

REF 90284

State of California
THE RESOURCES AGENCY
Department of Fish and Game

MOKELUMNE RIVER FISH INSTALLATION
ANNUAL REPORT FOR 1972-73 SEASON

by

Philo F. Jewett
Region 2, Inland Fisheries

Anadromous Fisheries Branch
Administrative Report No. 74-14

1974

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ABSTRACT

This report describes the operation of the king salmon (Oncorhynchus tshawytscha) spawning channel and the steelhead (Salmo gairdnerii gairdnerii) rearing program at the installation July 1, 1972 through June 30, 1973. Production tables present the numbers of adult salmonids received, and eggs and fish produced during the installation's nine years of operation. Appendix tables present daily water temperatures and zinc concentrations at the facility during the 1972-73 fiscal year.

^{1/} Anadromous Fisheries Branch Administrative Report 74-14.
Submitted for publication January, 1974.

INTRODUCTION

This is the ninth annual report of the Mokelumne River Fish Installation. It covers the period of operation from July 1, 1972, through June 30, 1973. Copies of previous annual reports are available upon request from the Anadromous Fisheries Branch, Sacramento.

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 inundated 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 (Figure 2), and (2) hatchery and rearing pond facilities for artificial spawning and rearing of steelhead trout. 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 steelhead facilities have a capacity of 100,000 yearlings. A detailed description of the facility appears in the first annual report (Groh, 1965).

The Installation was first operated January 1, 1964. Results of each year's salmon and steelhead operation are summarized in Tables 1 and 2.

WATER TEMPERATURES

Water temperatures were recorded continuously throughout the reporting period near the spawning channel entrance. Maximum and minimum recorded temperatures were 13.9 C (57 F) and 7.8 C (46 F), respectively. Diurnal fluctuations never exceeded 2.2 C (4 F) (Appendix).

COPPER AND ZINC ANALYSIS

In some years copper and zinc concentrations in the Mokelumne River become high enough to cause significant mortalities of our juvenile fish. This year, for the first time since 1967, there were heavy mortalities attributed to this cause. During January and February 1973 we lost 40,800 steelhead fry and 5,400 yearling steelhead. It was not determined if there were also heavy mortalities of juvenile salmon in the channels.

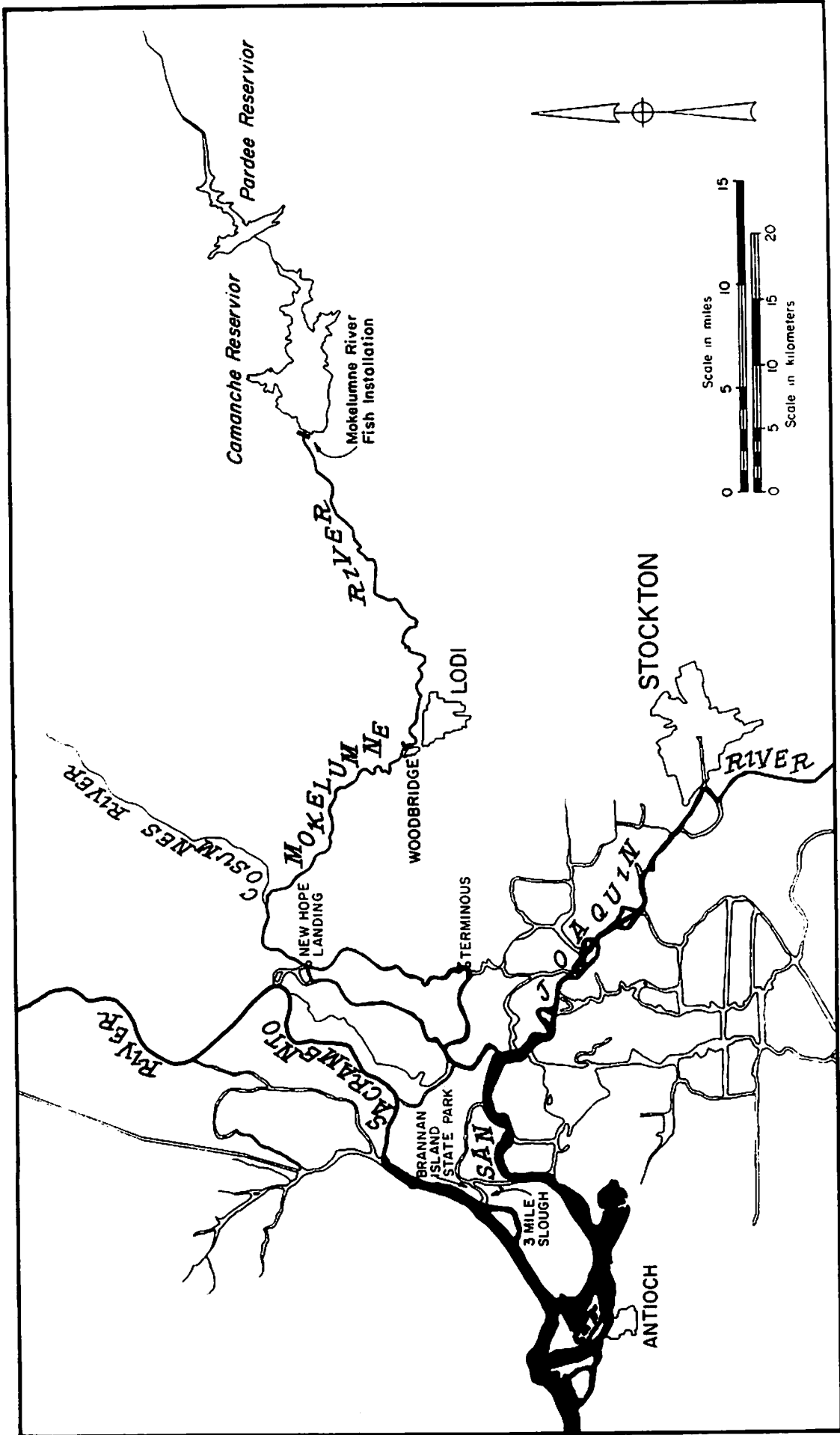


Figure 1. Map showing location of the Mokelumne River Fish Installation

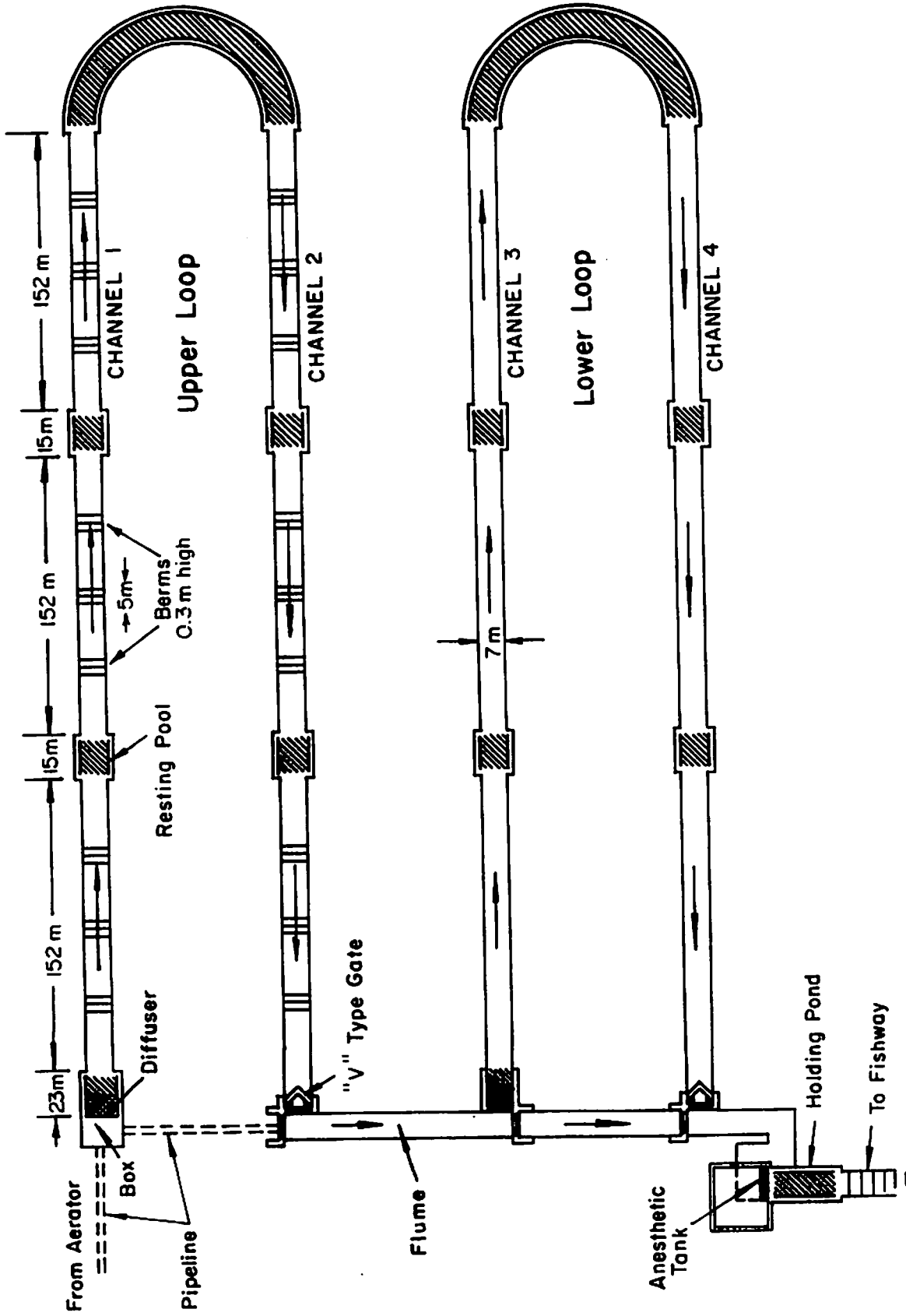


Figure 2. Diagram of the Mokolume River Spawning Channel (not to scale).

Table 1

King Salmon Spawning Channel Annual Summaries--
Mokelumne River Fish Installation 1964-65 through 1972-73 Seasons

Season	Number of females released in channel	Number females prespawning mortality	Potential number of eggs	Estimated egg deposition	Number of outmigrants	Estimated Percent Production	
						Of potential eggs	Of eggs deposited
1964-65	178	3	947,100	927,300	73,540	7.8	7.9
1965-66	33	1	157,043	150,883	76,435	48.7	50.6
1966-67	85	4	399,758	387,562	76,796	19.2	19.8
1967-68	93	0	490,186	487,220	177,542	36.2	36.4
1968-69	159	38	568,984	557,326	37,866	6.7	6.8
1969-70	314	77	1,183,953	1,164,430	497,130	42.0	42.7
1970-71	305	36	1,352,125	1,328,178	564,670	41.8	42.5
1971-72	539	183	1,951,639	1,900,022	560,506*	*	*
1972-73	30	0	141,344	137,006	40,828*	*	*

Table 2

Steelhead Hatchery Annual Summaries--
Mokelumne River Fish Installation 1963-64 through 1972-73 Seasons

Season	Number native fish received	Number females spawned	Number eggs taken	Number eggs from Nimbus	Total eggs	Number planted as fingerlings	Number planted as yearlings
1963-64	15	**	**	**	436,300	0	0
1964-65	30	Not recorded	55,300	315,450	370,750	163,280	92,520
1965-66	30	8	30,970	331,400	362,370	131,420	84,410
1966-67	17	3	13,524	164,600	178,125	94,520	74,630
1967-68	103	13	34,869	331,200	366,069	0	82,203
1968-69	24	4	25,580	301,240	326,820	125,760	101,207
1969-70	134	14	33,300	300,810	334,110	137,695	122,822
1970-71	215	39	167,158	251,550	418,708	152,862	107,972
1971-72	4	0	0	296,800	296,800	82,180	111,926
1972-73	13	97***	251,360	304,000	555,360	38,864	154,344***

* Outmigrants were not counted this year. Estimate based on average percent production for years 1964-65 through 1970-71.

** Adult steelhead from Nimbus Hatchery and Mokelumne River Fish Installation were spawned together to obtain a total of 436,300 eggs.

*** Includes broodstock adults.

We now have no way to control the concentrations of these metals in our pond water, but we do monitor them. We collected water samples daily at the head of the steelhead ponds from July 1 through September 18, 1972; from January 26 through April 30, 1973; and weekly in May and June, 1973. We also collected samples from the surface of Camanche Lake daily from January 31 through February 4; February 17 through April 30; and weekly in May and June to compare lake surface water concentrations of these metals with concentrations in the Installation water supply, which is drawn from the lake bottom.

The greatest observed concentration of copper at either sampling location was 0.01 ppm. The greatest observed concentration of zinc was 0.43 ppm on April 19, 1973. This sample was taken from the head of the steelhead ponds. The greatest observed concentration of zinc from the lake surface was 0.28 ppm on April 12, 1973. Zinc concentrations were usually higher in our supply water than at the lake surface (Appendix).

DISEASE

We had no significant disease problems of any type this fiscal year.

PUBLIC RELATIONS

During the 1972-73 fiscal year, an estimated 16,000 people visited the Installation. Tours of the Installation were conducted for many special interest groups, and talks were given to sportsman clubs and civic organizations.

MARKING PROGRAM

No king salmon or steelhead were marked this fiscal year.

KING SALMON MAINTENANCE PROGRAM

History of the 1972 Run

The spawning channel was in good condition at the start of the 1972 season; no gravel cleaning was required. Gravel berms, first constructed for the 1968-69 season, were rebuilt before the first fish was 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, 5 m (15 ft) wide, and 46 m (150 ft) apart. Their purpose is to curtail superimposition of redds.

Water was released into the spawning channel October 10, 1972. The flow was maintained between 1.6 and 1.7 m³/sec (55-60 cfs) throughout the spawning season.

Three hundred and fifty-three salmon were received at the Installation from October 11, 1972, through January 22, 1973. Because of the small number of adults, only one of the two spawning channel loops was used. All salmon entered the fishway voluntarily; all were cursorily examined for marks, sex, and condition, and then released into the spawning channel.

Mark Recoveries

Five marked king salmon were recovered this season. Mark recovery information is summarized as follows:

Mark	Brood year	Number recovered	FL(cm)	Release data			Average wt (g)	Origin
				Area	Date	Number		
Ad-RV	?	1	?	?	?	?	?	
RV-LP	1969	2	76;76	Sacto. R. at Rio Vista	6/70	263,331	5	Nimbus Hatchery
An-LP*	1969	1	55	*	6/71	40,050	61	Feather R. Hatchery
An-LP*	1970	1	38	*	2/72	109,340	76	"

* These fish also were marked with coded-wire nose tags. One-half of each group were released in the Sacramento River at Rio Vista; the rest were released at Feather River Hatchery.

Carcass Recoveries

Dead salmon were removed on a daily basis. The majority were recovered near the V-trap at the lower end of channel number 2, although some were taken from the resting pools and the sides of the channels. All carcasses were measured. The condition of the gonads was recorded, and the eggs retained in each female were counted.

Of the 353 salmon entering the spawning channel, 315 carcasses (30 females and 285 males) were recovered. All females recovered had spawned. Sex of the 38 unrecovered fish is not known.

Estimated Egg Deposition

Potential egg deposition based on the 30 spent females recovered was estimated using the length-fecundity relationship: $Fecundity = -4.983.99 + 350.24 FL$ (Jewett, 1972). Total fecundity of the 30 females (141,344) minus the unspawned eggs (4,342) produces an estimate of 137,006 eggs deposited in the channel.

Downstream Migrant Production

On January 2, 1973, the flow in the spawning channel was reduced to 0.07 m³/sec (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.

We did not count outmigrants this season. Production of downstream migrants during years 1964-65 through 1970-71 averaged 29.8% of estimated egg deposition (range: 8.0-50.6%). This mean was used in computing the estimated production

for this season--40,828 fish. Included in the total are 5,616 fish seined from the channels and released in the river at the Installation after June 12, when water to the channels was shut off.

Weight samples of the fingerlings were taken only in January and June. They averaged 0.4 g/fish (1,280/lb) in early January and 8 g/fish (59.2/lb) in mid-June.

STEELHEAD MAINTENANCE PROGRAM

History of the 1972-73 Run

The first adult steelhead entered the Installation December 30, 1972, and the last entered February 23, 1973. Eleven fish were received: 7 males and 4 females. The males averaged 44 cm (17.5 inches) and the females 60 cm (23.5 inches) FL. The four females were spawned, producing 7,060 eggs.

1973 Brood Year Eggs From Broodstock

We had 391 1971 brood year broodstock steelhead on hand July 1, 1972. Between October 1972 and January 1973 we spawned 93 females, producing 244,300 eggs (2,627 eggs/female). The eggs were of poor quality: they were small--1.923/100 ml (569/oz)--and many were over-ripe at spawning.

After spawning, 236 of these broodstock fish, averaging 1.2 kg (2.7 lb) in weight, were released in the Mokelumne River near Camanche Dam. The remaining 155 adults were retained as broodstock for next year.

Nimbus Hatchery Eggs Received

We received 304,000 1973 brood year steelhead eggs from Nimbus Hatchery in February 1973.

Planting 1972 Brood Year Steelhead

A total of 192,972 1972 brood year steelhead were planted (see following table). They were produced from 296,800 eggs received from Nimbus Hatchery in 1971. We had 7,120 yearlings on hand June 30, 1973, which are being held for release next fiscal year.

Date	Area	Average weight (g)	Number
September 1972	Mokelumne R. near Camanche Dam	4.1	38,864
November 1972	Mokelumne R. near Clements	21	58,555
Jan.-Mar. 1973	Mokelumne R. at Franklin Road Bridge	29-74	80,933
Jan.-Mar. 1973	"	76	7,650
March 1973	Mokelumne R. near Camanche Dam	76	1,050
May 1973	New Hope Landing	206	2,200
June 1973	Mokelumne R. near Camanche Dam	252	3,720
TOTAL			192,972

Steelhead Mark Recoveries

Two marked steelhead adults were recovered at the Installation as follows:

Mark	Brood year	Number recovered	Release data			Average wt (g)	Origin
			Date	Area	Number		
Ad-RV	1970	1	11/70	New Hope Landing	6,000	57	Mokelumne R. Fish Installation
LV	1970	1	1/71	Brannon Island	20,250	61	"

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. Admin. Rep. 72-9. 20 p.

Appendix

Water Temperatures and Concentrations of Zinc,
 Mokelumne River Fish Installation and Camanche Lake,
 1972-73 Season

Date	Water temp. (C*)	Zinc** (ppm)	Date	Water temp. (C*)	Zinc** (ppm)
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1972	July	1	12.2	11.1	0.04
		2	"	"	"
		3	"	"	"
		4	"	"	"
		5	"	"	"
		6	"	"	"
		7	"	"	"
		8	"	"	"
		9	"	"	"
		10	0.04	12.8	"
		11	0.05	12.2	0.03
		12	0.04	"	0.02
		13	"	11.1	0.02
		14	"	"	0.03
		15	"	"	"
		16	"	"	"
		17	"	"	0.02
		18	"	"	"
		19	"	"	"
		20	"	"	"
		21	"	12.8	"
		22	"	11.7	"
		23	"	"	"
		24	"	"	0.03
		25	"	"	"
		26	"	"	0.02
		27	"	"	0.03
		28	"	"	0.04
		29	"	"	0.03
		30	"	"	"
		31	"	"	"
	Aug.	1	12.2	11.1	0.04

* Temperatures recorded in F, and later converted to C.
 ** Detection limit is 0.01 ppm.

Appendix (continued)

Date	Water temp. (C*)		Zinc** (ppm)	Date	Water temp. (C*)		Zinc** (ppm)
	Max.	Min.	Hatchery		Max.	Min.	Hatchery
1972							
Sept. 1	12.8	11.7	0.05	Oct. 1	12.8	11.7	
2	"	"	0.03	2	"	"	
3	"	"	"	3	"	"	
4	"	"	"	4	"	12.2	
5	"	"	"	5	"	"	
6	"	"	"	6	"	"	
7	"	"	"	7	13.3	"	
8	"	"	"	8	12.8	"	
9	"	"	"	9	"	"	
10	"	"	"	10	"	"	
11	"	"	"	11	"	"	
12	"	"	"	12	"	"	
13	"	12.2	"	13	"	"	
14	"	"	"	14	"	"	
15	"	"	"	15	"	"	
16	"	"	"	16	"	"	
17	"	"	"	17	"	"	
18	"	"	"	18	"	"	
19	12.2	11.7	"	19	12.2	"	
20	"	"	Sampling discontinued	20	"	"	
21	12.8	12.2	until	21	12.8	"	
22	"	11.7	Jan. 26, 1973	22	"	"	
23	"	"		23	"	"	
24	"	"		24	"	"	
25	12.2	12.2		25	"	"	
26	"	"		26	"	"	
27	12.8	11.7		27	"	"	
28	"	"		28	"	"	
29	"	"		29	"	"	
30	"	"		30	"	"	
				31	"	"	

discontinued

Sampling

Appendix (continued)

Date	Water temp. (C*)		Zinc** (ppm)	Date	Water temp. (C*)		Zinc** (ppm)
	Max.	Min.	Hatchery		Max.	Min.	Hatchery
1972							
Nov. 1	12.8	12.2		Dec. 1	11.7	11.7	
2	"	"		2	"	"	
3	13.3	12.8		3	"	"	
4	12.8	12.2		4	"	"	
5	"	"		5	11.1	10.6	
6	"	"		6	"	"	
7	"	"	discontinued	7	10.6	10.0	discontinued
8	"	"		8	10.0	"	
9	"	"		9	"	9.4	
10	"	"		10	9.4	8.9	
11	"	"		11	9.4	8.9	
12	"	"		12	"	"	
13	13.9	13.3		13	8.9	"	
14	"	"		14	"	8.3	
15	"	"		15	8.3	"	
16	13.3	"		16	"	"	
17	"	"		17	8.9	"	
18	"	"		18	8.3	"	
19	"	12.8		19	8.9	8.9	
20	"	"		20	"	"	
21	"	"		21	"	8.3	
22	"	"	Sampling	22	"	"	Sampling
23	12.8	12.2		23	"	"	
12	12.2	"		24	"	"	
25	"	"		25	8.3	"	
26	"	"		26	8.9	8.9	
27	"	"		27	"	8.3	
28	"	"		28	8.3	"	
29	"	11.7		29	8.9	"	
30	"	"		30	"	"	
				31	"	"	

Appendix (continued)

Date	Water temp. (C*)		Zinc** (ppm)		Date	Water temp. (C*)		Zinc** (ppm)	
	Max.	Min.	Hatchery	Lake surface		Max.	Min.	Hatchery	Lake surface
1973									
Jan. 1	8.3	8.3			Feb. 1	8.3	8.3	0.04	0.04
2	8.9	"			2	"	"	0.05	"
3	"	"			3	"	"	0.13	"
4	8.3	"			4	8.9	8.9	0.06	"
5	"	7.8			5	"	"	0.07	Sampling
6	"	"			6	9.4	"	0.08	discontinued
7	"	"			7	"	"	0.09	
8	"	"			8	8.9	"	0.07	
9	"	8.3			9	9.4	"	0.13	
10	"	7.8			10	8.9	"	0.08	
11	"	"			11	"	8.3	0.11	
12	"	8.3			12	"	"	0.15	
13	"	"			13	"	"	0.15	
14	"	"			14	"	"	0.16	
15	9.4	"			15	"	"	0.21	
16	"	8.9			16	"	"	0.29	
17	"	"			17	"	"	0.28	0.07
18	8.9	8.3			18	"	"	0.31	0.08
19	"	"			19	"	"	0.29	0.10
20	"	"			20	"	"	0.33	0.06
21	"	"			21	8.3	7.8	0.34	0.07
22	"	"			22	"	"	0.37	0.13
23	"	"			23	8.9	8.3	0.34	0.12
24	"	"			24	11.1	8.9	0.17	0.07
25	"	"			25	10.0	"	"	0.10
26	8.3	7.8	0.14		26	9.4	"	0.22	0.13
27	"	"	0.15		27	10.0	"	0.27	0.10
28	"	"	0.25		28	9.4	"	0.23	"
29	"	8.3	0.39						
30	8.9	"	0.03						
31	"	7.8	0.03	0.04					

Appendix (continued)

Date	Water temp. (C*)		Zinc** (ppm)		Date	Water temp. (C*)		Zinc** (ppm)			
	Max.	Min.	Hatchery	Lake surface		Max.	Min.	Hatchery	Lake surface		
1973											
Mar.	1	8.9	8.9	0.26	0.10	Apr.	1	10.0	9.4	0.19	0.14
	2	"	"	0.25	"		2	"	"	"	0.16
	3	"	"	"	0.09		3	"	"	0.18	0.14
	4	"	8.3	"	0.10		4	"	"	0.19	"
	5	"	"	0.27	"		5	"	"	0.18	0.15
	6	9.4	8.9	0.25	0.09		6	"	"	0.19	0.14
	7	8.9	"	0.24	0.10		7	"	"	0.21	"
	8	9.4	"	0.22	"		8	"	"	0.17	0.12
	9	"	"	"	0.09		9	"	"	0.16	0.18
	10	"	"	0.23	0.10		10	"	"	0.18	***
	11	8.9	"	"	"		11	"	"	"	***
	12	9.4	"	"	0.12		12	"	"	0.17	0.28
	13	8.9	"	0.22	0.10		13	"	"	0.19	0.15
	14	9.4	"	"	0.12		14	"	"	0.18	0.17
	15	10.0	"	"	"		15	"	"	"	0.15
	16	"	"	0.20	0.13		16	"	"	"	"
	17	9.4	"	"	"		17	"	"	0.16	"
	18	10.0	9.4	0.24	0.12		18	10.6	10.0	"	0.14
	19	"	"	0.21	"		19	"	"	0.43	0.16
	20	"	"	"	0.11		20	"	"	0.16	"
	21	"	"	0.25	0.10		21	"	"	0.17	0.15
	22	"	"	0.20	0.12		22	"	"	0.16	0.16
	23	"	"	0.22	"		23	"	"	"	0.13
	24	"	"	"	"		24	"	"	0.14	0.14
	25	"	"	"	"		25	11.1	"	0.15	0.17
	26	"	"	"	"		26	"	"	"	0.16
	27	"	"	0.20	"		27	"	"	"	0.13
	28	"	"	0.21	"		28	"	"	0.14	"
	29	"	"	0.20	0.15		29	"	"	"	"
	30	"	"	"	0.14		30	"	"	"	0.15
	31	"	"	"	0.14						

*** No sampling.

Appendix (continued)

Date	Water temp. (C*)		Zinc** (ppm)		Date	Water temp. (C*)		Zinc** (ppm)	
	Max.	Min.	Hatchery	Lake surface		Max.	Min.	Hatchery	Lake surface
1973									
May					June				
1	11.1	10.0			1	11.7	11.1		
2	"	"			2	"	"		
3	"	"			3	12.2	"		
4	"	"			4	"	"	0.10	0.10
5	"	"			5	"	"		
6	"	"			6	"	"		
7	"	"	0.13	0.12	7	"	"		
8	"	"			8	"	"		
9	"	10.6			9	"	"		
10	11.7	"			10	"	"		
11	"	"			11	"	"	0.09	0.10
12	"	"			12	"	"		
13	"	11.1			13	"	"		
14	"	"	0.12	0.14	14	"	"		
15	"	"			15	"	"		
16	"	"			16	"	"		
17	"	"			17	"	"		
18	12.2	"			18	"	"	0.10	0.8
19	11.7	"			19	12.8	11.7		
20	"	"			20	"	"		
21	"	"	0.12	0.15	21	"	"		
22	"	"			22	"	"		
23	"	"			23	12.2	"		
24	"	"			24	12.8	"		
25	"	"			25	"	"	0.09	0.9
26	"	"			26	"	"		
27	12.2	"			27	"	"		
28	"	"	0.12	0.12	28	"	"		
29	"	"			29	"	"		
30	"	"			30	"	"		
31	11.7	"							