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DEPARTMENT OF FISH AND GAME

MOKELUMNE RIVER FISH INSTALLATION
ANNUAL REPORT FOR 1973-74 SEASON

by

Philo F. Jewett

Region 2, Inland Fisheries

Anadromous Fisheries Branch

Administrative Report No. 75-8

1975

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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, 1973 through June 30, 1974. Production tables present the numbers of adult salmonids received, and eggs and fish produced during the installation's ten years of operation. Appendix tables present daily water temperatures and zinc concentrations at the facility during the 1973-74 fiscal year.

1/ Anadromous Fisheries Branch Administrative Report No. 75-8
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INTRODUCTION

This is the tenth annual report of the Mokelumne River Fish Installation. It covers the period of operation from July 1, 1973, through June 30, 1974. 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 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 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 15.6 c (60 F) and 8.3 c (47 F), respectively (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, there were no mortalities attributed to this cause.

We have no way to control the concentrations of these metals in our water supply, but we do monitor them. We collected water samples daily at the head of our steelhead ponds from November 12, 1973 through February 15, 1974, and from February 23, through March 25, 1974. During the period of January 4 through March 25, 1974 samples were taken in the morning and evening.

Table 1

King Salmon Spawning Channel Annual Summaries--
Mokelumne River Fish Installation 1964-65 through 1973-74 Seasons

Season	Number of females released in channel	Number females prespawning mortality	Potential number of eggs	Estimated egg deposition	Estimated fingerling production
1964-65	178	3	947,100	927,300	73,540
1965-66	33	1	157,043	150,883	76,435
1966-67	85	4	399,758	387,562	76,796
1967-68	93	0	490,186	487,220	177,542
1968-69	159	38	568,984	557,326	37,866
1969-70	314	77	1,183,953	1,164,430	497,130
1970-71	305	36	1,352,125	1,328,178	564,670
1971-72	539	183	1,951,639	1,900,022	560,506
1972-73	30	0	141,344	137,006	40,828
1973-74	128	21	617,106	597,342	176,216

Table 2

Steelhead Hatchery Annual Summaries--
Mokelumne River Fish Installation 1964-65 through 1973-74 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
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*
1973-74	18	58*	252,800	0	252,800	286,590	48,285*

* Broodstock included.

The greatest observed concentrations of zinc were 0.39 ppm on January 23, and 0.36 ppm on January 25, 1974 (Appendix). Copper concentrations never exceeded 0.01 ppm.

ALGAE CONTROL AT OUTMIGRANT TRAP

This season we installed dam boards in the channel 4 outlet structure. This dam is 76.2 cm (30 inches) high. We fabricated two 2.7 m- (8 ft-) long, 38.1 cm- (15 inch-) diameter pipes from 1.21 m x 2.43 m (4 x 8 ft) sheets of perforated plate. The plate has 0.40 cm (5/32 inch) holes, 0.6 cm (1/4 inch) staggered centers, and is 36% open. Holes were cut in the dam, and the pipes inserted flush with the downstream side. The pipes upstream from the dam boards are covered with approximately 15.2 cm (6 inches) of 5.08 cm to 15.2 cm (2 to 6 inch) cobble. Each pipe will pass approximately .226 m^3/sec (8 cfs).

We installed two 10.1 cm- (4 inch-) diameter pipes through the dam to pass the outmigrants from the channel to the trap. All discharge pipes have shut-off controls.

As the algae in the channel breaks loose, and rises to the surface, it floats to the dam and forms a cover over the pipes. The shade that this provides curtails the growth of algae on the cobble covering the pipes. When the algae cover gets too heavy, and starts to draft into the pipes leading to the trap, we close the valves and allow the algae to flow over the dam. This system does not entirely eliminate the problem, but it is of substantial assistance (Figure 3).

DISEASE

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

PUBLIC RELATIONS

During the 1973-74 fiscal year, an estimated 14,000 people visited the Installation. Tours 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

History of the 1973 Run

The spawning channel was in good condition at the start of the 1973 season; no gravel cleaning was required. Gravel berms 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 2, 1973. The flow was maintained between 1.6 and 1.7 m^3/sec (55-60 cfs) throughout the spawning season.

Four hundred eight salmon were received at the Installation from October 10, 1973, through January 29, 1974. Because of the small number of adults, only one loop of the spawning channel was used. All salmon entered of their own volition; all were cursorily examined for marks, sex, and condition. Seventeen were in poor condition and were returned to the river, two died of mechanical injury, and 389 (128 females and 261 males) were released into the spawning channel.

Mark Recoveries - 1973

Eight marked salmon were recovered this season. All were measured to the nearest 0.6 cm (1/2 inch) FL. Fish less than 61 cm (24 inches) FL were considered grilse. Mark recovery information is summarized in the following table:

Mark	Brood year	Number recovered	FL (cm)	Release data				Origin
				Date	Area	Number	Average wt (g)	
Ad-RV	1970	2	63.5, 80.6	3/71	Rio Vista	400,000	5	Coleman Hatchery
Ad-AN	?	1	66.6	?	?	?	?	?
RV-LP	1969	1	86.3	6/70	Sacto. River	263,331	5	Nimbus Hatchery
LV	?	1	74.9	?	?	?	?	?
RV	?	3	57.7, 64.7, 75.5	?	?	?	?	?

Carcass Recovery

Dead salmon were removed daily. 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 389 salmon entering the spawning channel, 359 carcasses (128 females and 231 males) were recovered. Of the 128 females, 21 (16.4%) had died without spawning.

Estimated Egg Deposition

Potential egg deposition based on the 107 spent females recovered was estimated using the length-fecundity relationship: Fecundity = 350.24 FL -4,983.99 (Jewett, 1972). Total fecundity of the 107 females (617,106) minus the unspawned eggs (19,764) produced an estimate of 597,342 eggs deposited in the channel.

King Salmon Fingerling Production

On December 21, 1973, the flow in the spawning channel was reduced to 0.481 m^3/sec (17 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.

A trap was installed on January 2, 1974, and all outmigrants were counted until July 30, when the trap was removed. During this period 82,295 fish were counted.

We took weight samples of outmigrants weekly. They averaged 0.35 g/fish (1,280/lb) in early January, and 8.2 g/fish (55/lb) in July. All outmigrants were released into the Mokelumne River at the installation.

In all prior years, the spawning channel has been drained in late spring, and the king salmon remaining in the channel seined out and enumerated.

This year the spawning channel was not dewatered. All actual outmigrants were trapped and enumerated (82,295), but we have no estimate of the number of king salmon remaining in the channel after July 30.

Production of king salmon fingerlings during the years 1964-65 trough 1970-71 averaged 29.5% of the estimated egg deposition (Jewett, 1972). Assuming the same egg-to-fingerling production rate for this year, the spawning channel production was 176,216.

STEELHEAD MAINTENANCE PROGRAM

History of the 1973-74 Run

The first adult steelhead entered the Installation November 14, 1973, and the last entered April 5, 1974. Eighteen fish were received: 13 males and 5 females. The males averaged 57.4 cm (22.6 inches) and the females 66.9 cm (26.4 inches) FL. Three females were spawned, all others were returned to the river. The three females produced 26,800 eggs (Table 2).

Broodstock Spawning

We had 155 1971 brood year broodstock on hand July 1, 1973. These fish started spawning in July, 1973 and continued into December. The spawning peak occurred in December.

We spawned 55 females. The spawned females were retained as broodstock for next season. The rest (78) were planted in the Mokelumne River (Table 3).

A total of 226,000 eggs were taken (4,109/female) last season the eggs from these fish were small (569/oz). This year they averaged 270/oz.

In May, 1974 36,800 of the resulting 1974 brood year fish were released as swim-ups in the Mokelumne River.

We had an estimated 95,200 1974 brood year steelhead on hand June 30, 1974.

1972 Brood Year

We had an estimated 78,120 1972 brood year steelhead on hand July 1, 1973. Of these, 31,924 were planted from August, 1973 through January, 1974, at sizes ranging from 0.15 to 0.5 kg each (3/lb to 1.1 lb each) (Table 3). We retained 494 of these fish for future broodstock.

1973 Brood Year

We had an estimated 280,000 1973 brood year steelhead on hand July 1, 1973. A total of 266,073 were planted in the Mokelumne River at sizes ranging from 3.4 to 162 g/fish (135-2.8/lb) (Table 3). We had an estimated 5,695 on hand June 30, 1974.

Steelhead Mark Recoveries

Five marked steelhead were recovered this season (Table 4).

Table 3

Steelhead Planting Data, Mokelumne River Fish Installation, 1973-74 Fiscal Year

Pounds	Number	Size	Release location	Date
1971 Brood Year (Broodstock adults)				
312	78	4 lb each	Mokelumne River	1/74
1972 Brood Year				
2,750	3,025	1.1/lb	Mokelumne River	8/73
1,100	1,000	1.1 lb each	New Hope Landing	9/73
1,100	1,000	1.1 lb each	Brannan Island	9/73
1,100	1,000	1.1 lb each	Rio Vista (Sacto R.)	9/73
990	900	1.1 lb each	Terminous	10/73
8,333	24,999	3/lb	Mokelumne River	1/74
1973 Brood Year				
740	99,900	135/lb	Mokelumne River	7/73
755	60,400	80/lb	Mokelumne River	9/73
275	20,900	76/lb	Mokelumne River	9/73
2,150	22,790	10.6/lb	New Hope Landing	11/73
1,000	8,000	8/lb	New Hope Landing	12/73
9,000	37,800	4.2/lb	New Hope Landing	12/73
1,615	10,013	6.2/lb	Mokelumne River	1/74
250	1,000	4/lb	Mokelumne River	4/74
250	850	3.4/lb	Mokelumne River	5/74
330	990	3/lb	Mokelumne River	5/74
500	1,400	2.8/lb	Mokelumne River	6/74
700	2,030	2.9/lb	Mokelumne River	6/74
1974 Brood Year				
80	36,800	460/lb	Mokelumne River	5/74

Table 4

Steelhead Mark Recoveries, 1973-74 Season

Mark	Brood year	Number recovered	Release data				Origin
			Date	Area	Number	Average wt.	
Ad	1970	1	Mar., 1971	Feather R. at Gridley Bar	50,200	56.6 g (8/lb)	Feather R. Hatchery
Ad-RV	1970	1	Nov., 1970	New Hope Landing	6,000	56.6 g (8/lb)	Mokelumne R. Fish Inst.
LV	1970	1	Jan.-Mar., 1971	Three-mile Slough	46,452	4.7-6.5/lb	"
RV	1970	1	Jan.-Mar., 1971	Brannan Island New Hope Landing	46,420	4.7-6.7/lb	"
RP	?	1	?	?	?	?	?

REFERENCES

Groh, Frederick H. 1965. Annual report Mokleumne River Fish Installation from January 1, 1964 to June 30, 1965. Calif. Dept. Fish and Game, Inland Fisheries Admin. Rep. 65-21. 28 p.

Jewett, Philo F. 1972. Mokelumne River Fish Installation annual report for 1970-71 season. Calif. Dept. Fish and Game, Anad. Fish Admin. Rep. 72-9. 20 p.

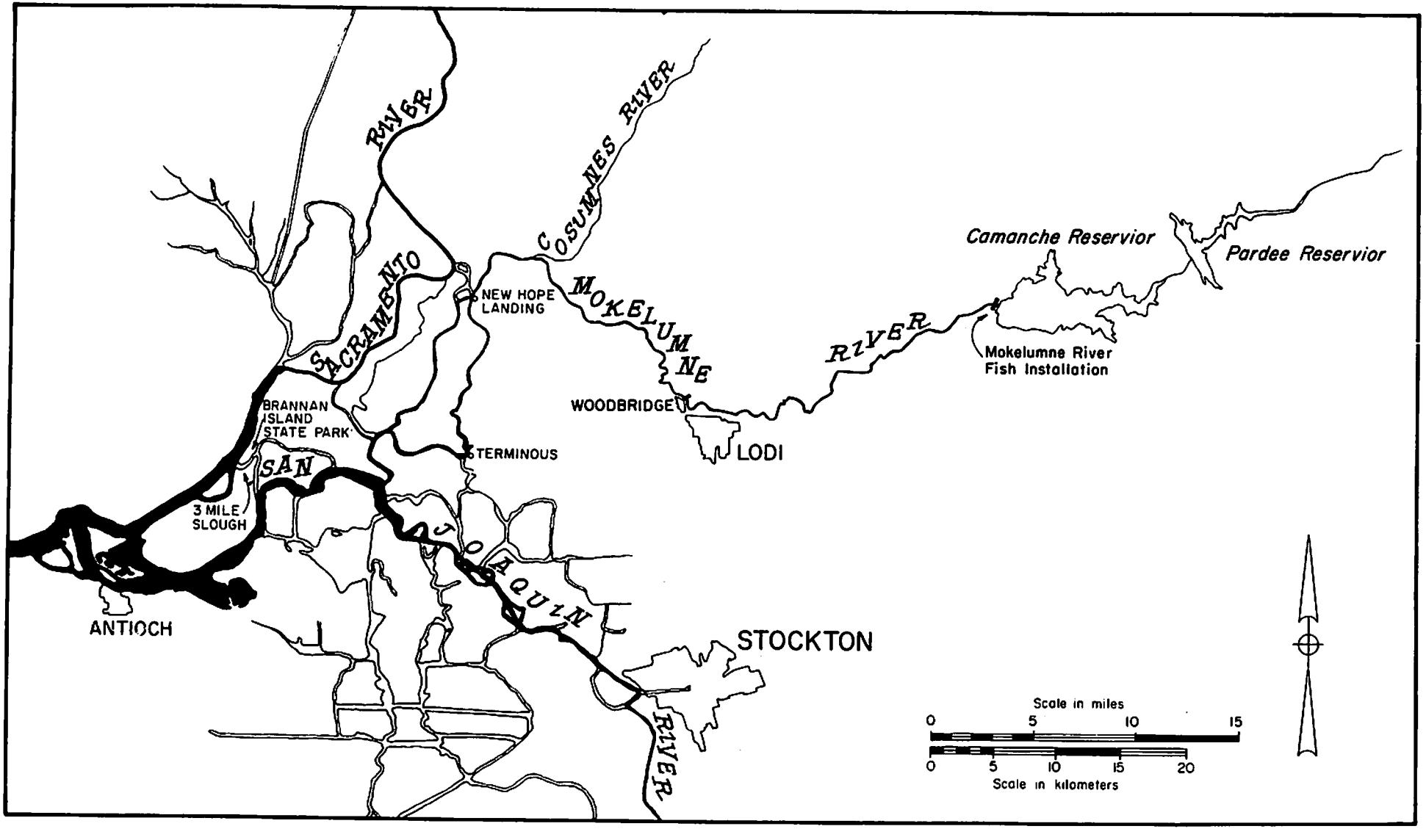

Figure 1. Map showing location of the Mokelumne River Fish Installation

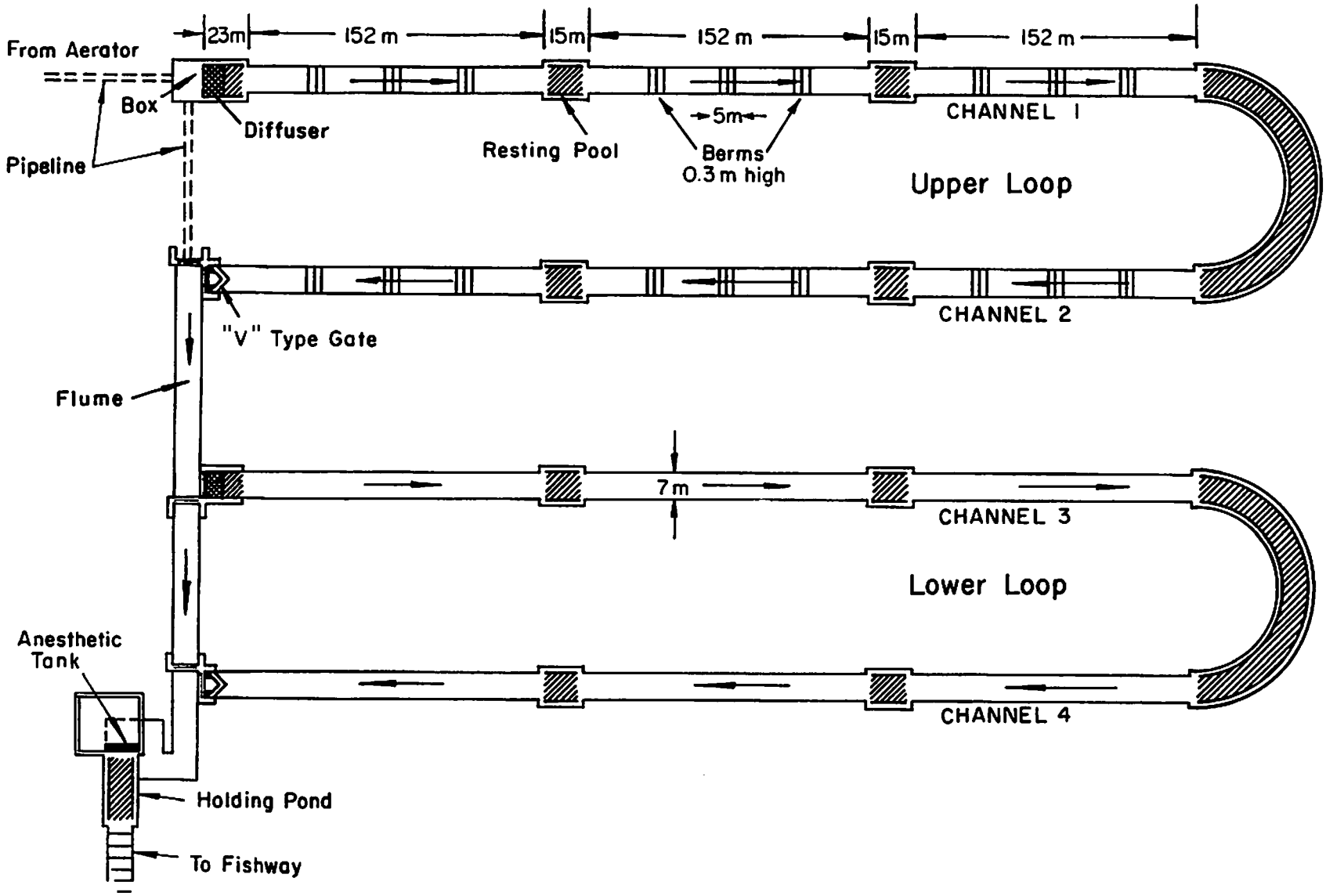

Figure 2. Diagram of the Mokelumne River Spawning Channel (not to scale).

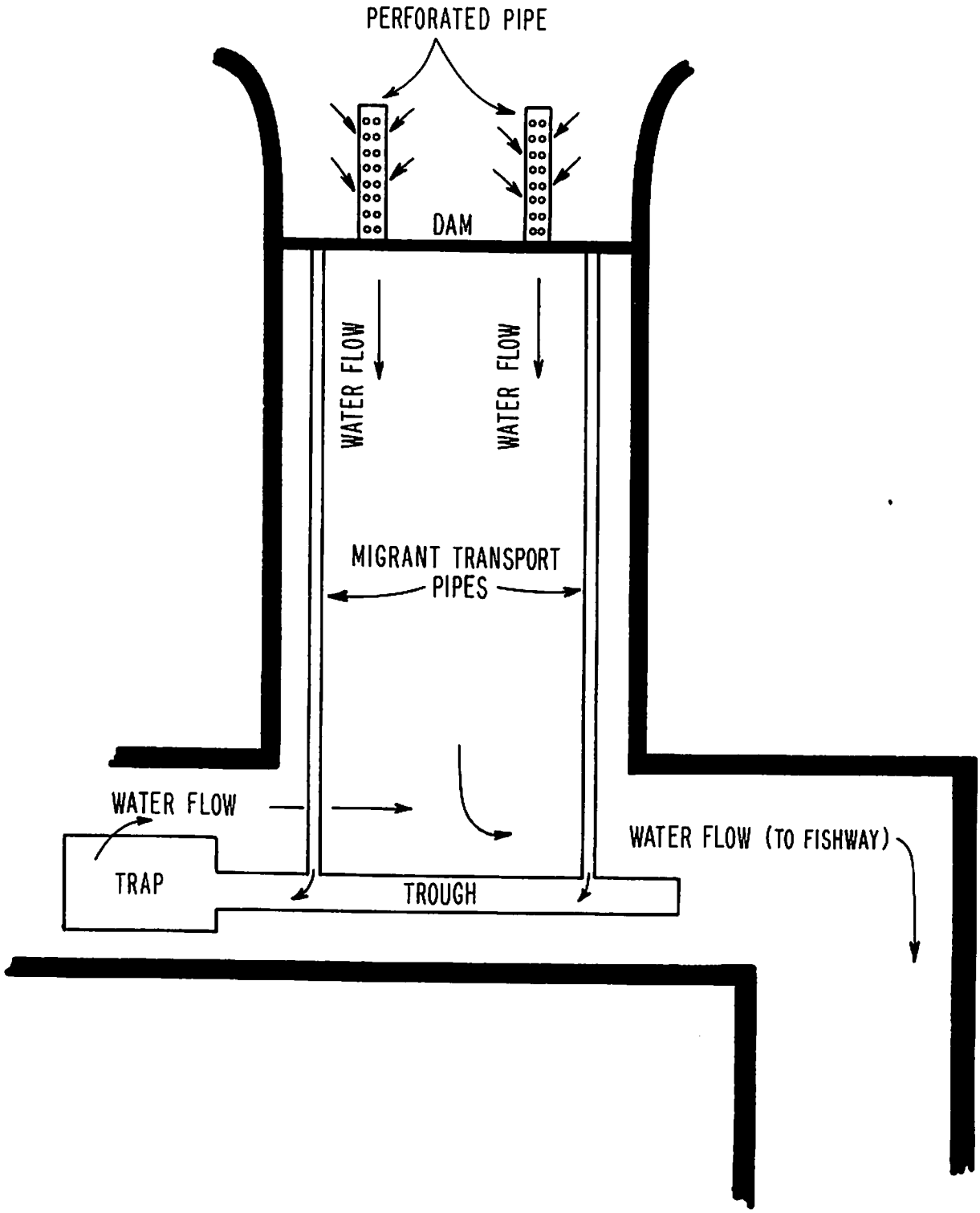

Figure 3. Schematic diagram of the outmigrant trap and the perforated pipe discharge system at the spawning channel.

Appendix

Water Temperatures and Zinc Concentrations,
Mokelumne River Fish Installation, 1973-74 Season

Date	Water temperature (C) Max.	Min.	Date	Water temperature (C) Max.	Min.
July 1	12.3	11.7	Aug. 1	13.3	11.7
2	12.8	11.7	2	13.3	12.7
3	12.8	11.7	3	13.3	12.2
4	12.8	11.7	4	13.3	12.2
5	12.8	11.7	5	13.3	12.2
6	12.8	11.7	6	12.8	11.7
7	12.8	11.7	7	13.3	12.2
8	12.8	11.7	8	12.8	11.7
9	12.8	11.7	9	13.3	11.1
10	12.8	11.7	10	13.3	11.7
11	13.3	12.2	11	13.3	12.2
12	13.3	12.2	12	13.3	11.7
13	13.3	12.2	13	13.3	11.7
14	13.3	12.2	14	13.3	11.7
15.	12.8	12.2	15	13.3	11.7
16	12.8	12.2	16	13.3	11.7
17	13.3	12.2	17	13.3	11.7
18	13.3	12.2	18	13.3	11.7
19	12.8	11.1	19	13.3	11.7
20	12.8	11.1	20	13.3	11.7
21	12.8	11.7	21	13.3	11.7
22	12.8	11.7	22	13.3	12.2
23	12.8	11.7	23	12.8	11.7
24	12.3	12.2	24	13.3	12.2
25	13.3	12.2	25	12.8	11.7
26	13.9	12.2	26	13.3	12.2
27	13.3	12.2	27	12.8	12.2
28	13.3	12.2	28	13.3	12.2
29	13.3	12.2	29	13.3	12.2
30	13.3	12.2	30	13.3	12.2
31	13.3	12.2	31	13.3	12.2

* No sampling for zinc concentrations before November 12.

Appendix (continued)

Date	Water temperature (C) Max.	Min.	Date	Water temperature (C) Max.	Min.
Sept.1	13.3	12.2	Oct. 1	13.3	12.2
2	13.3	12.2	2	13.3	12.2
3	13.3	12.2	3	13.3	12.2
4.	12.8	11.7	4	13.3	12.2
5	12.8	11.7	5	13.3	12.2
6	13.3	12.2	6	13.3	12.2
7	13.3	12.2	7	12.8	12.2
8	13.3	12.2	8	12.8	11.7
9	13.3	12.2	9	12.8	11.7
10	13.3	12.2	10	12.8	11.7
11	13.3	12.2	11	12.2	11.1
12	13.3	12.2	12	12.2	11.1
13	13.3	12.2	13	13.3	12.8
14	13.3	12.2	14	13.3	12.8
15	13.3	12.2	15	13.3	12.2
16	13.3	12.2	16	13.3	12.8
17	13.3	12.2	17	13.3	12.2
18	13.3	12.2	18	13.3	12.2
19	13.3	12.2	19	13.3	12.8
20	13.3	12.2	20	13.9	12.8
21	13.3	12.2	21	13.3	12.8
22	12.8	12.8	22	13.3	12.2
23	13.3	12.2	23	13.3	12.2
24	12.8	12.2	24	13.9	12.8
25	13.3	12.2	25	13.9	12.2
26	13.3	12.2	26	13.9	12.8
27	13.3	12.2	27	13.9	12.8
28	13.3	12.2	28	13.9	12.8
29	13.3	12.2	29	13.9	12.8
30	13.3	12.2	30	13.9	12.8
			31	13.9	12.8

Appendix (continued)

Date	Water temperature (C) Max.	Min.	Zinc (ppm)
Nov. 1	13.9	12.8	
2	13.9	12.8	
3	13.9	12.8	
4	13.2	12.2	
5	13.3	13.3	
6	13.9	13.3	
7	13.9	12.2	
8	13.9	12.8	
9	13.9	12.8	
10	14.4	13.3	
11	13.9	13.3	
12	14.4	13.3	0.06
13	15.0	13.9	0.06
14	15.0	13.9	0.04
15	15.0	14.4	0.04
16	15.6	14.4	0.12
17	15.6	14.4	0.02
18	15.0	13.9	0.03
19	14.4	13.9	0.02
20	14.4	13.9	0.01
21	14.4	12.8	0.01
22	14.4	12.8	0.02
23	13.9	13.3	0.03
24	13.9	13.3	0.03
25	13.9	13.3	0.02
26	13.3	12.2	0.02
27	12.8	12.8	0.02
28	13.3	12.2	0.01
29	13.3	12.2	0.02
30	13.3	12.2	0.05

Date	Water temperature Max.	Min.	Zinc (ppm)
Dec. 1	12.8	12.8	0.01
2	12.8	11.7	0.02
3	12.2	11.7	0.03
4	12.2	12.2	0.06
5	12.2	11.1	0.04
6	12.2	11.7	0.03
7	12.2	11.7	0.03
8	12.2	11.7	0.03
9	11.7	11.7	0.04
10	11.7	11.7	0.03
11	11.7	11.1	0.01
12	12.2	11.1	0.03
13	12.2	11.1	0.02
14	12.2	11.1	0.01
15	11.7	11.1	0.02
16	11.7	11.1	0.02
17	12.2	11.1	0.02
18	11.7	11.1	0.02
19	11.1	11.1	0.02
20	11.1	10.6	0.02
21	11.1	10.6	0.07
22	11.1	10.6	0.03
23	10.6	10.6	0.04
24	10.6	10.6	0.04
25	10.6	10.6	0.02
26	11.7	10.6	0.03
27	11.1	10.0	0.02
28	11.1	10.0	0.04
29	11.1	10.0	0.11
30	10.6	10.0	0.03
31	10.0	10.0	0.19

Appendix (continued)

Date	Water temperature (C) Max.	Min.	Zinc (ppm) am	pm
Jan.1	10.0	10.0	0.06.	
2	10.6	09.4	0.07	
3	10.6	09.4	0.03	
4	10.0	09.4	0.04	0.05
5	10.0	09.4	0.05	0.02
6	09.4	09.4	0.02	0.03
7	09.4	09.4	0.05	0.02
8	09.4	08.9	0.12	0.02
9	09.4	08.9	0.05	0.02
10	09.4	08.9	0.06	0.06
11	09.4	08.9	0.10	0.08
12	09.4	08.9	0.05	0.22
13	09.4	08.3	0.08	0.02
14	09.4	08.3	0.12	0.08
15	09.4	08.9	0.05	0.10
16	10.0	09.4	0.05	0.02
17	10.0	09.4	0.05	0.06
18	10.0	09.4	0.04	0.05
19	10.0	09.4	0.04	0.06
20	09.4	08.9	0.07	0.09
21	08.9	08.9	0.09	0.09
22	08.9	08.9	0.08	0.07
23	08.9	08.9	0.11	0.39
24	08.9	08.9	0.08	0.08
25	08.9	08.9	0.36	0.08
26	08.9	08.9	0.08	0.09
27	08.9	08.9	0.07	0.07
28	08.9	08.9	0.06	0.06
29	08.9	08.9	0.06	0.04
30	08.9	08.9	0.05	0.08
31	08.9	08.9	0.10	0.09

Date	Water temperature Max.	Min.	Zinc (ppm) am	pm
Feb. 1	08.9	08.9	0.08	0.08
2	08.9	08.3	0.08	0.08
3	08.9	08.3	0.08	0.07
4	08.9	08.3	0.07	0.08
5	08.9	08.3	0.08	0.09
6	08.9	08.3	0.07	0.07
7	08.9	08.3	0.05	0.07
8	08.9	08.3	0.05	0.06
9	08.9	08.3	0.05	0.08
10	08.9	08.9	0.08	0.05
11	08.9	08.3	0.10	0.07
12	08.9	08.3	0.07	0.09
13	08.9	08.3	0.07	0.07
14	08.9	08.3	0.20	0.06
15	08.9	08.3	0.09	0.06
16	08.9	08.3	No sampling for zinc concentration Feb. 16-21	
17	08.9	08.3		
18	08.9	08.3		
19	08.9	08.7		
20	08.9	08.9		
21	08.9	08.7		
22	08.9	08.7	0.08	0.08
23	08.9	08.7	0.09	0.06
24	08.9	08.7	0.06	0.06
25	08.9	08.7	0.06	0.08
26	08.9	08.7	0.07	0.04
27	08.9	08.9	0.05	0.05
28	10.0	08.9	0.06	0.07

Appendix (continued)

Date	Water temperature (C) Max.	Min.	Zinc (ppm) am	pm
Mar. 1	10.6	10.0	0.07	0.20
2	10.0	9.4	0.16	0.03
3	9.4	8.9	0.08	0.08
4	10.0	8.9	0.07	0.04
5	9.4	8.9	0.07	0.06
6	9.4	8.9	0.07	0.06
7	9.4	8.9	0.04	0.07
8	9.4	8.9	0.04	0.06
9	9.4	8.9	0.06	0.03
10	9.4	8.9	0.07	0.06
11	8.9	8.3	0.04	0.06
12	8.9	8.3	0.07	0.07
13	8.9	8.3	0.08	0.08
14	8.9	8.3	0.07	0.07
15	8.9	8.3	0.07	0.08
16	8.9	8.3	0.07	0.07
17	8.9	8.3	0.07	0.07
18	8.9	8.3	0.08	0.08
19	8.9	8.3	0.07	0.08
20	8.9	8.9	0.10	0.12
21	8.9	8.9	0.08	0.08
22	8.9	8.9	0.07	0.07
23	8.9	8.9	0.08	0.08
24	8.9	8.9	0.07	0.07
25	8.9	8.9	0.07	0.07
26	8.9	8.9		
27	8.9	8.9	Zinc	
28	8.9	8.9	concentration	
29	8.9	8.9	not measured	
30	8.9	8.9	after March 25.	
31	8.9	8.9		

Date	Water temperature Max.	Min.
April 1	9.4	8.9
2	10.0	9.4
3	10.0	9.4
4	10.0	9.4
5	9.4	8.9
6	10.0	9.4
7	10.0	9.4
8	9.4	9.4
9	9.4	8.9
10	10.0	9.4
11	10.0	9.4
12	10.0	9.4
13	10.0	9.4
14	10.6	10.0
15	10.0	10.0
16	10.6	10.0
17	10.0	10.0
18	10.0	9.4
19	10.6	10.0
20	10.6	10.0
21	10.6	10.0
22	10.0	10.0
23	10.0	10.0
24	10.0	10.0
25	10.6	10.0
26	10.6	10.0
27	10.6	10.0
28	10.6	10.0
29	10.6	10.0
30	11.1	10.0

Appendix (continued)

Date	Water temperature (C) Max.	Min.	Date	Water temperature (C) Max.	Min.
May 1	11.1	10.0	June 1	12.2	11.1
2	11.1	10.0	2	12.2	11.1
3	11.1	10.0	3	12.2	11.1
4	11.1	10.0	4	12.2	11.1
5	11.1	10.0	5	12.2	11.7
6	11.1	10.0	6	12.2	11.7
7	11.1	10.0	7	12.2	11.7
8	11.1	10.6	8	12.2	11.7
9	11.1	10.6	9	12.2	11.7
10	11.1	10.6	10	12.2	11.7
11	11.1	10.6	11	12.2	11.7
12	11.1	10.6	12	12.2	11.7
13	11.1	10.6	13	12.2	11.7
14	11.1	10.6	14	12.2	11.7
15	11.1	10.0	15	12.2	11.7
16	11.1	10.0	16	12.2	11.7
17	11.1	10.0	17	12.2	11.7
18	11.1	10.0	18	12.2	11.7
19	11.1	10.0	19	12.2	11.7
20	11.1	10.0	20	12.2	11.7
21	11.1	10.0	21	12.2	11.7
22	11.7	11.1	22	12.2	11.7
23	11.7	11.1	23	12.2	11.7
24	11.7	11.1	24	12.2	11.7
25	12.2	11.1	25	12.2	11.7
26	12.2	11.1	26	12.8	12.2
27	12.2	11.1	27	12.8	12.2
28	11.7	11.1	28	12.8	12.2
29	12.2	11.1	29	12.8	12.2
30	12.2	11.1	30	12.8	12.2
31	12.2	11.1			