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MOKELUMNE RIVER FISH INSTALLATION
ANNUAL REPORT FOR 1976-77 SEASON

by

Philo F. Jewett
Region 2, Inland Fisheries

Anadromous Fisheries Branch
Administrative Report No. 79-4

1979

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ABSTRACT

This report describes the operation of the Mokelumne River Fish Installation from July 1, 1976 through June 30, 1977. The installation consists of a spawning channel, hatchery, and rearing ponds.

Six female king (chinook) salmon (Oncorhynchus tshawytscha) spawned in the channel, depositing an estimated 27,533 eggs. These were supplemented with fingerlings hatched from a shipment of 80,000 eggs from Nimbus Hatchery. Total fingerling production from the channel was 71,280.

Preliminary results of a 3-year study to evaluate fall versus spring releases indicate that fall-release salmon contribute to ocean fisheries at a greater rate than spring-release, but that spring-release fish may provide greater returns to fresh water.

Appendix tables present daily water temperatures and zinc concentrations at the facility.

^{1/} Anadromous Fisheries Branch Administrative Report No. 79-4.
Submitted February 1979.

INTRODUCTION

This is the 13th annual report for the Mokelumne River Fish Installation. It covers the period of operation from July 1, 1976 through June 30, 1977. Copies of previous annual reports are available upon request from the Anadromous Fisheries Branch, Rancho Cordova.

The Mokelumne River Fish Installation is located on the south bank of the Mokelumne River at the base of Camanche Dam in San Joaquin County (Figure 1). Camanche Dam is presently the upper limit of anadromous fish migration in the river. The Mokelumne River enters the San Joaquin River about 98 river km (61 miles) downstream from the dam.

The installation was constructed to compensate for the loss of fall-run king salmon and steelhead trout spawning and rearing areas blocked by Camanche Dam. It is operated by the California Department of Fish and Game. The East Bay Municipal Utility District paid construction costs and also pays the annual operating and maintenance costs.

The installation is made up of two parts: (1) a spawning channel for natural spawning and rearing of fall-run king salmon, and (2) hatchery and rearing pond facilities for artificial spawning and rearing of steelhead and salmon. The salmon spawning channel is 2,073 m (6,800 ft) long by 6 m (20 ft) wide at the bottom. It consists of two loops of equal length, each containing two channels with spawning sections and resting pools. The rearing pond facilities have a capacity to rear 100,000 yearlings. A detailed description of the facility appears in the first annual report (Groh 1965).

WATER TEMPERATURES

Water temperatures were recorded continuously throughout the reporting period near the spawning channel entrance. Maximum and minimum recorded temperatures were 16.1 C (61 F) and 8.3 C (47 F), respectively (Appendix).

COPPER AND ZINC ANALYSIS

In only two of the 13 years of operation did copper and zinc concentrations in the Mokelumne River become high enough to cause significant mortalities of our juvenile fish. This year, there were no mortalities attributed to this cause. The highest concentrations of zinc reached 0.18 ppm on March 27, 1977 (Appendix).

DISEASE

We had no significant disease problems this year.

PUBLIC RELATIONS

During the 1976-77 year, an estimated 15,000 people visited the installation. Tours were conducted for many special interest groups, and talks were given to sportsman clubs and civic organizations.

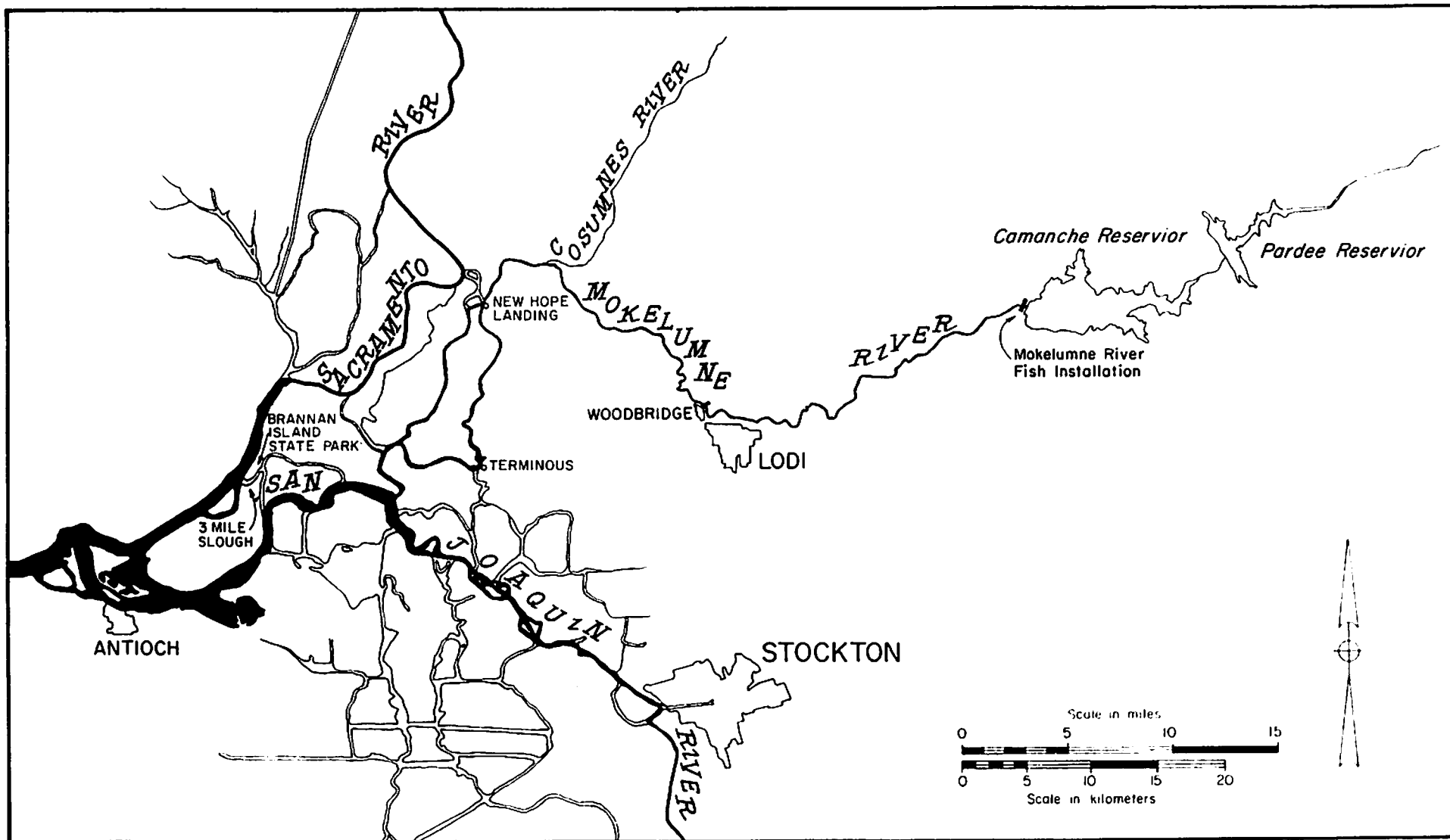


FIGURE 1. Location of the Mokelumne River Fish Installation.

PRODUCTION SUMMARY

King salmon production during 1976-77 increased over the previous year, but was still among the lowest of the last decade (Table 1). Production of Mokelumne River fish was the lowest on record. Steelhead production was discontinued last year.

KING SALMON MAINTENANCE

History of the 1976 Run

The spawning channel was in good condition at the start of the 1976 season; no gravel cleaning was required. Gravel berms were rebuilt before the first fish were received. These berms are of uniform size, 0.3 m (1 ft) higher in elevation than the channel bottom, perpendicular to the sides of the channel, 4.6 m (15 ft) wide, and 45.7 m (150 ft) apart. Their purpose is to reduce superimposition of redds.

Water was released into the spawning channel November 30. The flow was maintained between 0.85 and 0.99 m³/s (30-35 cfs) throughout the spawning season.

From November 16 through December 30, 74 salmon entered the holding pond and were examined for marks, sex, and condition. We released 17 (6 females, 9 adult males, and 2 grilse^{2/}) of these into the spawning channel. The remaining 57 salmon were marked by clipping the tip of the caudal fin and returned to the river.

Mark Recoveries--1976 Season

No marked salmon were recovered.

Carcass Recovery

Dead salmon were removed daily and measured to aid in making egg deposition estimates. The condition of the gonads was recorded, and the eggs retained in each female were counted.

Of the 17 salmon entering the spawning channel, 13 carcasses (6 females and 7 males) were recovered. All the females had spawned.

Estimated Egg Deposition

Potential egg deposition based on the 6 spent females recovered was estimated using the length-fecundity relationship: $Fecundity = 350.24 \times FL - 4,983.99$ (Jewett 1972). Total fecundity of the 6 females (27,535) minus the unspawned eggs (2) produced an estimate of 27,533 eggs deposited in the channel.

King Salmon Fingerling Production

On January 6, 1977 the flow in the spawning channel was reduced to 0.71 m³/s (25 cfs) where it remained for the duration of the season. At this time water was released into channels three and four for added nursery area.

^{2/} Male king salmon less than 61 cm (24 inches) FL are considered grilse.

TABLE 1. King Salmon Production Summary, Mokelumne River Fish Installation, 1966-67 through 1976-77.

Season	Number handled			Number of females released in channel	Female prespawning mortality	Estimated egg deposition	Number of eggs received	Fingerling production	Yearling production
	Total	Volunteer	Trapped ^{a/}						
1964-65	362	242	120	178	3	927,300		73,540	
1965-66	173	173	0	33	1	150,883		76,435	
1966-67	489	293	196	85	4	387,562		76,796	
1967-68	250	250	0	93	0	487,220		177,542	
1968-69	954	565	389	159	38	557,326		37,866	
1969-70	615	296	319	314	77	1,164,430		497,130	
1970-71	925	377	548	305	36	1,328,178		564,670	
1971-72	1,291	366	925	539	183	1,900,022		560,506 ^{b/}	
1972-73	353	353	0	30	0	137,006		40,417 ^{b/}	
1973-74	408	408	0	128	21	597,342	100,800	176,216 ^{b/}	
1974-75	220	220	0	37	5	144,566	101,640	7,216 ^{d/}	54,948 ^{c/}
1975-76	399	399	0	81	2	378,641	197,500	68,070 ^{d/}	49,542
1976-77	74	74	0	6	0	27,533	80,000	71,280	51,855

- ^{a/} Trapped at Woodbridge Dam and trucked to the installation.
- ^{b/} Calculated from average production for years 1964-65 through 1970-71.
- ^{c/} Includes 12,788 yearlings which failed to migrate the previous year.
- ^{d/} Minimum estimate. Trap was not in place during one week of emigration.

A trap was installed on May 11, 1977 and all outmigrants were counted until August 5, 1977 when the trap was removed. During this period 71,280 1976 broodyear (BY) fingerlings were physically counted.

KING SALMON TAGGING PROGRAM

This was the 3rd year of an experimental program comparing fall and spring releases of yearling king salmon raised at the installation from eggs obtained from Nimbus Hatchery. This year's yearlings, 1975 BY, were marked with adipose clips, received coded wire nose tags (CWT), and released in the Sacramento River at Brannon Island: 25,059 (code 6-2-5) in October and November 1976, and 26,796 (code 6-2-6) in January 1977 (Table 2).

TABLE 2. Number of Tagged Yearling King Salmon Released from Mokelumne River Fish Installation, 1974-1977

Brood year	Tag code	Number released	Size at release	Date of release	Release location
1973	6-2-1	24,874	18.7/kg	Oct. 1974	Brannon Island
	6-2-2	13,818	10.4/kg	Jan.-Feb. 1975	Brannon Island
1974	6-2-3	24,832	26.5/kg	Nov. 1975	Brannon Island
	6-2-4	26,043	11/kg	Feb. 1976	Brannon Island
1975	6-2-5	25,059	19.4/kg	Oct.-Nov. 1976	Brannon Island
	6-2-6	26,796	9.7/kg	Jan. 1977	Brannon Island

Returns of the 1973 BY fish indicate that fall-release fish contribute to the ocean fisheries at a rate 1.7 times that of spring-release fish (Table 3). Freshwater returns, on the other hand, show that spring-release fish return to the Sacramento-San Joaquin River system at a rate 1.4 times that of fall-release kings. Preliminary returns from the 1974 and 1975 BY's repeat the ocean return pattern of the 1973 BY, but thus far show fall-release fish also contributing more to freshwater returns than spring-release.

REFERENCES

- Groh, Frederick H. 1965. Annual report Mokelumne River Fish Installation from January 1, 1964 to June 30, 1965. Calif. Dep. Fish and Game, Inland Fish. Admin. Rep. 65-21. 28 p.
- Jewett, Philo F. 1972. Mokelumne River Fish Installation annual report for 1970-71 season. Calif. Dep. Fish and Game, Anad. Fish. Br. Admin. Rep. 72-9. 20 p.

TABLE 3. Summary of Returns through 1977 of King Salmon Tagged and Released from Mokelumne River Fish Installation

Recovery Location	Year	Release data					
		1973 BY		1974 BY		1975 BY	
		Fall	Spring	Fall	Spring	Fall	Spring
		24,874*	13,818*	24,832*	26,043*	25,059*	26,796*
Ocean Sport	1975	178(31) ⁺	52(8)				
	1976	114(19)	48(7)	36(8)	8(2)		
	1977	0	4(1)	347(36)	537(27)	79(11)	76(8)
Commercial	1975	680(100)	0				
	1976	347(55)	310(27)	25(2)	11(1)		
	1977	91(9)	38(6)	1,170(126)	547(54)	0	0
TOTAL		1,410(214)	452(49)	1,578(172)	1,103(84)	79(11)	76(8)
%		5.67(0.86)	3.27(0.35)	6.35(0.69)	4.24(0.32)	0.32(0.04)	0.28(0.03)
Freshwater							
Mokelumne R.	1975	2	14				
	1976	0	0	0	0		
	1977	0	0	0	0	0	0
Nimbus Hat.	1975	31	30				
	1976	44	20	11	32		
	1977	1	1	22	28	8	19
Feath. R. Hat.	1975	0	0				
	1976	10	0	0	1		
	1977	0	0	1	1	0	0
Red Bluff Div. Dam	1975	2	2				
	1976	5	0	1	1		
	1977	0	0	0	0	0	0
Tehama-Colusa Fish Facility	1975	3	11				
	1976	12	6	1	6		
	1977	1	2	10	13	5	10
Cottonwood Cr.	1975	0	0				
	1976	0	1	0	0		
	1977	0	0	0	0	0	0
Coleman Hat.	1975	0	0				
	1976	0	0	1	1		
	1977	0	2	0	0	0	0
TOTAL		111	89	47	83	13	29
%		0.45	0.64	0.19	0.32	0.05	0.11

* Number released.

+ Estimated catch. The numbers in parentheses show the number of marked fish sampled.

Appendix

Water Temperatures and Zinc Concentrations,
Hokelumne River Fish Installation, 1976-77 Season

Date	Water temperature (C)		Zinc ppm	Date	Water temperature (C)		Zinc ppm
	Max.	Min.			Max.	Min.	
July 1	14.4	13.3	.01	Aug. 1	15.0	13.9	.06
2	14.4	13.3	.01	2	15.0	13.9	.02
3	14.4	13.3	.02	3	15.0	13.9	.03
4	14.4	13.3	.02	4	15.0	13.9	.02
5	15.0	13.9	.02	5	15.0	13.9	.06
6	15.0	13.9	.02	6	15.0	13.9	.01
7	15.0	13.9	.17*	7	15.0	13.9	.02
8	15.0	13.9	.01	8	15.0	13.9	.02
9	15.0	13.9	.02	9	15.0	13.9	.02
10	15.0	13.9	.02	10	15.0	13.9	.01
11	15.0	13.9	.08	11	15.6	14.4	.03
12	15.0	13.9	.01	12	15.6	14.4	.02
13	15.0	13.9	.01	13	15.0	14.4	.02
14	15.0	13.9	.01	14	14.4	14.4	.03
15	15.0	13.9	.01	15	14.4	13.9	.03
16	15.0	13.9	.01	16	14.4	13.9	.02
17	15.0	13.9	.02	17	14.4	14.4	.05
18	15.0	13.9	.02	18	14.4	14.4	.03
19	15.0	13.9	.02	19	15.0	14.4	.02
20	15.0	13.9	.01	20	15.3	14.4	.02
21	15.0	13.9	.01	21	15.3	14.4	.01
22	15.6	14.4	.02	22	15.0	13.9	.02
23	15.6	13.9	.02	23	15.3	14.4	.02
24	15.6	13.9	.02	24	15.3	14.4	.01
25	15.6	14.4	.02	25	15.6	14.4	.02
26	15.6	14.4	.08	26	15.6	14.4	.03
27	15.6	14.4	.02	27	15.6	14.4	.02
28	15.0	13.9	.02	28	15.6	14.4	.02
29	15.0	13.9	.03	29	15.6	14.4	.01
30	15.0	13.9	.03	30	16.1	14.4	.02
31	15.0	13.9	.02	31	16.1	14.4	.02

* Possible contaminated sample

Appendix

Water Temperature and Zinc Concentrations,
Mokelumne River Fish Installation, 1976-77 Season

Date	Water temperature (C)		Zinc ppm	Date	Water temperature (C)		Zinc
	Max.	Min.			Max.	Min.	
Sept. 1	16.1	14.4	.08	Oct. 1	15.6	15.0	.02
2	15.6	14.4	.04	2	15.6	15.0	.02
3	15.6	14.4	.03	3	15.6	14.4	.03
4	15.6	14.4	.02	4	15.6	15.0	.02
5	15.6	14.4	.02	5	15.6	15.0	.02
6	15.6	14.4	.02	6	16.1	15.0	.02
7	15.6	14.4	.02	7	16.1	15.0	.02
8	15.6	14.4	.02	8	16.1	15.0	.02
9	16.1	15.0	.06	9	16.1	15.0	.02
10	15.6	14.4	.02	10	15.6	15.0	.02
11	15.6	14.4	.02	11	16.1	15.0	.02
12	15.6	14.4	.03	12	16.1	15.0	.02
13	15.6	14.4	.04	13	16.1	15.0	.01
14	15.6	14.4	.02	14	16.1	15.0	.02
15	15.6	14.4	.04	15	16.1	15.0	.02
16	15.6	14.4	.02	16	15.6	15.0	.02
17	15.6	14.4	.02	17	15.6	15.0	.08
18	15.6	14.4	.02	18	15.6	15.0	.01
19	15.6	14.4	.03	19	15.6	15.0	.02
20	15.6	14.4	.02	20	15.6	15.0	.01
21	15.6	14.4	.02	21	16.1	15.0	.01
22	15.6	14.4	.02	22	16.1	15.0	.02
23	15.6	14.4	.06	23	15.6	14.4	.01
24	15.6	14.4	.01	24	15.6	15.0	.01
25	15.6	14.4	.01	25	15.6	15.0	.01
26	15.6	14.4	.04	26	15.6	15.0	.01
27	15.6	14.4	.02	27	16.1	15.0	.02
28	15.6	14.4	.02	28	16.1	15.0	.02
29	15.6	15.0	.01	29	16.1	15.0	.01
30	15.6	15.0	.02	30	15.6	15.0	.04

Appendix

Water Temperatures and Zinc Concentrations,
Mokelumne River Fish Installation, 1976-77 Season

Date	Water temperature (C)		Zinc ppm	Date	Water temperature (C)		Zinc ppm
	Max.	Min.			Max.	Min.	
Nov. 1	16.1	15.0	.02	Dec. 1	14.4	13.3	<.01
2	16.1	15.0	.02	2	14.4	13.3	.02
3	16.1	15.0	.01	3	14.4	13.3	<.01
4	16.1	15.0	.01	4	13.9	13.3	<.01
5	16.1	15.0	.06	5	13.9	13.3	<.01
6	16.1	15.0	.01	6	13.3	12.8	<.01
7	16.1	15.0	.01	7	13.3	12.8	<.01
8	16.1	15.0	.01	8	13.3	12.8	<.01
9	16.1	15.0	.01	9	13.3	12.8	.02
10	15.6	15.6	.01	10	13.3	12.8	<.01
11	15.6	15.0	.02	11	12.8	12.8	<.01
12	15.6	15.0	.04	12	12.8	12.8	.03
13	15.6	15.0	.01	13	12.8	12.8	No sample
14	15.6	15.6	.03	14	12.8	12.2	.01
15	15.6	15.0	.01	15	12.2	11.7	<.01
16	15.6	15.6	.01	16	12.2	11.7	<.01
17	15.6	15.6	.01	17	12.2	11.7	<.01
18	15.6	15.6	.01	18	12.2	11.7	<.01
19	15.6	15.6	<.01	19	12.2	11.1	.01
20	15.6	15.6	.01	20	12.2	11.1	<.01
21	15.6	15.0	.01	21	12.2	11.1	.04
22	15.6	15.0	.03	22	11.7	11.1	.02
23	15.6	15.6	.04	23	11.7	11.1	.02
24	15.6	15.0	.01	24	11.7	11.1	<.01
25	15.0	15.0	.02	25	11.1	11.1	<.01
26	15.0	14.4	.01	26	11.1	10.6	<.01
27	15.0	14.4	.02	27	11.1	10.6	<.01
28	14.4	13.9	.05	28	11.1	10.6	<.01
29	14.4	13.9	<.01	29	11.1	10.6	<.01
30	14.4	13.9	.04	30	11.1	10.6	<.01
				31	11.1	10.6	<.01

Appendix

Water Temperatures and Zinc Concentrations,
Mokelumne River Fish Installation, 1976-77 Season

Date	Water temperature (C)		Zinc ppm	Date	Water temperature (C)		Zinc
	Max.	Min.			Max.	Min.	
Jan. 1	10.6	10.0	<.01	Feb. 1	8.9	8.3	<.01
2	10.6	10.0	.03	2	8.9	8.3	<.01
3	10.6	10.0	<.01	3	8.9	8.3	<.01
4	10.0	10.0	<.01	4	8.3	7.8	<.01
5	10.0	10.0	<.01	5	8.3	7.8	No sample
6	10.0	10.0	<.01	6	8.3	7.6	No sample
7	10.0	9.4	<.01	7	8.9	8.3	<.01
8	10.0	9.4	<.01	8	8.9	8.9	.01
9	10.0	9.4	<.01	9	8.9	8.9	<.01
10	10.0	8.9	<.01	10	8.9	8.9	<.01
11	9.4	8.9	<.01	11	8.9	8.9	<.01
12	9.4	8.9	<.01	12	8.9	8.9	<.01
13	8.9	8.9	<.01	13	8.9	8.9	<.01
14	8.9	8.9	<.01	14	8.9	8.9	<.01
15	8.9	8.9	<.01	15	8.9	8.9	<.01
16	8.9	8.9	<.01	16	9.4	8.9	<.01
17	8.9	8.9	<.01	17	9.4	8.9	<.01
18	8.9	8.9	.01	18	9.4	8.9	.08
19	8.9	8.9	<.01	19	9.4	8.9	<.01
20	8.9	8.9	.01	20	8.9	8.9	<.01
21	8.9	8.9	<.01	21	8.9	8.9	.02
22	8.9	8.9	.02	22	8.9	8.9	<.01
23	8.9	8.9	<.01	23	8.9	8.9	<.01
24	8.9	8.3	.01	24	8.9	8.9	<.01
25	8.9	8.9	.03	25	9.4	8.9	<.01
26	8.9	8.3	.01	26	9.4	8.9	.05
27	8.3	8.3	<.01	27	9.4	8.9	<.01
28	8.9	8.3	.01	28	9.4	8.9	<.01
29	8.9	8.9	<.01				
30	8.9	8.3	<.01				
31	8.9	8.3	<.01				

Appendix

Water Temperature and Zinc Concentrations,
Mokelumne River Fish Installation, 1976-77 Season

Date	Water temperature (C)		Zinc ppm	Date	Water temperature (C)		Zinc ppm
	Max.	Min.			Max.	Min.	
March 1	9.4	8.9	.01	April 1	11.7	11.1	.01
2	10.0	8.9	.01	2	11.7	11.1	.01
3	10.0	9.4	.01	3	12.2	11.7	.10
4	10.0	10.0	.01	4	12.2	11.7	.02
5	10.6	10.0	.01	5	12.2	11.7	.01
6	10.6	10.0	.01	6	12.2	11.7	.01
7	10.6	10.0	.01	7	12.2	11.7	.01
8	10.6	10.0	.01	8	12.2	11.7	.01
9	10.0	10.0	.01	9	12.2	11.7	No sample
10	10.6	10.0	.01	10	12.2	11.7	No sample
11	11.1	10.6	.01	11	12.2	11.7	.01
12	11.1	10.6	.02	12	12.2	12.2	.01
13	11.1	10.6	.02	13	12.8	12.2	.01
14	11.1	10.6	.01	14	12.8	12.2	.01
15	11.7	11.1	.01	15	12.8	12.2	.01
16	11.1	10.6	.01	16	12.8	12.2	.01
17	11.1	10.6	.01	17	12.8	12.2	.01
18	11.1	10.6	.01	18	12.8	12.2	.01
19	11.1	10.6	.01	19	12.8	12.2	.01
20	11.1	10.6	.01	20	12.8	12.2	.01
21	11.1	10.6	.01	21	12.8	12.2	.01
22	11.1	10.6	.01	22	12.8	12.2	.01
23	11.1	10.6	.17	23	12.8	12.2	.01
24	11.1	10.6	.01	24	12.8	12.2	.02
25	11.1	10.6	.01	25	12.8	12.2	.01
26	11.1	11.1	.01	26	12.8	12.2	.01
27	11.1	11.1	.01	27	12.8	12.2	.02
28	11.7	11.1	.18	28	12.8	12.2	.01
29	11.7	11.1	.01	29	12.8	12.2	.01
30	11.7	11.1	.01	30	12.8	12.2	.01
31	11.7	11.1	.01				

Appendix

Water Temperature and Zinc Concentrations,
Mokelumne River Fish Installation, 1976-77 Season

Date	Water temperature (C)		Zinc ppm	Date	Water temperature (C)		Zinc ppm
	Max.	Min.			Max.	Min.	
May 1	12.6	12.2	.01	June 1	14.4	13.9	4.01
2	12.3	12.2	.03	2	14.4	13.9	.01
3	12.3	12.2	.01	3	14.4	13.9	.01
4	12.3	12.2	.01	4	14.4	13.9	.01
5	12.3	12.2	.01	5	14.4	13.9	.01
6	12.8	12.8	.01	6	15.0	13.9	.01
7	12.8	12.8	.01	7	15.0	13.9	.01
8	12.8	12.8	.01	8	14.4	13.9	4.01
9	12.8	12.8	.01	9	14.4	13.9	4.01
10	12.8	12.8	.01	10	14.4	13.9	4.01
11	13.3	12.8	.02	11	14.4	13.9	.01
12	13.3	12.8	4.01	12	14.4	13.9	.01
13	13.3	12.8	4.01	13	14.4	13.9	.01
14	13.3	12.8	4.01	14	14.4	13.9	.01
15	13.3	12.8	4.01	15	15.0	13.9	.01
16	13.3	12.8	.01	16	15.0	13.9	.02
17	13.3	12.8	4.01	17	15.0	13.9	.01
18	13.3	12.8	.01	18	15.0	13.9	.01
19	13.3	12.8	4.01	19	15.0	13.9	4.01
20	13.3	12.8	.01	20	15.6	14.4	.02
21	13.3	12.8	.01	21	15.6	14.4	.01
22	13.3	12.8	.01	22	15.6	14.4	.01
23	13.3	12.8	.02	23	15.6	14.4	Zinc samples discontinued
24	13.3	13.3	.01	24	15.6	14.4	
25	13.9	13.3	.06	25	15.6	14.4	
26	13.9	13.3	.01	26	15.6	15.0	
27	13.9	13.3	4.01	27	15.6	15.0	
28	13.9	13.3	.01	28	15.6	15.0	
29	13.9	13.3	.01	29	15.6	15.0	
30	14.4	13.9	.02	30	15.6	15.0	
31	14.4	13.3	.01				