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State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

THE STATUS OF SPRING-RUN STEELHEAD
(SALMO GAIARDNERI) OF THE EEL RIVER SYSTEM

Memorandum Report

This report was prepared under interagency agreement
between the Department of Water Resources and the
Department of Fish and Game.

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FOREWORD

This report was prepared to fulfill a contractual obligation to the Department of Water Resources under Work Authority 1257-0184, the Middle Fork Eel River Investigation.

The information presented in this report was obtained from field studies by the Contract Services Section, from Department of Fish and Game regional files and from communication with personnel of Regions 1, 2, and 3.

The primary purpose of the report is to present the data from which comments on spring-run steelhead have been made within other Contract Services Section reports. These data do not provide all of the information needed to describe fully the life history of spring-run steelhead; however, the report provides an important contribution to the literature because very little has been written about California spring-run steelhead.

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ABSTRACT

Spring-run steelhead in the Middle Fork Eel River may make up about 80% of the native spring-run steelhead in California. Since 1966, the spring-run steelhead population in the Middle Fork Eel River has been increasing. In 1974, the run in the Middle Fork Eel River was at least 1,850 fish (1,522 reached the summer holding area and 328 were landed in the sport catch).

An examination of scales from 58 Van Duzen River fish in 1968 and 82 Middle Fork Eel River fish in 1973 and 1974 showed that most had spent 2 years in freshwater and 2 years in the ocean. Few were repeat spawners.

About 5,000 angler hours were expended each year from mid-April to mid-June in 1973 and 1974 fishing for spring-run steelhead in the Middle Fork Eel River. Anglers caught an estimated 394 fish in 1973 and 328 in 1974.

INTRODUCTION

The Eel River system supports at least three types of steelhead: winter-run, halfpounder and spring-run (summer) steelhead. Most winter-run fish enter the Eel River from November through April and spawn throughout the river system within the same season, generally from February through April. Halfpounders, which are predominantly 23 to 43 cm (9 to 17 inches) long (Murphy and DeWitt, 1951), spend less than 1 year in the ocean and enter the Eel River in late July and August. Halfpounders are generally immature (U. S. Bureau of Sport Fisheries and Wildlife, 1960) and they are commonly taken in the sport catch in the lower reaches of the main Eel River and in the lower reaches of the South Fork Eel River (Figure 1).

Spring-run steelhead enter the Eel River during the final high stream-flows in the spring, from April through June. They migrate to the upper reaches of the Middle Fork Eel and the Van Duzen Rivers and remain there throughout the summer. They probably spawn the following winter and spring, although duration and extent of spawning in the wild have not been documented.

The Eel River has been proposed for water development and some alternative proposals include a dam on the Middle Fork at Dos Rios. Fish passage to the spring-run steelhead habitat would be blocked by a dam at Dos Rios. Consequently, a compilation of existing information on spring-run steelhead is necessary to alert the water development planner of the requirements of spring-run steelhead to design a project to prevent damage to the steelhead run. This report presents some of the information needed by the planners. It presents data on the life history, culture, and management of spring-run steelhead. For comparative purposes, this report includes fish counts and fish culture of spring-run steelhead in other

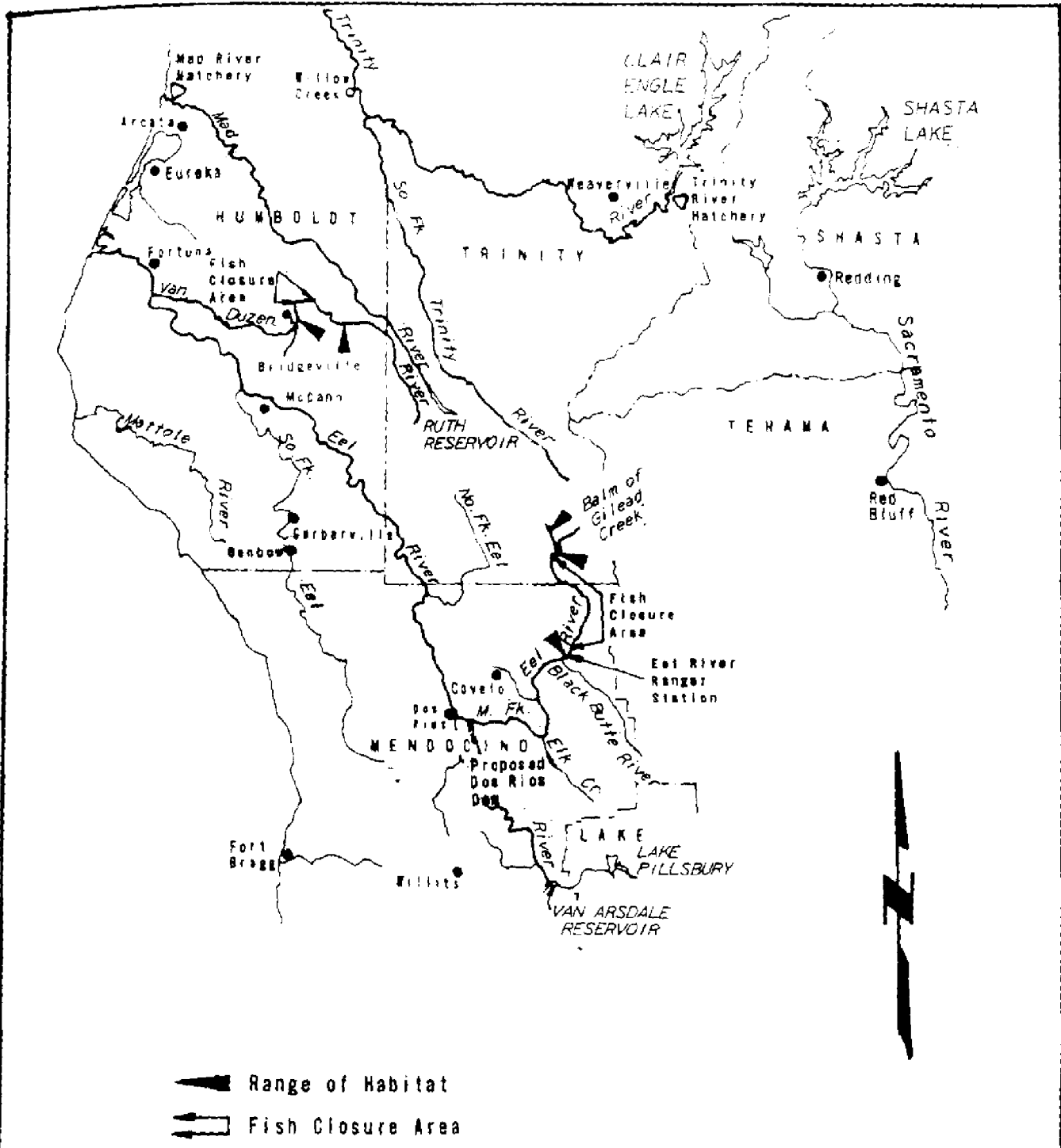


Figure 1
 LOCATION OF
 SPRING-RUN STEELHEAD HABITAT
 IN THE EEL RIVER, CALIFORNIA

California streams to demonstrate the importance of the runs in the Eel River system.

METHODS

Most of the information on the life history and status of spring-run steelhead was obtained during stream surveys of the Middle Fork Eel and Van Duzen Rivers, during trapping on the lower main Eel and Van Duzen Rivers, and during two creel censuses on the Middle Fork Eel River.

Surveys

Since 1966, Department of Fish and Game personnel from Regions 1 and 3 have made periodic estimates of the numbers of spring-run steelhead in streams with known spring-run populations. The estimates have been made from visual counts of the spring-run steelhead present in the late summer in the areas where the fish hold. Department personnel, wearing face plates, dive under the water and count adult spring-run. Only one count is commonly made in a stream in a given year; however, with the exception of the Middle Fork Eel River, these counts are not made each year. Consequently, there is no special significance about the year in which an estimate is made for a given stream.

Trapping

In 1968 wire fences with traps were positioned across the lower main Eel River near McCann to block fish migrating to the Middle Fork Eel River, and across the Van Duzen River just above Bridgeville. The fence across the Eel blocked fish from passing upstream through 70% of the river width, and the fence on the Van Duzen blocked all fish passage. The Eel River weir was fished 52 days from April 12 to July 16, 1968; and the Van Duzen weir was fished 31 days from April 1 to July 2, 1968. The weirs provided

61 fish from the Eel River for length and weight measurements and 58 fish from the Van Duzen River for length and weight measurements and for age determination.

Creel Censuses

Creel censuses were conducted in 1973 and 1974 on a 5-mile reach of the Middle Fork Eel River near the Eel River Ranger Station (Puckett, 1974). Most of the fishing for spring-run steelhead on the Middle Fork Eel River occurs in this area. The censuses included angler interviews and counts (four times daily) of anglers from April 1 through June during each of the 2 years. The censuses provided 68 steelhead stomachs for examination, 89 fish for length and weight measurements, and 82 fish for age determination.

Length-Weight Relationship

Length-weight relationships were calculated using a geometric mean functional regression described by Ricker (1973).

Age Determination

Enlarged images of fish scales were projected on a screen and examined by at least two observers to determine fish ages. The scales of fish from the Van Duzen River in 1968 were examined by Department of Fish and Game biologists James Horton and David Rogers. Scales of fish from the Middle Fork Eel River in 1973 were examined by DFG seasonal aid, James Lytle; DFG biologist, Charles Brown; and Dr. John DeWitt (California State University, Humboldt). Scales of fish from the Middle Fork Eel River in 1974 were examined by DFG biologists Charles Brown and L. B. Boydston.

ECOLOGY AND LIFE HISTORY

Distribution

Spring-run steelhead are found on the Pacific Coast from Alaska to California. In California they occur in the Middle Fork Eel River, Van Duzen River, Mad River, North Fork Trinity River, New River (tributary to Trinity River), and Clear and Wooley Creeks in the Klamath River system. In 1973, spring-run steelhead were reported near Kelsey Creek on the Scott River and in Elliot Creek, tributary to the Middle Fork Applegate River. In 1974, a few fish were reported in Blue Creek, tributary to the Klamath River. Spring-run steelhead have been observed in the past in the North Fork Eel River, in Elk and Dillon Creeks (Klamath River system), and in the South Fork Trinity River; however, they have not been observed there in recent years.

The reason for the presence of these fish in some streams and their absence in others is probably related to physical conditions within each stream. Observations on the topography of British Columbia streams suggest that natural barriers such as small waterfalls and stretches of very turbulent water, which are navigable by fish only at moderate flows, may be common to streams which contain spring-run steelhead. These barriers may only allow upstream passage of the more vigorous fish during the moderate streamflow periods in the spring. Consequently, these stream conditions would tend to perpetuate an isolated population of adult steelhead that migrate higher into the drainage and that reproduce separately from winter-run fish (Withler, 1966). The streams in California inhabited by spring-run steelhead fit this description (Figure 2).



Figure 2: This imposing cluster of boulders at the Van Duzen River creates a barrier to salmon at all flows and it is a barrier to steelhead at very high flows and at low flows. Spring-run steelhead, however, are able to pass over it at moderate flows.

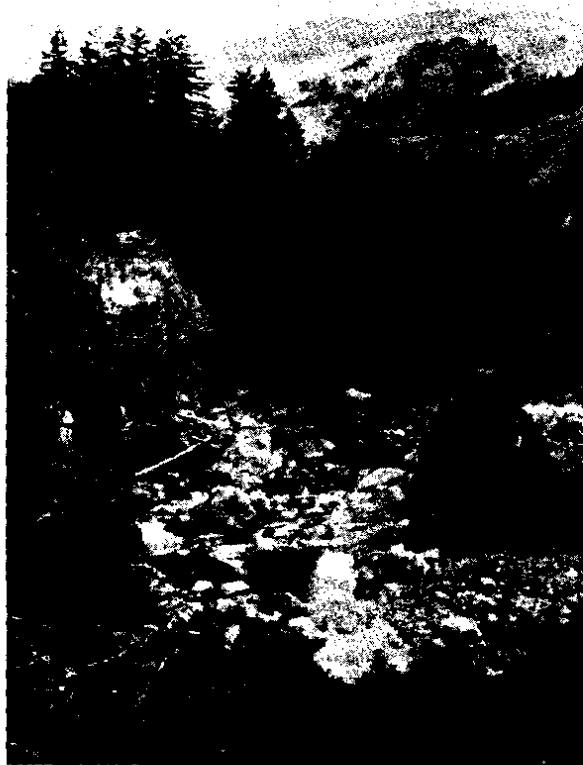


Figure 3: Stream channel of the Van Duzen River showing the steep canyon and large boulders which typify the portions of the Eel River inhabited by spring-run steelhead.

Habitat

In the Middle Fork Eel and the Van Duzen Rivers, adult spring-run steelhead spend the summer in deep pools in steep "V"-shaped canyons (Figure 3). Most of these pools are from 2 to 6 m (6 to 20 ft) deep. The stream channels are strewn with large, sometimes house-sized boulders.

In these reaches of stream, flows subside to less than $0.1 \text{ m}^3/\text{sec}$ (5 cfs) by summer and, consequently, the amount of habitat available depends upon the size and number of pools. In some years, the Middle Fork Eel River becomes intermittent and the pools become isolated.

Low streamflows influence water temperatures which normally range daily in the summer from 16 to 21 C (60 to 70 F). Cool water, which emanates from springs, and in the early summer from snowmelt, keeps temperatures from becoming lethal. Shade in the steep canyons also helps maintain low temperatures. Some of the deeper pools in the Middle Fork, although occasionally as high as 26 C (80 F) on the surface, stratify thermally, keeping the bottom water cool enough for the steelhead. Pools with cold water are scarce in the Van Duzen River because the pools are shallower than those in the Middle Fork Eel River. The water in the Van Duzen River cascades over sun-drenched boulders and is constantly warmed and mixed, even in most of the pools. A submersible thermograph placed in a 12-foot deep pool holding most of the spring-run steelhead in the Van Duzen River showed that temperatures tolerated by spring-run steelhead are rather high for adult salmonids. During a 19-day period in July 1967, temperatures ranged from 18.5 to 25.5 C (65 to 78 F). The average minimum temperature during the period was 21 C (70 F) and the average maximum temperature was 24 C (75 F).

Upstream Migration

Migrations upstream of adult spring-run steelhead were observed on the Van Duzen and main Eel Rivers in 1968. On the Van Duzen River migration was already in progress by April 1 and the last fish of that run was captured in the weir on June 15. The fish migrated into the weir at the rate of one or two per day with no apparent peak. Spring-run steelhead were caught immediately after the weir was installed at McCann on the main Eel River. The first adult was trapped on April 12 and the last fish of that run was trapped on June 15. The fish also migrated to this weir at a rate of one or two per day. Spring-run steelhead have been observed in the upper Middle Fork Eel River near the Eel River Ranger Station from April through June (Smith and Elwell, 1961). Migrations of adult fish were observed there during creel censuses in 1973 and 1974 (Puckett, MS). In 1973, the first fish observed was caught April 20 and the last one was caught June 3. In 1974, the first fish was also caught April 20 and the last one was caught June 11. Fish checked during the 1974 census were separated by sex. The results showed that males predominated in the early portion of the censused angler's catch and that females predominated in the later portion.

Size

Fifty-three adult spring-run steelhead measured at the Van Duzen River weir averaged 67 cm (26.4 inches) fork length and ranged from 51 to 79 cm (20.0 to 31.0 inches). They weighed from 1.6 to 7.5 kg (3.5 to 16.6 lb) and averaged 3.5 kg (7.8 lb).

Sixty-one adult spring-run steelhead measured at the weir on the lower Eel River averaged 61 cm (24.0 inches) and ranged from 48 to 84 cm (18.9 to 33.0 inches). They weighed from 1.6 to 8.6 kg (3.5 to 19.0 lb) and averaged 2.9 kg (6.4 lb).

Forty-six male and 43 female spring-run steelhead were measured on the Middle Fork Eel River in 1974. Males averaged 4 cm (1.6 inches) longer than females and they averaged 0.7 kg (1.4 lb) more in weight. The males averaged 66 cm (26.1 inches) fork length and ranged from 52 to 79 cm (20.5 to 30.1 inches). They weighed from 1.4 to 5.5 kg (3.1 to 12.1 lb) and averaged 3.3 kg (7.2 lb). The females averaged 62 cm (24.3 inches) and ranged from 49 to 79 cm (19.2 to 30.1 inches). They weighed from 1.2 to 5.0 kg (2.6 to 11.0 lb) and averaged 2.6 kg (5.8 lb). The length-weight relationship of the males is described by the formula: $\text{Log } W = -4.8374 + 2.9537 \text{ Log } L$, and the correlation coefficient is .91. The formula for females is: $\text{Log } W = 4.9898 + 3.0055 \text{ Log } L$, and the correlation coefficient is .93.

Food

Stomachs of 68 migrating adult spring-run steelhead were examined in anglers' catches on the Middle Fork Eel River in 1973 and 1974. Thirty-eight stomachs were empty, 15 stomachs contained items such as salmon eggs (bait) and small particles of gravel, and 15 contained a few animal organisms which included aquatic insect larvae (Ephemeroptera, Megaloptera, and Plecoptera), Jerusalem crickets (Orthoptera), a few ants (Hymenoptera), a water strider (Hemiptera), and a banana slug (Pulmonata).

The meager contents of the stomachs plus the presence of numerous juvenile steelhead, which were often isolated for months with spring-run steelhead in the resting pools, indicate that Middle Fork Eel River adult summer steelhead probably feed very little while they are in fresh water. Studies of adult spring-run steelhead held in British Columbia hatcheries further indicate that food is not essential for over-summer survival or for attaining sexual maturity (Smith, 1960).

Summer Holdover

The behavior of spring-run steelhead after their arrival in the summer resting areas is anything but clandestine. Often, an observer's first encounter with the fish is startling, since the fish tend to mill around in the center of crystal clear pools within full view (Figure 4). Shortly after the initial encounter, however, the fish seek shelter under rocks or in caverns created by clusters of overhanging rocks. Spring-run steelhead also move between pools. In the Van Duzen River in 1968, for example, two fish were observed moving upstream during daylight in a riffle so shallow that their dorsal fins were above water. Several fish were observed moving upstream in a riffle on the upper Middle Fork Eel River from 1 a.m. to 5 a.m. on a moonlit night in July 1975.

Animals as obvious as large steelhead in relatively small, clear pools are bound to attract attention from predators, such as furbearers. Department of Fish and Game personnel have witnessed river otters eating spring-run steelhead and the remains of steelhead have been observed in otter scats. Low, clear water undoubtedly renders these steelhead vulnerable to other predators such as bear and raccoon.

Fishermen and poachers also reduce spring-run numbers. Evidence of poaching is from eye witness reports to Fish and Game wardens and by the discovery of poaching implements during stream surveys.

Abundance

Late summer counts of adult spring-run steelhead in the Middle Fork Eel River ranged from 196 fish in 1966 to 1,522 fish in 1974, and their numbers have been increasing (Table 1).



Figure 4: Spring-run steelhead congregated in a pool in the Middle Fork Eel River.

Table 1

Late summer counts of Adult Spring-run Steelhead
in Middle Fork Eel River from 1966 through 1974

<u>Year</u>	<u>Number of Fish</u>
1966	196
1967	241
1968	335
1970	859
1971	997
1973	1,422
1974	1,522

Based on the highest counts of native spring-run steelhead from Wooley Creek, Clear Creek, Mad River, New River, North Fork Trinity River, Van Duzen River and Middle Fork Eel River, there are probably at least 2,000 native adult spring-run steelhead present in California streams at the end of each summer (Table 2).

Table 2

The highest recent counts of Native Adult Spring-run Steelhead
in California Streams

<u>Stream</u>	<u>Date of Survey</u>	<u>Number of Fish</u>
Wooley Creek	August 1968	33 ^{1/}
Clear Creek	August 1970	220
Mad River	August 1972	2
New River	September 1967	18
North Fork Trinity River	October 1971	66
Van Duzen River	August 1968	61
Middle Fork Eel River	August 1974	<u>1,522</u>
	Total	1,962

^{1/} In excess of 100 spring-run steelhead were counted in a 5-mile reach of Wooley Creek in mid-August 1975. There may be more fish in other portions of the stream, but the remainder of the stream will not be checked before this report is in print (Dave Rogers, Department of Fish and Game personal communication).

The Middle Fork Eel River may support about 80% of the known native adult spring-run steelhead in California.

These numbers do not represent the total numbers of fish in the runs. Each year the number of fish that enters a stream is higher than the number of fish that remains at the end of summer because the fish succumb to man, to wildlife, and to environmental stress. Surveys of the Van Duzen River in August 1968, for example, revealed that only 61 out of 82 of the fish that were counted in a weir from April to June as they migrated upstream actually survived the summer.

Life Cycle

Examination of scales from 58 fish trapped in the Van Duzen River in 1968 showed that all 58 had spent 1 year in freshwater prior to emigrating to the ocean. Thirty-six spent 2 years in the ocean before returning to freshwater, 17 spent 3 years, and 5 spent 1 year. None of the fish had spawned previously (Table 3). The observers who interpreted the ages of the Van Duzen River fish agreed that all the scales had one freshwater annulus; however, several persons who reviewed this finding were skeptical that wild steelhead could reach smolt size in just one year. Unfortunately, the scale samples were loaned to a student for study and were lost, which precludes collaboration of the age interpretations.

Table 3

Life History Categories of Spring-run Steelhead
in Van Duzen and Middle Fork Eel Rivers

<u>Fresh/Ocean</u> ^{1/}	<u>1/1</u>	<u>1/2</u>	<u>1/3</u>	<u>2/1</u>	<u>2/2</u>	<u>2/3</u>	<u>3/1</u>	<u>3/2</u>	<u>3/3</u>	<u>Total</u>
Van Duzen, 1968	5	36	17	0	0	0	0	0	0	58
Middle Fork Eel, 1973	0	0	0	16	10	0	2	0	0	28
Middle Fork Eel, 1974	<u>1</u>	<u>1</u>	<u>1</u>	<u>21</u>	<u>17</u>	<u>1</u>	<u>6</u>	<u>6</u>	<u>0</u>	<u>54</u>
Total	6	37	18	37	27	1	8	6	0	140

^{1/} The first number denotes years in freshwater; the second denotes years in the ocean.

Examination of scales from 82 Middle Fork Eel River fish showed that 65 had spent 2 years in freshwater prior to migration to the ocean, 14 spent 3 years, and 3 spent 1 year. Forty-six of these fish spent 1 year in the ocean, 34 spent 2 years, and 2 spent 3 years.

Three fish described in Table 3 in the 1974 catch had spawned previously. One of these, a male (2/3) had spawned twice previously; and the others, one male and one female (both 2/2), had spawned once previously. Twenty-eight fish observed during the 1974 creel census were not described in Table 3 because they had scales that were regenerated near the focus. However, the ocean phase of their life cycle could be interpreted, and 4 of the 28 had also spawned previously. One of these fish was a male and three were females.

SPORT FISHERY

The results of the censuses on the Middle Fork Eel River in 1973 and 1974 showed that anglers spent an estimated 5,000 angler-hours (1,400 angler-days) each year from mid-April to mid-June fishing for spring-run steelhead (Puckett, MS). They caught an estimated 394 fish in 1973 and 328 in 1974. Anglers who fished on weekends and holidays caught fish at a rate of 0.036 fish per hour in 1973 and 0.037 fish per hour in 1974. Anglers who fished on weekdays caught fish at the rate of 0.108 fish per hour in 1973 and 0.087 in 1974.

MANAGEMENT

Angling Regulations

Fishing closures imposed specifically for spring-run steelhead are designed to protect the fish in upstream areas where they congregate during

the summer. The Middle Fork Eel River is closed to fishing from its confluence with Bar Creek to its confluence with the North Fork of the Middle Fork Eel River (Figure 1). The Van Duzen River is closed to fishing from the mouth of Bloody Run Creek to the mouth of Baker Creek. Other angling regulations that govern the fish pertain to the general steelhead season and bag.

Barrier Removal

Large rocks lodged in the stream channel, as a result of frequent landslides in the Eel River watershed, which is characteristically very unstable, sometimes interfere with the upstream passage of fish. Some barriers, such as the one in the Van Duzen River at Salmon Hole, block the passage of steelhead at most flows and block the passage of salmon at all flows. Department of Fish and Game, Region 1, used dynamite in 1974 to reduce the Salmon Hole barrier in the Van Duzen River. Not much of the barrier was removed; however, a few fish were observed above the barrier in 1975 (Region 1 Monthly Report, July 1975).

Blasting is risky because of the precarious relationship between loose soil and the large rocks that repose adjacent to these stream channels. Large amounts of explosives, necessary to remove all of the rubble, would cause more rocks to slide into the stream than the blast would remove.

If seasonal barriers tend to perpetuate separately reproducing stocks of winter and spring-run steelhead, then complete barrier removal could allow mixing. The consequences of mixing stocks should be given consideration in all barrier removal programs.

Fish Culture

Large dams proposed for the Middle Fork Eel and the Mad Rivers prompted the Department of Fish and Game to test their technology for raising

spring-run steelhead in hatcheries. Initially, 19 adult spring-run steelhead were transported from the weir on the main Eel River at McCann to the Trinity River Hatchery in May 1968. These fish (11 males and 8 females) were held in a shaded raceway until they matured sexually. The first female was spawned artificially on March 27, 1969. Before the remainder of the fish could be spawned, vandals entered the hatchery and killed three females and six males. The remaining four females were spawned on April 8, 1969. The five fish were stripped of 19,000 eggs. The fertility rate of the eggs averaged 93%, which is comparable to the 95% fertility rate of winter steelhead processed at the Trinity River Hatchery (Jerry Bedell, Department of Fish and Game, personal communication). The eggs were incubated and the fry were reared using procedures that are standard in modern steelhead and salmon hatcheries. All of the adult fish that were spawned developed fungus (Saprolegnia sp). Despite flushes with malachite green, they all died by May 1, 1969.

The progeny of the five fish were reared for 2 years until they averaged 2.5 per pound. An infestation of copepods (Eucopepoda) developed among the young fish; consequently, most of them (7,300) were planted in the Trinity River to prevent transfer of parasites indigenous to the Trinity River to the Eel River. U. S. Forest Service biologists have since determined that copepods are present on Middle Fork Eel River spring-run steelhead. Two thousand fish remained, and they were held at the hatchery to continue the fish culture program. These fish were reared to adults (43 cm - 17 inches long) for broodstock.

The Department has expanded its spring-run steelhead culture program and the goals of this program are to diversify the sport fishery of the American River and to improve the sport fisheries of the Mad and Trinity Rivers.

Half of the Eel River broodstock reared at the hatchery was spawned in 1972. Half of the eggs was sent to the Mad River Hatchery. The other half was hatched and reared at the Trinity River Hatchery and the resulting smolts planted in the Trinity River in the spring of 1973 (Table 4). The remainder of the Eel broodstock was spawned in 1973. Half of their eggs was sent to the Mad River Hatchery. Half was hatched and reared to fingerlings at the Trinity River Hatchery and the fingerlings were planted in the Trinity River in November 1973.

The eggs of the Eel River strain that were brought to the Mad River Hatchery in 1972 were hatched, the resulting young reared to smolts and planted in the Mad River in May 1973. Eel River eggs brought to this hatchery in 1973 were hatched, the young reared to fingerlings and planted in the Middle Fork Eel River in November 1973.

Eggs of spring-run steelhead from Roaring River Hatchery in Oregon and Skamania Hatchery on the Washougal River in Washington have been cultured in the Trinity River, Mad River, and Nimbus Hatcheries and the resulting smolts have been planted in the Trinity, Mad, Sacramento, and American Rivers (Table 4).

Returns to California streams of marked adult fish resulting from the culture program have been few. No adult fish has been positively identified as a spring-run steelhead in the Trinity River. About 100 adults returned to the Mad River Hatchery in 1974 and rough estimates by fishermen and Department of Fish and Game personnel (Dave Rogers) indicate about 200 of the planted fish were caught as adults in the Mad River by mid-summer 1974. Most of these fish were Washougal strain that were planted in the spring of 1972 (Will, 1975). Only three spring-run returned to the hatchery in 1975 and only a few were caught by fishermen in 1975. Forty-three adults returned to Nimbus Hatchery in 1972, and 72 returned there in 1973

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Table 4 (cont.)
Hatchery Results

Brood		Release					
Strain	Year of Eggs	Mark	Number Released	Size No./lb	Date Released	Site of Release	
<u>Mad River Hatchery</u>							
Eel R. (Cal.)	1972	None	8,000	12.1	May 1973	Mad R. (hatchery)	
Eel R.	1972	None	5,200	7.5	May 1973	Mad R. (hatchery)	
Eel R.	1972	None	6,900	6.4	May 1973	Mad R. (hatchery)	
Eel R.	1973	None	57,400	27.2	Nov. 1973	Middle Fork Eel R.	
Washougal R. (Wash.)	1973	None	92,900	26.5	Nov. 1973	Mad R. (hatchery)	
<u>Nimbus Hatchery</u>							
Washougal R.	1969	LP	18,700	8.5	March 1970	Sacramento R. (Clarksburg)	
Washougal R.	1970	LP	60,200	7.5	April 1971	Sacramento R. (Clarksburg)	
Washougal R.	1970	None	3,400	17.0	March 1971	Sacramento R. (Clarksburg)	
Washougal R.	1970	None	3,900	15.5	March 1971	Sacramento R. (Clarksburg)	
Roaring R.	1971	None	23,200	23.2	Dec. 1971	American R. (hatchery)	
Roaring R.	1971	None	8,900	8.5	March 1972	Sacramento R. (Clarksburg)	
Roaring R.	1971	LP	60,100	8.2 to 10.2	March 1972	Sacramento R. (Clarksburg)	
Washougal R. (from returning adults)	1973	None	12,200	510	June 1973	American R. (hatchery)	
Washougal R.	1973	LP	19,000	4.4	Feb. 1974	Sacramento R. (Garcia Bend)	
Washougal R. (from returning adults)	1973	LP	32,400	4.3	Feb. 1974	Sacramento R. (Garcia Bend)	
Washougal R. (from returning adults)	1973	None	52,700	9.0	Feb. 1974	Sacramento R. (Garcia Bend)	

Table 4
Hatchery Results

Brood		Release				
Strain	Year of Eggs	Mark	Number Released	Size No./lb	Date Released	Site of Release
<u>Trinity River Hatchery</u>						
Eel R. (Cal.)	1969	None	7,300	2.5	March 1971	Trinity R. (hatchery)
Eel R.	1972	None	9,300	30.0	April 1973	Trinity R. (hatchery)
Eel R.	1972	None	11,800	11.8	April 1973	Trinity R. (hatchery)
Eel R.	1972	None	5,200	12.2	April 1973	Trinity R. (hatchery)
Eel R. (broodstock)	1969	None	705	2.3 lb each	April 1973	Trinity R. (hatchery)
Eel R.	1973	Ad-LV	65,400	18.0	Nov. 1973	Trinity R. (hatchery)
Roaring R. Hatchery (Ore.)	1970	None	33,000	8.3	April 1971	Trinity R. (China Slide)
Roaring R. Hatchery	1970	Ad-RM	20,000	8.3	April 1971	Trinity R. (China Slide)
Washougal R. (Wash.)	1970	None	35,000	6.0	May 1971	Trinity R. (hatchery)
Washougal R.	1970	Ad-LM	20,000	6.0	May 1971	Trinity R. (hatchery)
Washougal R.	1970	None	18,500	13.0	May 1971	Trinity R. (hatchery)
Washougal R.	1971	None	23,200	6.4	April 1972	Trinity R. (hatchery)
Washougal R.	1971	None	20,200	8.6	April 1972	Trinity R. (hatchery)
Washougal R.	1971	None	22,400	14.0	April 1972	Trinity R. (hatchery)
Washougal R.	1973	None	73,300	11.0	May 1974	Trinity R. (hatchery)
Washougal R.	1973	Ad-RV	6,100	11.0	May 1974	Trinity R. (Weitchpec)

(Jochimsen, Department of Fish and Game, personal communication). These fish could have been both Roaring River strain and Washougal strain. No fish returned there in 1974, and a few were observed in the hatchery fishway in mid-August 1975. A few marked fish (Washougal strain) have been reported in the sport catch on the American River since the program began (Jerry Staley, Department of Fish and Game, personal communication).