stipulated by the Trinity River Act: "...the flow of the Trinity River below the diversion point at not less than one hundred and fifty cubic feet per second for the months July through November..." (P.L. 84-386).

Since the diversion of Trinity River water began in 1963, Lewiston Dam exports an average of 86 percent of the annual river flow from the upper Trinity Basin to the Sacramento River (USFWS 1980b). The remaining 10 to 15 percent released at Lewiston Dam to the Trinity River was thought to be adequate for fisheries conservation. This did not prove to be correct. Low base flows, in combination with decreased annual flood flows (Figure 3), have resulted in many dramatic morphological changes in the Trinity River channel below Lewiston. Sediment accumulation and the growth of riparian vegetation have occurred on a scale never before seen below a water development project. Both of these unforeseen consequences of the trans-basin transfer of water have severely degraded the Trinity River's aquatic environment for anadromous salmonids. It was these problems of sediment and riparian vegetation encroachment that initiated the post-project mitigation process and the creation of the TRBF&WTF. The TRBF&WTF and its efforts to cope with problems in the Trinity River Basin will compose the remainder of this paper.

TRINITY RIVER BASIN FISH AND WILDLIFE TASK FORCE

In the fall of 1967, the California Senate Standing Committee on Natural Resources visited a section of the Trinity River about 8 miles

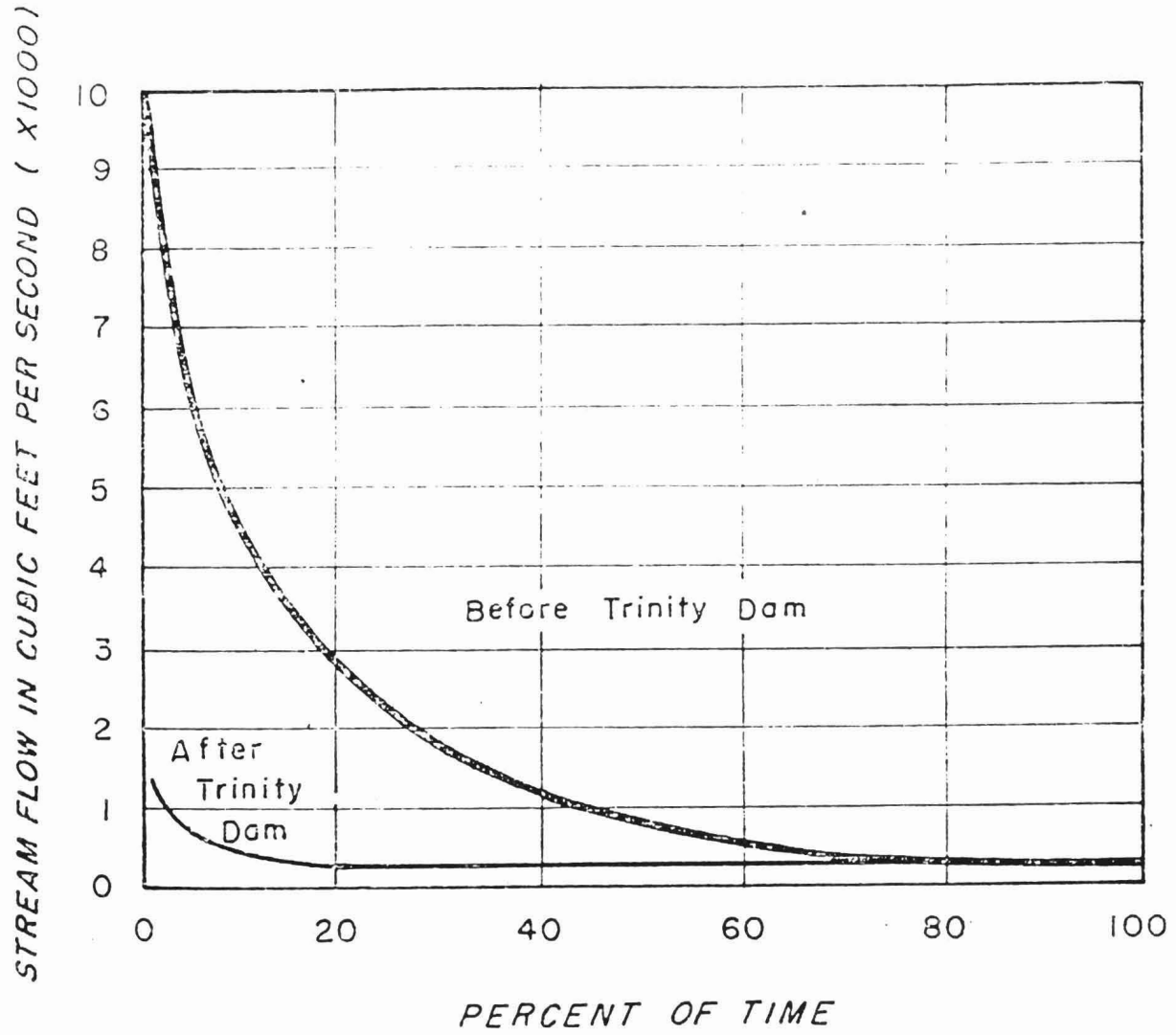

Figure 3. Flow duration curves for the Trinity River at Tom Lang Gulch.

From: Calif. Dept. Fish and Game. 1970. Preliminary report on the impact of Trinity River water development on fish and wildlife resources. Environ. Ser. Admin. Report No. 70-2.

below Lewiston Dam. During this field review of forest management and stream conditions in northern California, the committee noted that this section of the Trinity River, once excellent spawning and rearing habitat for anadromous salmonids, was now blanketed by a thick layer of coarse granitic sand. Poor logging practices and improper road construction on private lands in the Grass Valley Creek drainage, a tributary to the mainstem, had brought tons of granitic sands into the Trinity River channel below the mouth of the creek. Low flows of the post-project Trinity River were incapable of carrying away all incoming sediments, thus allowing the granitic sands of Grass Valley to accumulate rapidly in the stream channel. It was here, during this field trip, that the first formal plans for post-project mitigation on the Trinity River were formulated. A team of specialists in watershed management, fisheries, forestry, geology, and hydrology from the state departments of Conservation (Soil Conservation Service), Fish and Game, and Water Resources were pooled into the Grass Valley Creek Task Force.

The objectives of the Grass Valley Creek Task Force were to identify the sources and causes of sediment production and determine the ability of the Trinity River to transport these materials under present and pre-project conditions. The findings and recommendations of this task force were summarized into a report for the Secretary of Resources (Calif. Resource Agency 1970). The report estimated that 28 percent of the total spawning area in a 16-mile reach below Lewiston was lost due to sediment deposition and riparian encroachment. The report also confirmed that Grass Valley Creek was the major source of the sediment. Since any corrective measures would be partially

dependent upon water releases from Lewiston Dam, the task force requested that remedial action be made in cooperation with BOR.

On February 3, 1970, a small state and federal task force was formed to study the fish and wildlife problems of the Trinity River. This new task force composed representatives from BOR, USFWS, U.S. Geological Survey (USGS), CDFG, and California's Soil Coservation Service (SCS). Following a series of meetings and field trips to the Trinity River, the task force recommended the rehabilitation of Jackson Riffle as a pilot project.

In 1971, a new cooperative agreement between state and federal agencies created the Trinity River Basin Fish and Wildlife Task Force (TRBF&WTF). The small 1970 task force was now incorporated into the TRBF&WTF as the Engineering (sediment) Work Group. The primary objectives of the TRBF&WTF in 1971 were to identify factors adversely affecting fish and wildlife resources and to recommend measures to correct existing problems.

During August and September in 1972, the Engineering Work Group saw to the construction of a new riffle area adjacent to the Trinity River hatchery and the reconstruction of an existing riffle near the town of Lewiston. In 1973, Paul Hubbell of CDFG and TRBF&WTF completed a detailed report entitled Program to Identify and Correct Salmon and Steelhead Problems in the Trinity River Basin. Hubbell's report recommended an 8-year, $1.8 million program which would include studies of adult salmonid harvest and escapement, juvenile salmonid life history and emigration, hatchery evaluation, and habitat constraints (Hubbell 1973).

In 1974, funds were not available for the TRBF&WTF programs, but the problems of the Trinity River were becoming aware to the general public, particularly in Trinity and Humboldt counties. As public concern grew, a staff member of Congressman Harold T. "Bizz" Johnson prepared a summary report on fish and wildlife problems in the basin (Anonymous 1974). The report advocated the establishment of a joint committee containing federal, state, and local agencies to formulate and implement immediate and long-range action programs for fish and wildlife mitigation. Utilizing this report, as well as their own studies, the TRBF&WTF developed a proposal for a 3-year, $6 million Trinity River Basin Action Program. It consisted of an interim action program for fish, wildlife, and watershed rehabilitation and a plan for developing a long-term management program.

The post-project mitigation process really really began to roll along in 1975 when the TRBF&WTF was restructured to include the California Department of Water Resources (DWR), USFS, BLM, U.S. Soil Conservation Service (USSCS), Bureau of Indian Affairs (BIA), Trinity County, Humboldt County, and the Hoopa Valley Indian Tribe. Shortly following this expansion, Congressman Johnson successfully obtained funding for the Trinity River Basin Action Program. In December 1975, Congress appropriated a total of $7.6 million for an 3-year action program. The newly funded and expanded task force had basically the same objectives as before except that their responsibilities now included definition and correction of fish and wildlife declines in the Trinity River Basin attributable to the TRD and other causes.

In 1978, the TRBF&WTF was again expanded to include the California State Water Resources Control Board (SWRCB) and the

National Marine Fisheries Service (NMFS) and, in 1984, the California Department of Forestry (CDF). Presently, the TRBF&WTF includes a total of 14 entities. Below is a brief outline of each TRBF&WTF member and their appropriate responsibility or interest in the basin.

FEDERAL - Bureau of Reclamation (BOR) - responsible for the operation of the Trinity River Division of the Central Valley Project, lead agency in the preparation of the Action Program (1976 to 1982), lead agency in basic administration of the Management Program (P.L. 98-541), and coordinator of the TRBF&WTF.

- U.S. Fish and Wildlife Service (USFWS) - responsible for investigation of spawning escapement and in-river harvest of the Trinity and Klamath rivers.
- Bureau of Land Management (BLM) - involved in watershed rehabilitation programs in the Trinity River Basin.
- U.S. Soil Conservation Service (USSCS) - involved in emergency erosion and sediment control on Grass Valley Creek.
- U.S. Forest Service (USFS) - management of Six Rivers and Shasta-Trinity National Forests which composed the majority of federally-owned land in the basin.
- Bureau of Indian Affairs (BIA) - responsible for

resource management on the Hoopa Valley Indian Reservation.

- National Marine Fisheries Service (NMFS) - management of ocean fish stocks which include salmon that spawn in the Trinity Basin.

STATE

- Department of Fish and Game (CDFG) - primary management authority for fish and wildlife in the Trinity River Basin and operation of the Trinity River Salmon and Steelhead Hatchery.
- Department of Water Resources (DWR) - involved in watershed erosion investigations, and collection of hydrologic and climatologic data in the Trinity River Basin.
- State Water Resources Control Board (SWRCB) - management of water resources in the State of California and the coordination of water quality control measures.
- Department of Forestry (CDF) - interest in logging practices in the Trinity Basin and plan to complete in October 1986, the Trinity River Conservation Camp for minimum-security inmates. Work crews from the camp will be available for conservation and restoration work.

LOCAL

- Trinity County - responsible for development of a land use management plan for the county (90 percent of the basin is within Trinity County).
- Humboldt County - responsible for development of

a land use management plan for the county (10 percent of the basin is within Humboldt County).

- Hoopa Valley Indian Tribe - Indians in the lower basin reserve the right to utilize water, fish, and other Trinity River resources on the Hoopa Valley Indian Reservation. Established in 1864, the reservation is located on the lower Trinity and Klamath rivers.

The TRBF&WTF contains three administrative levels, each of which contain representatives from the 14 membering agencies. The Task Force, the highest level, is the policy and decision-making body. It's members are regional directors (or their equivalents) who meet once or twice each year. The Management Group serves as staff and liaison to the Task Force. It's function is to review and coordinate program activities and make specific recommendations to the Task Force for action. The Management Group, composed of division chiefs, meets 2 to 4 times a year. The Action Group develop plans, make recommendations, and implement field programs. It is generally composed of branch chiefs from the agencies and they meet about once a month.

This organizational structure has carried the TRBF&WTF through 1985. However, with the implementation of the Trinity River Basin Management Program (P.L. 98-541) in 1986, the structure of the TRBF&WTF is being reviewed and may be subject to modification. Some members of the Action Group have proposed eliminating the Management

Group level to facilitate a more direct link between themselves and the Task Force (TRBF&WTF Action Group Meeting, minutes 1985).

POST-PROJECT MITIGATION

Since their formation in 1971, the TRBF&WTF has coordinated nearly all fisheries/wildlife research and habitat management activities in the Trinity River Basin. Action programs of the TRBF&WTF include watershed revegetation, tributary stream improvements, improved hatchery operations, sediment transport and removal studies, and fisheries investigations. Due to the great number of mitigation and research activities which have occurred in the Trinity River Basin since the completion of the TRD, only a few of the major actions can be discussed here.

Grass Valley sediment control

The accumulation of sediments in the Trinity River channel below Grass Valley Creek was the first major problem attributed to the operation of the TRD. Investigations since the late 1960's have revealed that one of the principle causes of anadromous salmonid declines in the Trinity River Basin is deterioration of pools, spawning riffles, and rearing areas by granitic sands from Grass Valley Creek. Sediments have created large tributary deltas in the Trinity River channel impeding flows and forming sandy-bottomed pools and riffles. This sediment-laden channel below Lewiston Dam today bares little resemblance to the prime anadromous salmonid habitat that historically existed.

Prior to the construction of the TRD, the Trinity River was easily capable of flushing out sediments and debris that entered its channel. Even the fantastic volumes of mud, sand, and debris that

were dumped into the channel during the hydraulic gold mining era (1880 to 1940) were swept away by winter and spring flows. Only since the TRD began to divert the majority of the upper basin run-off, has the Trinity River had difficulty maintaining a healthy, productive, and sediment-free channel.

Diversion of 85 to 90 percent of the streamflow at Lewiston Dam has created low base flows and decreased annual floods downstream (Figure 3). Flood flows, although relatively infrequent, are extremely important for bedload movement and general channel maintenance. It has been reported that operation of the TRD reduced the sediment transport capability of the Trinity River below Lewiston by 95 percent (California Resource Agency 1970). At the same time, sediment loading by tributary streams has increased due to poor logging practices and improper road construction on steep, erosive hillsides.

Since 1970, when Grass Valley Creek was identified as the single largest contributor of sediment to the river, many studies, proposals and action plans have attempted to cope with the problem. In 1976, the TRBF&WTF assigned DWR the task of investigating methods to control sediment production from the tributary drainage. DWR completed the Grass Valley Creek Sediment Control Study in April 1978. Of the methods proposed, Buckhorn Mountain Dam and Reservoir combined with a sand dredging program were selected as the most viable solution. The Buckhorn Mountain project, unanimously endorsed by TRBF&WTF, consists of a debris dam in the upper Grass Valley drainage to contain the sediment traveling down the creek and a sand dredging program near the creek's mouth to annually remove materials from sediment-trap pools.

On September 4, 1980, legislation (P.L. 96-335) was authorized by Congress for construction of the Buckhorn Mountain Debris Dam and the sand dredging program. The Grass Valley Act (P.L. 96-335) appropriated $3.5 million for the building of the debris dam by BOR, but also stipulated the State of California must, on a dollar-for-dollar basis, match federal funds for construction, operation, and maintenance of the sand dredging system. In February 1983, the entire Grass Valley sediment control program was jeopardized by California Governor George Deukmejian. As part of a deficit-reduction program, Deukmejian proposed eliminating California's share of the sand dredging project. His attempts were unsuccessful and the sediment control program is underway.

With the completion of an environmental impact statement, the incorporation of the debris dam and sand dredging program into the Trinity River Basin Management Plan, and public hearings on the subject, it appeared the stage was set for BOR construction at Buckhorn Mountain. However, late in 1984, some new information appeared which suggested the majority of sediment production in the Grass Valley watershed originates from areas below the proposed debris dam. In light of this new information, it has been suggested to build the debris dam near the creek's mouth, but this lower site has some drawbacks too. Nine miles of restorable anadromous fish habitat would be blocked off; the lower site will cost 4 times as much for construction; and it will take more time to complete. The Buckhorn site has already been authorized, funded, and environmentally approved, so it may be more advantageous to get underway with sediment control on Grass Valley Creek than to prolong the process. Funding

for other restoration work in the Trinity River below Grass Valley (P.L. 98-541) is dependent upon implementation of the sediment control program. An additional proposal for control of Grass Valley sediment production includes the purchase or land swap of privately owned timber lands on erosive slopes. Champion Timberlands who currently own most of the Grass Valley drainage has agreed to sell or trade their holdings.

Flow releases from Lewiston Dam

Public outcry for increasing the amount of water released from Lewiston Dam began in 1967. BOR, however, was only required by law to maintain 150 cfs in the channel below the diversion at Lewiston and they continued to deny any request for increased flow releases until 1974. Under pressure from CDFG, BOR agreed to increase its annual releases from 120,600 to 245,000 acre-feet. This was intended to be the beginning of a 3-year experiment, but drought conditions in 1976 postponed the experimental flows.

During this time of the increased flow releases, BOR officials complained bitterly. BOR stated that with their abilities to use return flows and coordinate water supplies from other sources, the proposed annual reduction of 195,000 acre-feet of Trinity River water to the CVP amounted to an equivalent of 340,000 acre-feet of firm irrigation water. BOR estimated the annual diversion reductions cost $2.2 million in lost water revenues and $4 million in lost power revenues (Sasaki 1976).

Despite the economic concerns of BOR, experimental flow releases in 1974 and 1975 looked very promising for fish in the Trinity River. At the end of the drought in 1978, USFWS in cooperation with BOR and

DWR initiated an instream flow study between Lewiston Dam and the North Fork. The purpose of this investigation was to assess the opportunities for improving salmon and steelhead habitat through increased flows. The study clearly demonstrated that substantial gains in habitat for critical life stages of anadromous salmonids could be obtained by increasing flows from the dam above 150 cfs (USFWS 1980). Based on a preliminary analysis of these results, Secretary of Interior Cecil Andrus ordered in April 1980, a temporary increase of streamflows on the Trinity River. The USFWS was selected by the Secretary to complete an environmental impact statement for a proposed release schedule of 340,000 arce-feet during wet years, 287,000 acre-feet during dry years, and 140,000 acre-feet during critical dry years. Under Andrus' plan, a minimum base flow of 300 cfs would be required in each of these years except critically dry years. The environmental impact statement, completed in December 1980, predicted economic losses similar to BOR estimations, but under a provision of the Fish and Wildlife Coordination Act (P.L. 85-624), restoration is a compensatory measure to reduce impacts of a federal water project and need not be justified in economic terms (USFWS 1980).

Public hearings on the proposed release schedule received overwhelming support in Trinity and Humboldt counties and, in his final days of office, Secretary Andrus decided to make the increased flow schedule permanent on the Trinity River. Andrus' successor, James Watt, toyed with the idea of overturning the Trinity River instream flows decision. A Burbank-based group, California Water

Resource Association, petitioned Watt to overturn the increased flow decision, but pressure from DWR, CDFG, and USFWS did not permit him to do so. Andrus' decision also included plans for a 12-year study of his action. In 1983, BOR provided initial funding to USFWS for the Trinity River Instream Flow Study. Funding for the remaining 9 or 10 years of the instream flow investigations has not yet been appropriated, but may be provided by funds appropriated in the Trinity River Restoration Act (P.L. 98-541).

National wild and scenic river status

Just about the same time Secretary Andrus decided to permanently increase flows on the river, the Secretary also placed 5 northern California streams, including portions of the Trinity River, into the National Wild and Scenic River System. Portions of the Klamath and Trinity rivers were already under protection by the California Wild and Scenic Rivers Act of 1972, but a state statute could not prevent federal agencies from developing federal projects in these areas.

At the request of California Governor Jerry Brown, Secretary Andrus acknowledged the "outstanding remarkable anadromous fishery values" of the Trinity River deserve protection offered by the National Wild and Scenic Rivers Act (P.L. 90-542). Suit contesting this designation was later filed in District Court by 2 counties within the Klamath River Basin and in February 1983, wild and scenic status was invalidated by a U.S. District Court Judge. In July 1984, Federal Wild and Scenic Protection Standards were reinstated. This classification provides that all future federal actions within the watershed be carefully designed to avoid degrading water quality and adversely impacting the anadromous fishery.

Trinity River Restoration Act

Numerous references have already been made to the Trinity River Restoration Act of 1984 (P.L. 98-541). This Act, which was signed into law on October 24, 1984, represents the culmination of efforts by the TRBF&WTF, Congressmen Chappie, Bosco and Shumway, and concerned citizens in Trinity and Humboldt counties. Based on the TRBF&WTF's management program of 1982, the Act directs the Secretary of Interior to "formulate and implement a fish and wildlife management program for the Trinity River Basin designed to restore fish and wildlife populations in such basin to levels approximating those which existed immediately before the start of construction (of the TRD, CVP)... and to maintain such levels."

The restoration program, to be implemented in 1986, will mainly consist of fish restoration facilities on the mainstem, south fork and tributaries of the Trinity River below Lewiston and the establishment of a monitoring program to evaluate the effectiveness of the rehabilitation work. From October 1, 1985 to October 1, 1995, P.L. 98-541 authorizes the expenditure of $33 million for construction of salmon, steelhead and wildlife restoration facilities and $2.2 million annually for 10 years to operate, maintain and evaluate the program.

Congressmen Gene Chappie (R-Chico), Doug Bosco (D-Occidental) and Norman Shumway (R-Stockton), who offered and pushed for the bill, developed a cost-sharing formula to pay for the $50 million program. The State of California and the counties of Trinity and Humboldt will pay 15 percent of project costs, while water and power users of the TRD pay 50 percent and the federal government pays 35 percent.

Miscellaneous activities

During the last 15 years, the TRBF&WTF has been actively involved in a variety of other fish and habitat rehabilitation projects in the basin. These activities include:

- Development and implementation of a program to estimate salmon and steelhead stocks in the Klamath and Trinity basins.
- Modernization of the Trinity River hatchery including the installation of water temperature control devices.
- Construction and operation of a small hatchery on the Hoopa Valley Indian Reservation.
- Removal or modification of stream barriers to permit anadromous fish access to previously unavailable spawning and rearing habitat.
- Design, construction and installation of fish screens at the Lewiston Dam diversion facilities.

CONCLUSION

Mitigation on the Trinity River is a story of both good and bad: bad in that mitigation measures adopted by the TRD were sorely inadequate and unsuccessful; good in that the mitigation process is still continuing with new technology, funding and interest. It is unfortunate that the TRD-induced environmental degradation and fishery declines occurred so rapidly while the mitigation process proceeds so slowly.

The Trinity River is often cited as a textbook example of how unsound water development projects can devastate a river and its

fishery. The waters of the Trinity River, now transferred to California's Central Valley, were once thought of as "surplus being dumped into the sea". We now know that this concept of "surplus" water is, for the most part, a myth. Rivers, fish and their environment are delicately in balance with one another. It is not possible to disturb one component without impacting the others to some degree.

The problems associated with water development on the Trinity River are by no means new or unique, although the magnitudes and complexities may be. The problems with planning, operation, and evaluation of the TRD may be inherent in most water development schemes. Too often, projects are designed to maximize water uses (irrigation, hydroelectric, etc.) while the critical needs of fish and other aquatic life are considered unessential.

In the past, the majority of fisheries problems was solved through structural means such as hatcheries, while adequate protection and maintenance of natural existing habitat were ignored. We now realize that we must reduce our reliance on hatcheries and stocking programs, and focus our energies upon maintaining and restoring natural habitat. Nature, sometimes with a little bit of human help, is amazingly capable of remedying many environmental problems. With the aid of the Trinity River restoration program, I am optimistic about reversing the downward trends of the Trinity River anadromous fish stocks; although, I sometimes think to truly restore <u>all</u> fish and wildlife resources of the Trinity River Basin to pre-project levels will take nothing short of blowing-up the TRD.

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