JUVENILE SALMONID MONITORING AT ROCK ISLAND DAM BYPASS SAMPLER

ANNUAL REPORT

by
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ABSTRACT

Downstream migrating salmon (Oncorhynchus spp.) and steelhead (Salmo gairdneri) smolts were monitored at the Rock Island Dam bypass trap from 1 April - 31 August, 1986. Data collected included: 1) number of fish caught per species, 2) number of branded fish caught per species, 3) daily average riverflow, 4) daily average powerhouse #1 and #2 flows, and 5) daily average spill. These data were transmitted to, and used by, the Fish Passage Center to manage a water budget of allocated upstream water storage to augment river flows to improve survival of downstream migrating salmonids. The Rock Island Dam trapping facility collected 176,188 downstream migrating salmonids in 1986. Collected fish included 901 chinook salmon (Oncorhynchus tshawytscha) and 1,502 steelhead which had been freeze branded (to determine migration and survival rates) and 2,290 chinook and 22,506 steelhead with clipped d adipose fins The middle 80% (between 10% and 90%) of the 1986 spring migration (excluding sub-yearling chinooks) passed Rock Island Dam during a 32 day period, 29 April - 30 May. Passage rates of hatchery released chinook and steelhead smolts and downstream migration timing of all salmonids are presented.

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INTRODUCTION

In 1982, the Northwest Power Planning Council developed a fish and wildlife program to protect, mitigate and enhance fish and wildlife resources affected by construction and operation of Columbia River hydroelectric facilities. Under this program, a Water Budget of allocated upstream water storage was established to be used for instream flow augmentation to improve survival of downstream migrating salmon (*Oncorhynchus* spp.) and steelhead trout (*Salmo gairdneri*). The Council s plan also calls for studies to monitor juvenile fish migration timing and survival. This information is then applied to the daily management and evaluation of the benefits resulting from the use of the Water Budget.

The fishery agencies and tribes formed a Water Budget Center (renamed as the Fish Passage Center) to direct the use of the Water Budget and to conduct and coordinate those studies related to Water Budget management and evaluation. The Fish Passage Center developed a Smolt Monitoring Program, and selected several sites on the Columbia and Snake rivers as smolt monitoring stations. Rock Island Dam was selected as one of these stations. It is the first dam downstream from all of the major salmon and steelhead producing tributaries of the mid-Columbia River (Fig. 1).

The 1986 Smolt Monitoring Program for the mid-Columbia was designed to index the daily number of outmigrating salmonids at Rock Island Dam and to report numbers of marked juveniles collected. Data from this program allows a comparison and evaluation of year to year migration timing, travel time, and survival rates of different stocks of naturally produced and hatchery smolts.

Funding of the program, as implemented by the Fish Passage Center, was provided by the Bonneville Power Administration. The Public Utility District No. 1 of Chelan County (Chelan PUD) provided the trapping facility, personnel, and equipment to conduct the monitoring.

METHODS

Daily sampling data collected at the Rock Island monitoring station were 1) total number of fish caught per species, 2) total number of branded fish caught per species, 3) daily average riverflow, 4) daily average powerhouse flow through Rock Island #1 (old powerhouse) and Rock Island #2 (new powerhouse) (Fig. 2), and 5) daily average spill. The flow data were recorded so that an expanded index of fish passage through powerhouse #2 could be

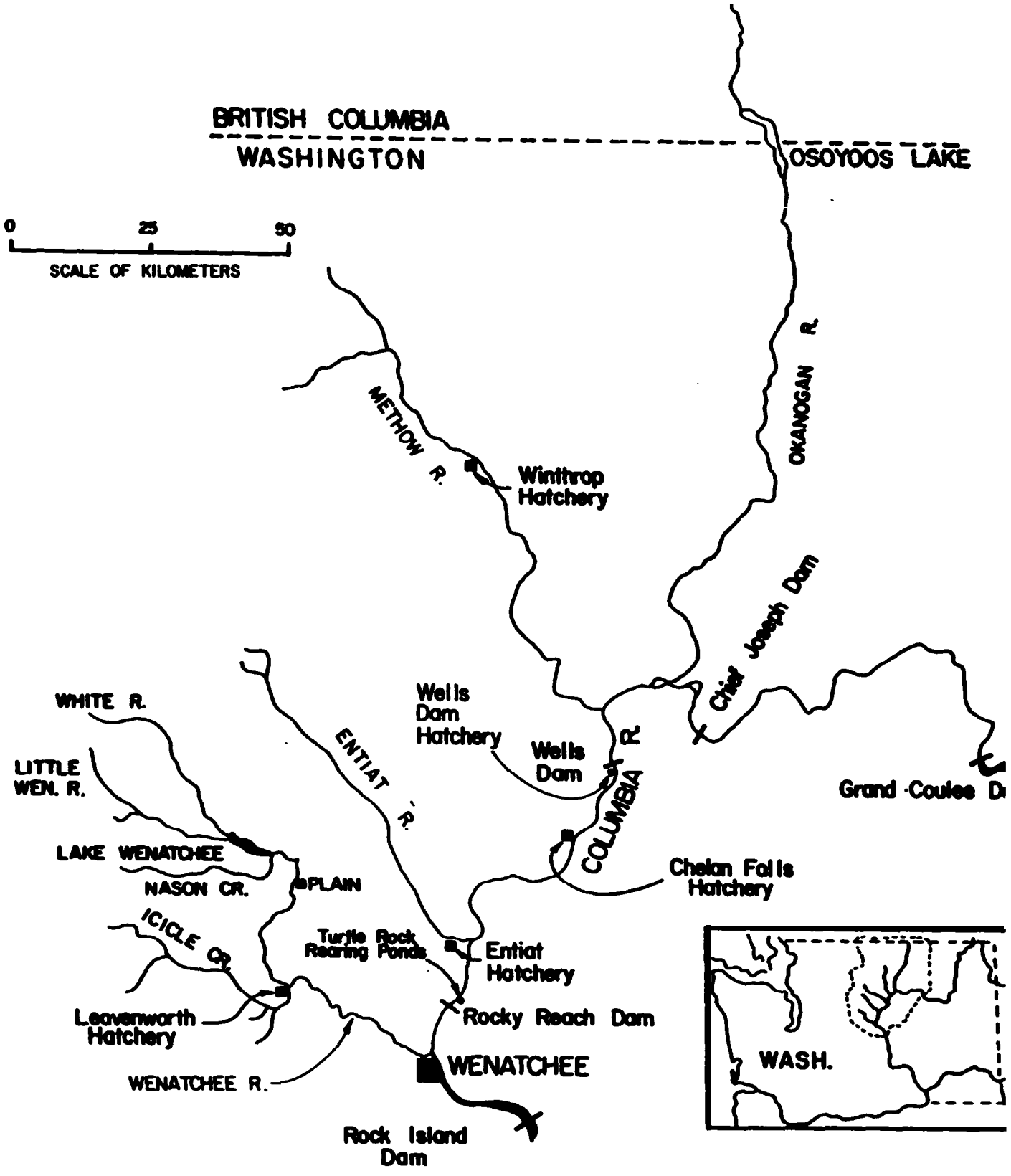

Figure 1. Columbia River between Rock Island and Grand Coulee dams showing major tributaries and hatcheries.

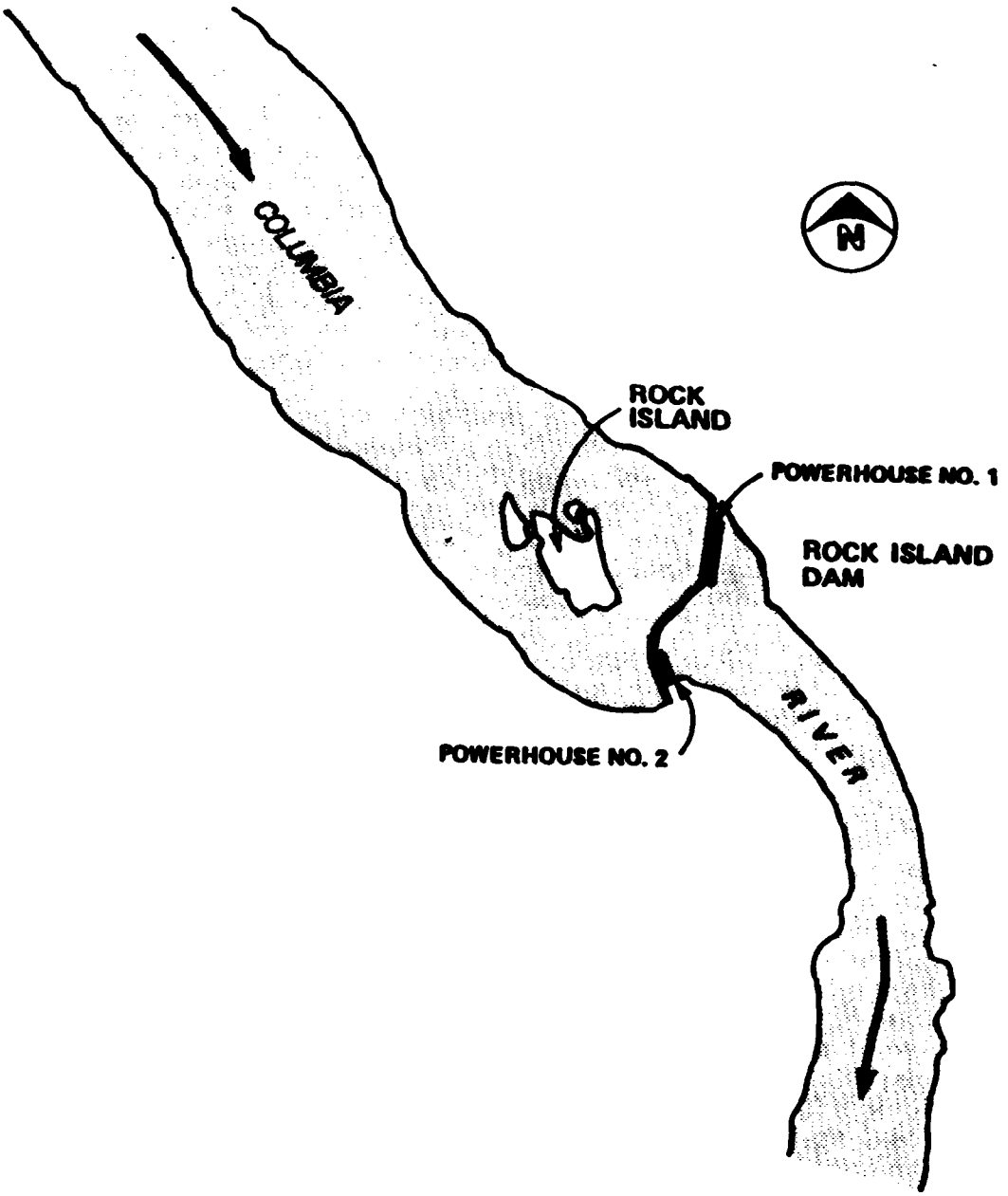

Figure 2. Location of powerhouse #1 and powerhouse.#2 of Rock Island hydro-electric project #943-002 (Taken from Olson 1983).

developed, based on the bypass collection count in relation to the proportion of total riverflow passing through powerhouse #2.

To provide travel time estimates between hatchery release points and Rock Island Dam, yearling chinook (Oncorhynchus tshawytscha), sub-yearling chinook, and steelhead in state and federal hatcheries were freeze branded (using liquid nitrogen) by the Fish Passage Center. The combination of timed releases of marked smolts (according to brand configuration) and daily sampling of these branded smolts from the bypass trap provide travel time estimates between hatchery release points and Rock Island Dam. Unmarked hatchery and native salmonids were also monitored to provide an indicator of the peak arrival times for each species at Rock Island Dam.

The bypass trap was monitored by personnel of the Fish and Wildlife Operations Section of the Power Operations Department of Chelan PUD.

Fish collected by the trap during the 24 hour sampling period (0900-0900) were held in the bypass flume before being delivered, via an elevator hopper, to an 8'x8'x3' portable fiberglass holding tank (Figs. 3, 4, and 5). The holding tank was supplied with a continuous water supply from the right bank fishway with a 5 horsepower submersible pump.

Samples of 30-50 fish were anesthetized with a solution of MS 222 (Tricaine methane sulfonate) before handl ing. Fish were identified by species and examined for brands and clipped fins in a sampling shed located next to the holding tank. Fork length measurements were taken from random subsamples of sockeye (Oncorhynchus nerka) between 8 April and 15 June and steelhead between 1 April and 30 June. Steelhead were also categorized as "hatchery or "native fish, depending on presence of an adipose fin, or (if an adipose fin was present) a worn appearance of the dorsal and ventral fins (Peven 1986a) (the Washington Department of Game and U.S. Fish and Wildlife Service clipped adipose fins of all hatchery steelhead before releasing them). The fish were then allowed t 0 recover in an isolated section of the holding tank. Field forms (Figs. 6, 7, and 8) were used at the dam to record data. After the examined fish had fully recovered from the effects of the MS 222, they were released through a 4" PVC pipe from the recovery sect ion of the tank, elevation 620 m.s.l., to the tailrace, elevation 574 m.s.l. (Fig. 5). The release area of the tailrace was effectively protected from seagull predation with parallel lengths of 80 pound test monofilament fish 1 ine tied at approximately 6 foot intervals overhead of the pipe outlet.

Data pertinent to the smolt monitoring program were transferred from Chelan P.U.D. headquarters in Wenatchee to the Fish Passage Center daily via the Data Management System (IBM System 36) utilizing an IBM PC.

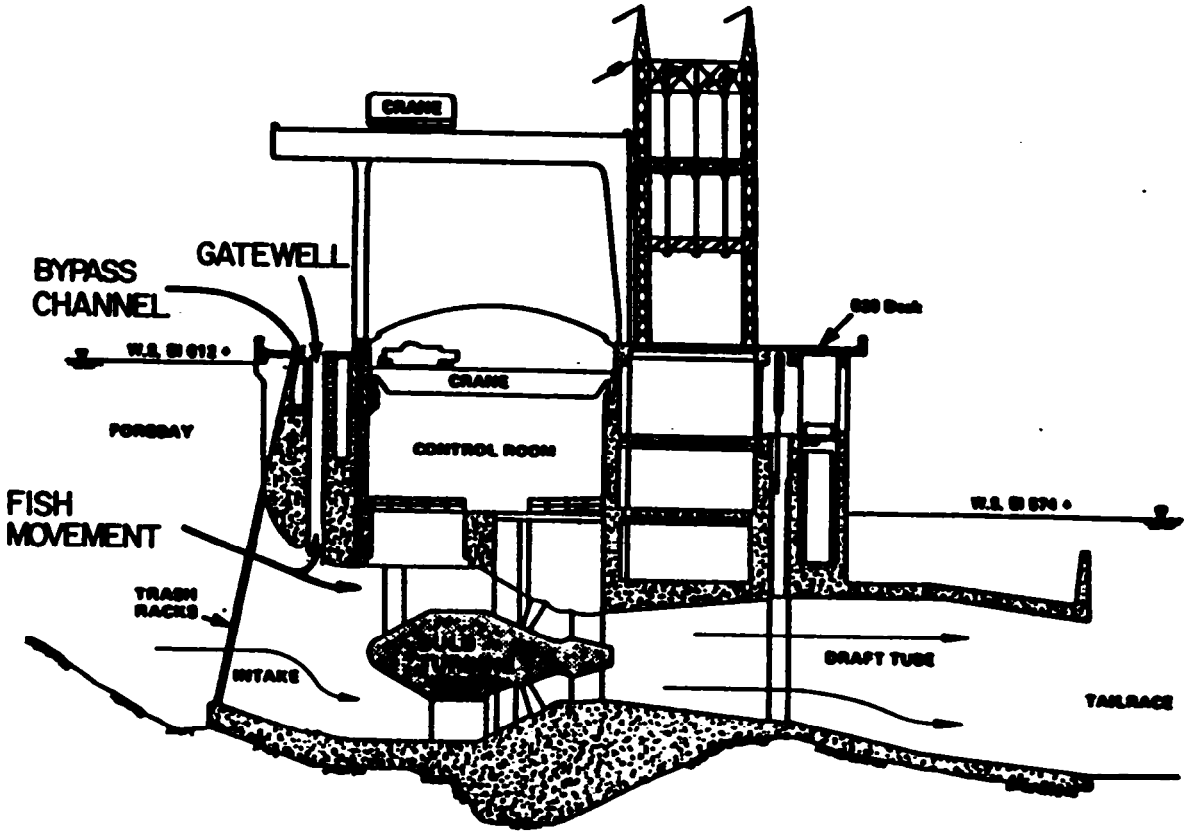

Figure 3 . Section through Rock Island Dam second powerhouse indicating fish movement into gatewell system (Taken from Olson 1983).

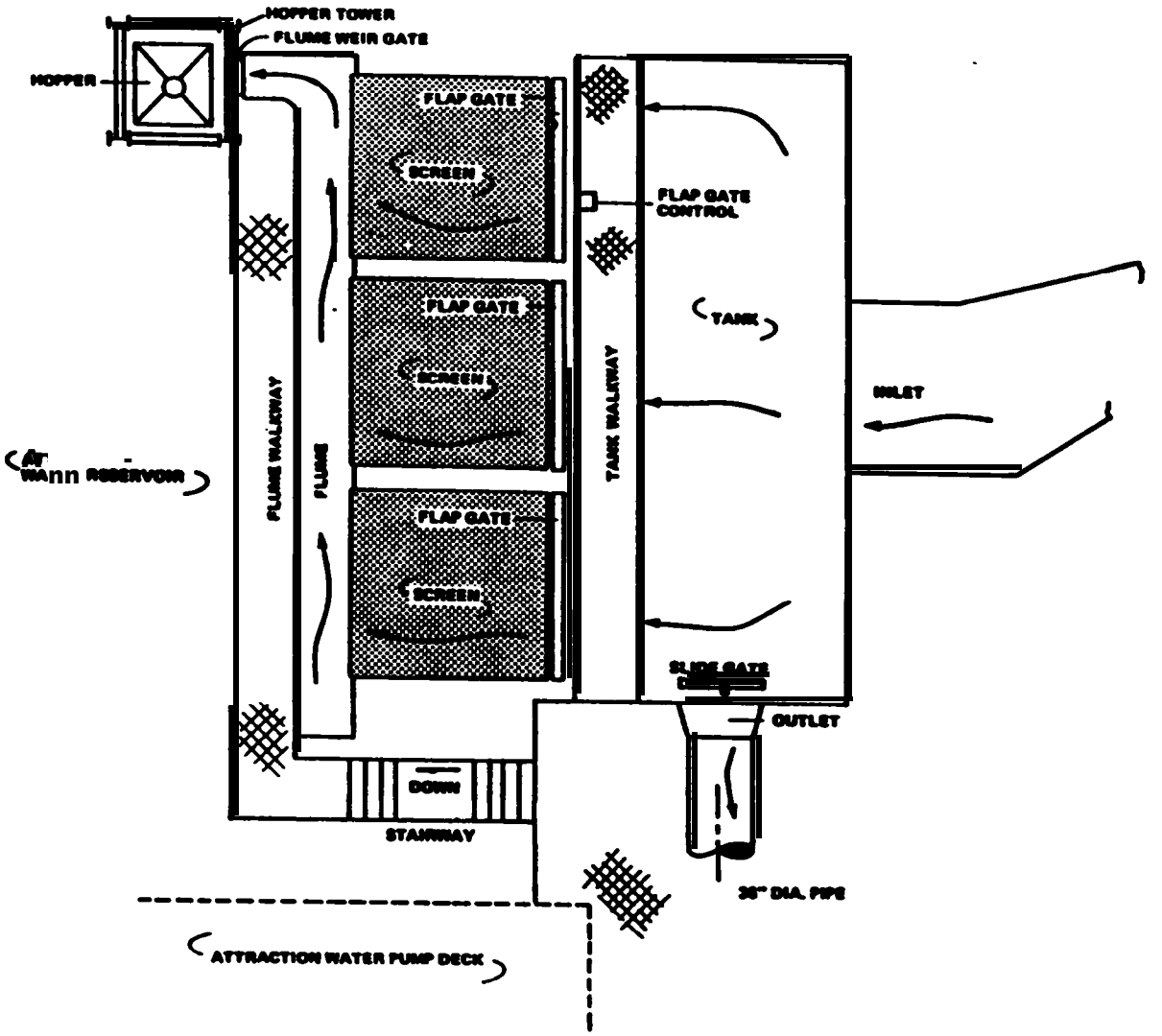

Figure 4. Rock Island Dam fingerling collection trap (Taken from Olson 1983).

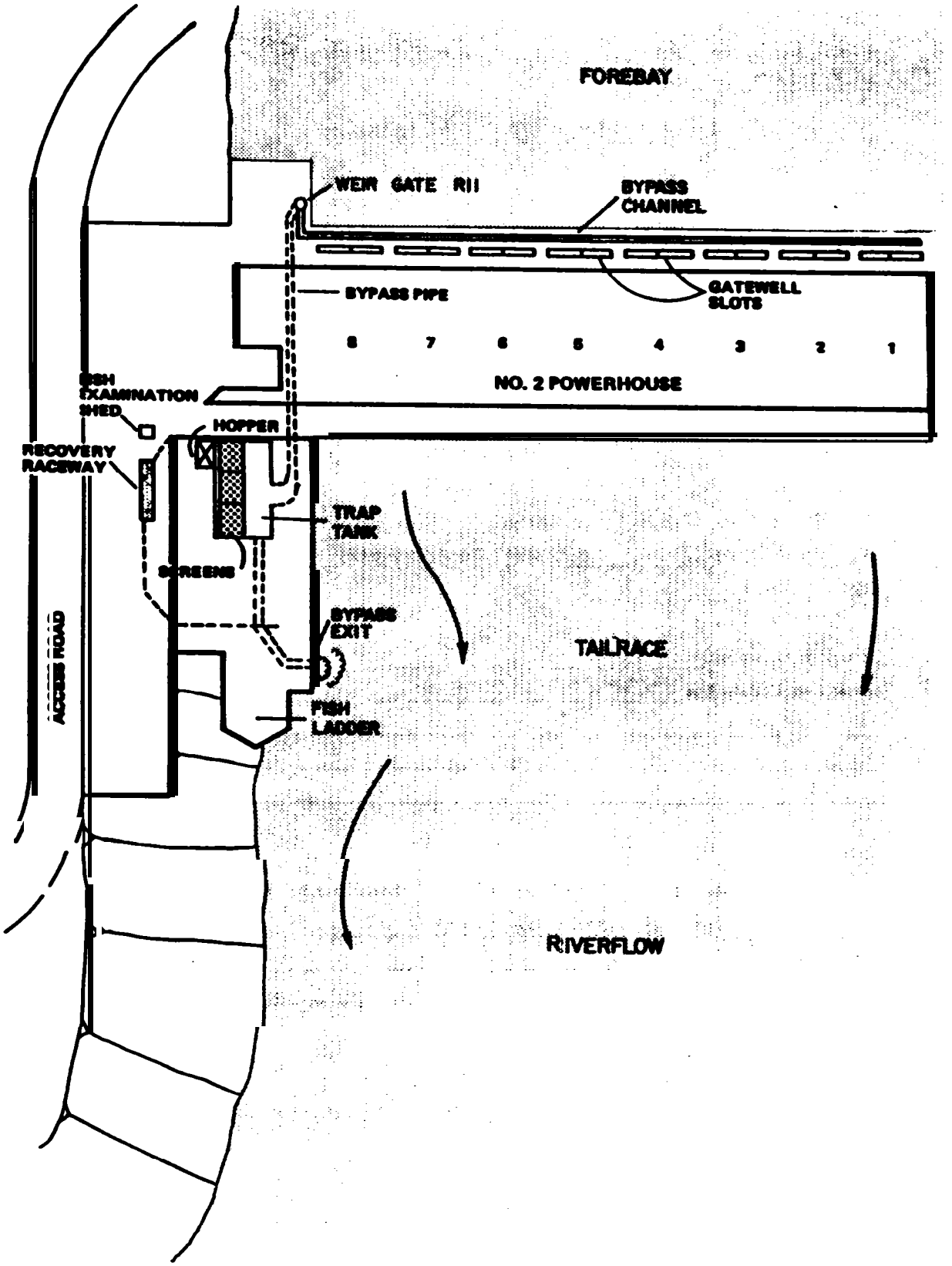

Figure 5:. Plan view of fingerling bypass and collection system at Rock Island Dam second powerhouse (Taken from Olson 1983).

ROCK ISLAND

FPC DAILY SMOLT MONITORING DATA

Page ____ of ____

Recorder _____

Site Code _____

Batch # _____

Start Date/Time _____ (MMDDYY HHMM

Stop Date/Time _____ (MMDDYY HHMM)

Sample Method Code _____

Sample Quality Code _____

Hours Sampled _____

Sample Rate _____

Avg. River Flow (Project Discbarge) _____

Avg. Powerhouse(1) _____ Avg. Powerhouse(2) _____

Avg. Spill _____

Summary Comment _____

Detailed Comments _____

	Chinook 1's (Yearlings)	Chinook 0's (Subyearlings)	Steelhead	Cobo	Sockeye	Total
# collected						
# Sampled						

Figure 6 Fish Passage Center daily smolt monitoring data sheet.

ROCK ISLAND BRAND RECOVERY

DATE _____ RECORDER _____

TIME _____ BATCH # _____

	AD CLIP	BRAND	LOCATION	POSITION	TALLY
CHINOOK 1					
CHINOOK 0					
STLHD.					

Figure 7. Rock Island Dam brand recovery data sheet.

Site code _____ Page____ of _____

Batch # _____ Recorder_____

	Gatewell	Species	Brand Position	Brand	Rotation	Fin Clips		Length	Tally	NOTES		Gatewell	Sp eies	Br ad Po ation	Br ad	Rotio	Fin Clips		Lengh	Tally	NOTES
1											26										
2											27										
3											28										
4											29										
5											30										
6											31										
7											32										
8											33										
9											34										
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22											47										
23											48										
24											49										
25											50										

Figure 8. Fish Passage Center smolt monitoring brand recovery data sheet.

RESULTS

Rock Island powerhouse #2 operated under normal conditions during the smolt monitoring program sample period (1 April - 31 August, 1986). The gatewell orifice bypass trap at Rock Island Dam (Figs. 3, 4, 5) collected fish from all of the 16 gate slots of the second powerhouse, with no mechanical failures or unusual circumstances which would affect bypass trap sampling efficiency.

The bypass trapping facility operated without mechanical failure during the smolt monitoring program. There was one instance of a non-normal sampling procedure. On 28 May the bypass flume became clogged with debris and overflowed, allowing the probable loss of a portion of the sample.

An examination of daily powerhouse X2 turbine flows in proportion to total river flow showed a variance in powerhouse operations during the period of peak salmonid outmigration. Monthly average powerhouse #2 flows for the period of 1 April through 30 June ranged from 63.8% to 80.6% of average total riverflow and daily averages ranged from 30.9% to 96.9% of the daily average total riverflow (Table 1).

The Rock Island trapping facility collected 176,188 juvenile salmon and steelhead during the 1986 smolt. monitoring program (Appendix A-1 - A-6).

A total of 901 freeze branded chinook salmon and 1,502 freeze branded steelhead trout representing 13 distinct marks and releases, were collected and recorded during 1986 (Table 2). In addition, we collected 2,290 chinook and 22,506 steelhead with clipped adipose fins (Appendix B-1 - B--6).

Average daily hydraulic data for Rock Island Dam were supplied to the Fish Passage Center, which used it to develop an expansion of Rock Island trap data. The expansion was derived by taking the actual trap collection count multiplied by the inverse proportion of water passing through powerhouse #2 during the sampling period (i.e., (collection count X 100) / (powerhouse #2 flow / powerhouse #1 flow + powerhouse X2 flow + spill). A comparison of actual trap collection counts to the expanded index (Table 3) indicated little difference in the smolt timing estimates. The largest differences in timing estimates observed between the two counts amounted to a 19 and a 4 day difference in the 50% and 90% passage dates, respectively, for chinook sub-yearl ings, a 3 day difference in the 50% passage date for sockeye, and a 2 day and 7 day difference in the 50% and 90% passage dates, respectively, for total salmonids. Because the expansion did not significantly affect timing estimates, actual count data were used in our analysis and discussion.

Table 1. Rock Island Dam powerhouse operations expressed in kcfs and % streamflow, 1 April - 31 August, 1986.

Average KCFS	April	May	June	July	August
Total river flow	142.7	135.0	131.9	116.7	97.8
monthly range	102.0-181.2	103.6-157.3	90.7-167.0	45.0-153.5	56.1-124.5
Powerhouse #1 flow	36.7	6.5	9.6	20.4	5.5
monthly range	0.5-69.9	0.5-17.2	0.5-30.2	0.5-46.8	0.5-17.5
Powerhouse #2 flow	97.1	108.8	84.1	95.3	91.3
monthly range	73.9-123.9	77.6-130.2	45.5-108.0	43.5-115.9	54.6-117.8
Spill	7.8	18.4	37.1	0.0	0.0
monthly range	0.0-38.8	10.0-41.1	0.0-100.4	0.0	0.0
Average percent					
Powerhouse #1 flow	25.7	4.8	7.3	17.5	5.6
monthly range	0.4-45.8	0.5-10.9	0.3-20.4	0.6-32.3	0.4-.15.0
Powerhouse #2 flow	68.0	80.6	63.8	81.7	93.4
monthly range	53.6-86.4	60.4-87.7	30.9-96.9	66.9-98.1	84.2-98.7
Spill	5.5	13.6	28.1	0.0	0.0
monthly range	0.0-22.8	6.6-32.0	0.0-67.7	0.0	0.0

Table 2. Summary of brand recovery rates for yearling chinook, sub-yearling chinook, and steelhead, 1 April - 31 August, 1986.

Fish	Brand	Release date	Release site	Branded fish released	First recovery date	Last recovery date	10% recovery date	50% recovery date	90% recovery date	Number recovered	% recovered
Chinook yearling											
	LA-7T-1	4/23/86	Lvwth NFH	40,602	4/25/86	5/30/86	4/27/86	5/10/86	5/28/86	254	0.63
	RA-7C-1	4/21/86	Methow R	34,466	4/26/86	6/02/86	5/03/86	5/16/86	5/30/86	136	0.39
	RA-7C-3	4/25/86	Methow R	34,485	4/29/86	6/05/86	5/07/86	5/21/86	5/30/86	108	0.31
	RA-7T-3	4/29/86	Methow A	34,353	5/03/86	6/03/86	5/07/86	5/21/86	5/30/86	107	0.31
Chinook aubyrl ing											
	RD-S-1	5/29/86	Wells WDF	100,447	6/03/86	7/28/86	6/O5/86	6/12/86	7/16/86	296	0.29
Steelhead											
	LA-7N-1	5/01/86	Methow R	29,451	5/05/86	6/06/86	5/08/86	5/13/86	5/22/86	640	2.17
	LD-7N-1	5/09/86	Methow R	29,992	5/13/86	6/09/86	5/15/86	5/19/86	5/25/86	232	0.77
	LA-7N-3	5/05/86	Methow R	30,046	5/09/86	6/01/86	5/11/86	5/15/86	5/22/86	611	2.03
	LA-N7-3	5/09/86	Methow R	213	5/21/86	5/22/86	5/21/86	5/22/86	5/22/86	4	1.88
	LA-N7-1	5/09/86	Methow R	557	5/21/86	5/29/86	5/21/86	5/23/86	5/28/86	7	1.26
	LD-N7-1	5/15/86	Methow R	190	5/24/86	5/26/86	5/24/86	5/24/86	5/24/86	2	1.05
	RA-P7-3	5/09/86	Methow R	456	5/21/86	5/31/86	5/21/86	5/23/86	5/23/86	4	0.88
	RA-P7-1	5/05/86	Methow R	216	5/22/86	5/23/86	5/22/86	5/22/86	5/22/86	2	0.93
	RD-P7-1	5/15/86	Methow R	126						0	0.00

Table 3. Comparison of actual and expanded fish counts and passage dates for the Rock Island Dam bypass trap, 1986 (expanded data in parentheses).

Species	Nmbers				Dates		
	Totals	10%	50%	90%	10%	50%	90%
Chinook Yearlings	20479 (26126)	2048 (2613)	10239 (13063)	18431 (23513)	4/25/86 (4/24/86)	5/07/86 (5/07/86)	5/24/86 (5/24/86)
Chinook Sub-yearlings	44799 (72982)	4480 (7298)	22399 (36491)	40319 (65684)	6/03/86 (6/03/86)	6/29/86 (6/10/86)	7/28/86 (7/24/86)
Coho	48516 (59308)	4851 (5931)	24258 (29654)	43664 (53377)	5/16/86 (5/16/86)	5/22/86 (5/22/86)	5/28/86 (5/28/86)
Sockeye	31286 (42804)	3129 (4280)	15643 (21402)	28157 (38524)	4/20/86 (4/20/86)	5/19/86 (5/22/86)	6/03/86 (6/04/86)
Steelhead	31108 (38900)	3111 (3890)	15554 (19450)	27997 (35010)	5/12/86 (5/11/86)	5/20/86 (5/21/86)	5/28/86 (5/29/86)
Total Salmonids	176188 (240120)	17619 (24012)	88094 (120060)	159569 (216108)	5/05/86 (5/05/86)	5/23/86 (5/25/86)	7/02/86 (6/25/86)

DISCUSSION

MIGRATION TIMING

Yearling Chinook

Yearling chinook were present the first day of the smolt monitoring program, 1 April and continued to be present every day until 12 June. The last yearling chinook was collected on 12 August. The 10% and 90% passage dates for yearling chinook were 25 April and 24 May, respectively. Peak passage of 1,513 yearling chinook occurred on 7 May. Brand recovery data (Appendix B-2) links this peak with the 23 April Leavenworth Hatchery release of 1,970,000 yearling spring chinook. A second peak, lasting only from 8 May to 12 May, coincides with the 50% passage date of 7 May (Appendix C-1).

Sub-yearling Chinook

The first sub-yearling chinook was collected on 4 April with daily occurrence starting 22 May and continuing until the last day of the smolt monitoring program, 31 August. Peak passage of 2,505 sub-yearling chinook occurred on 2 June. The 10% and 90% passage dates were 3 June and 28 July, respectively, while the 50% passage date for sub-yearling chinook was 29 June (Appendix C-2).

Steelhead

Daily collection of steelhead smolts began on 1 April and continued until July, after which steelhead were intermittently collected in low numbers (<10) until 26 August. Peak passage of 2,479 steelhead occurred on 21 May, just one day after the 50% passage date (20 May). The 10% and 90% passage dates were 12 May and 28 May, respectively (Appendix C-3).

Peven (1986a) found that hatchery steelh-ead comprised 72.5% of the total outmigrants (n=4,773) collected at Rock Island Dam in 1986. Hatchery saolts averaged 200 mm fork length during the study period (1 April - 30 June) while native steelhead smolts (27.5% of the run) averaged 172 mm. A comparison of hatchery and native run timing showed little difference (2 days) in peak passage dates past Rock Island Dam (Fig. 9).

Sockeye

Sockeye smolts were present at Rock Island Dam on the first day of the monitoring program, 1 April, and were collected daily until 20 June. The last sockeye smolt was trapped on 24 August. Peak passage occurred on 20 April, with 3,218 sockeye smolts trapped. The 10% and 90% passage dates were 20 April and 3 June respectively, while 50% of the outmigrating sockeye smolts had passed Rock Island Dam by 19 May (Appendix C-4).

Two sub-yearling sockeye were observed at the Rock Island bypass trap in 1986. On 17 July, examination of the first gill

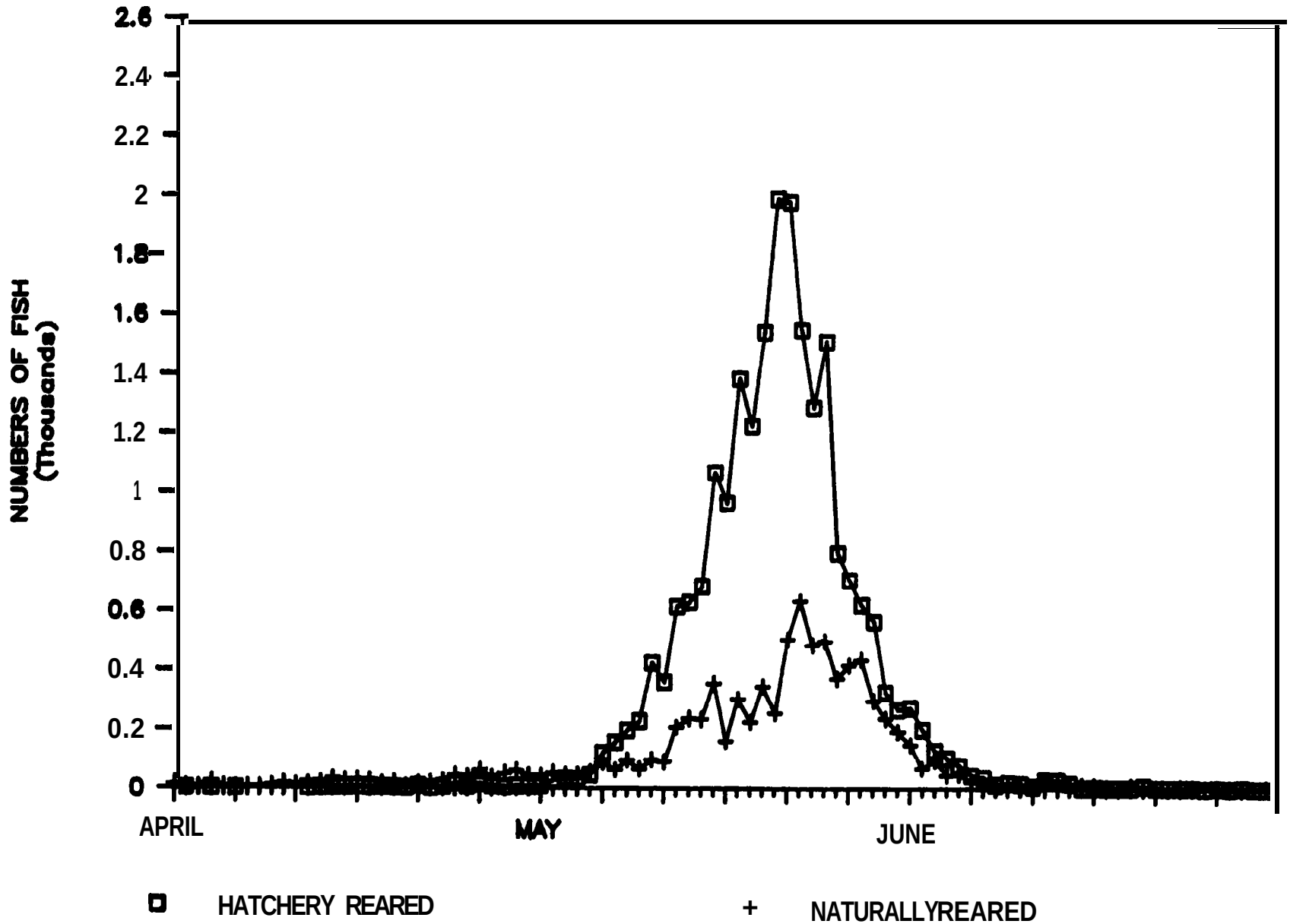

Figure 9. Daily catch comparison of hatchery and wild steelhead smolts from the Rock Island bypass trap, 1 April - 30 June, 1986 (taken from Peven 1986a).

arch confirmed that a questionable juvenile was a sub-yearling sockeye. Refore this time, zero age sockeye may have been misclassified as chinook sub-yearlings. At that time, chinook sub-yearlings (over 90% of which were less than 50 mm) predominated the daily catch. The sub-yearling sockeye may be offspring of either the few Entiat River spawners or spawners below Tumwater Dam (an impassable upstream barrier to sockeye fry) on the Wenatchee River (J. Mullan, USF&WS, personal communication).

In 1986, the downstream migration of sockeye was bimodal (Appendix C-4). This is due to the difference in run timing of the two stocks of sockeye that migrate past Rock Island Dam. Wenatchee River outmigrants pass Rock Island primarily in April and Okanogan River smolts are more prevalent at Rock Island in May (Peven 1986b).

Coho

Daily collection of coho (Oncorhynchus kisutch) smolts began on 6 May and continued until 16 June. Sporadic samples of coho were collected after 16 June, with the last coho collected on 24 July. Peak passage of 5,866 coho smolts occurred on 21 May (Appendix A-2, C-5). The 10%, 50%, and 90% passage dates for coho in 1986 were: 16 May, 22 May, and 28 May, respectively.

Eight sub-yearling coho were collected at the Rock Island bypass trap between 4 and 7 June. Additional sub-yearling coho may have been misclassified as chinook sub-yearlings because; 1) chinook sub-yearlings predominated the catch at that time, and 2) zero age coho were not expected in the catch. The origin of these fry is uncertain. There appears to be some natural spawning by coho upstream from Rock Island Dam. In 1984 and 1985, 118 and 78 adult coho were counted, respectively, at Wells Dam (riverkilometer 731). Coho are raised and released at the Turtle Rock hatchery upstream from Rocky Reach (and Rock Island) Dam, but these fish are released as yctarlings.

Total Salmonid Run

The total juvenile salmonid run timing is represented in Appendix C-6. The early peak passage count 3,276 on 20 April is largely influenced by the large collection of sockeye (3,218). The 21 May peak count of 9,193 is the combination of coho (5,866) and steelhead (2,479) which made up 90.8% of the sample.

The effect of sub-yearling chinook was assessed on the 10%, 50%, and 90% dates for the total cumulative juvenile salmonid passage. A comparison of data was done between a population of juvenile salmonids excluding sub-yearling chinook (Fig. 10) with a population of all juvenile salmonids (Fig. 11). The duration of the middle 80% of the total juvenile salmonid passage (10% date to 90% date) was 59 days, 5 May to 2 July, with a 50% passage date on 23 May. Excluding sub-yearling chinook from this same analysis, results in a spring migration of 32 days, 29 April to 30 May, with a 50% passage date on 20 May. The 90% passage

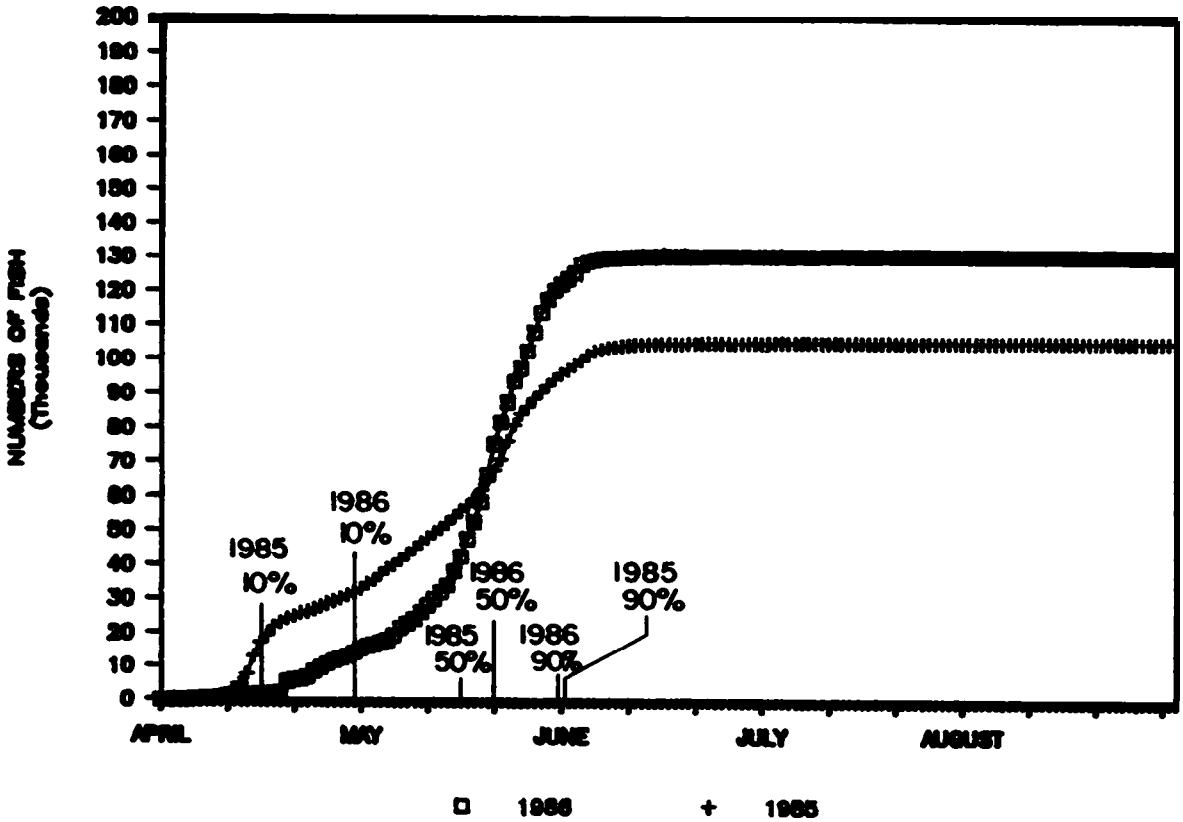

Figure 10. Cumulative numbers of juvenile salmonid passage excluding sub-yearling chinook, 1 April - 31 August, 1986.

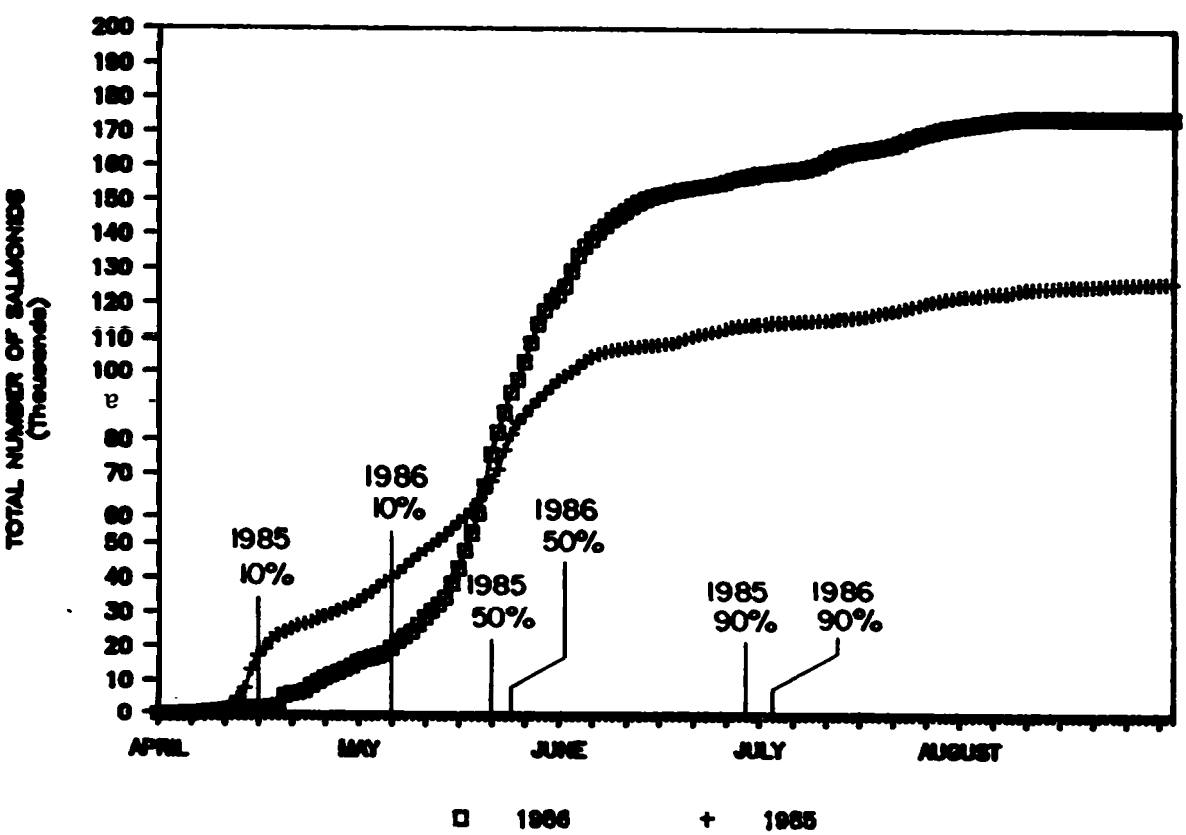

Figure 11. Cumulative numbers of total salmonid passage, Rock Island Dam, 1 April - 31 August, 1986.

date of the run, if sub-yearling chinook were not included, was 30 May in 1986, compared to 2 July, if sub-yearling chinook were included.

Run timing was confined to a narrower time frame in 1986 than in 1985, by both of these comparisons. The middle 80% of the run of total juvenile salmonids passed Rock Island during a 59 day period in 1986, compared to 73 days in 1985. The middle 80% of the 1986 run, excluding sub-yearling chinook, passed Rock Island Dam in 32 days, compared to 47 days in 1985 (Figs. 10 and 11).

MARKED FISH RECOVERIES

The Fish Passage Center released 14 groups of freeze branded hatchery smolts (totaling 335,600 fish) into the Columbia River system upstream from Rock Island Dam to evaluate the relationships between Columbia River flow rates and travel time and survival. These releases consisted of 143,906 spring chinook (40,602 released from the Leavenworth National Fish Hatchery into the Wenatchee River and the remainder released into the Methow River) 100,447 sub-yearling chinook released at Wells Dam, and 91.247 steelhead released into the Methow River. Table 2 presents information concerning these releases as well as recovery data.

Yearling Chinook

Leavenworth National Fish Hatchery - The first brand recovery at Rock Island Dar was on 25 April consisting of the yearling spring chinook released on 23 April from Leavenworth National Fish Hatchery. The 50% recovery date at Rock Island for the Leavenworth chinook was 10 May,resulting in a median travel time of 17 days. Final recovery of the Leavenworth branded chinook occurred on 30 May. The Rock Island bypass trap 0.63% of the fish in this release. These fish enter the Columbia River 15 miles above Rock Island Dam and, as a result, Columbia River flows have less influence on travel time to Rock Island Dam for this group compared to fish released into the Methow River or at Wells Dam.

Winthrop National Fish Hatchery - Three groups of yearling chinook were released into the Methow River, each 4 days apart (Table 2). The median passage times for these 3 groups of fish were 25, 26, and 22 days, with the last group released having the shortest passage time. Fish released into the Methow River had a longer distance to travel before reaching Rock Island Dam than did fish released into the Wenatchee River. The. Rock Island bypass trap sampled from 0.39% - 0.31% of these released fish /Table 2).

Sub-yearling Chinook

One group of marked sub-year1 ing chinook was released from the Washington Department of Fisheries hatchery at Wells Dam. The median travel time to Rock Island Dam for this group was 14

days and the Rock Island bypass trap collected 0.29% of the marked fish from this release. These fish had a shorter travel distance than the yearl ing chinook released into the Methow River.

Steelhead

Marked steelhead (that were raised at the Washington Department of Game's Wells hatchery) were released on four dates (1, 5, 9, and 15 May) into the Methow River (Table 2). The last 3 steelhead release dates each included 2 or more release groups and brand configurations on each date. As a result, analysis of data for these release dates is difficult. Median travel times of the 3 largest groups of fish released on 1, 5, and 9 May (each approximately 30,000 steelhead) were 12, 10, and 10 days, respectively. Steelhead migrated downstream faster than chinook yearlings or sub-yearlings traveling about the same distance. Of the steelhead released on 1 and May, 2.17% and 2.03% were recovered, respectively, at the Rock Island bypass trap, compared to 0.79% and 0.63% of the fish in the 9 and 15 May releases, respectively.

Brands Conditions

Sub-yearling Chinook - Beginning in late June and throughout July, sub-yearling chinook brands (RD/S/l) were increasingly difficult to detect. We feel that it is probable that a small percentage of these brands ray have been overlooked because of their decreasing detectability.

Steelhead - During peak passage of steelhead smolts, a number of the branded fish exhibited brands which were ulcerated (broken through the skin). We collected data concerning ulcerated brands between 15 and 31 May. Seventeen percent of the brands observed during that period were ulcerated (Table 4). In 1985, over 50% of the branded steelhead collected at the Rock Island bypass trap had ulcerated brands. Overall, steelhead brands appeared to be in better condition in 1986 than in 1985.

SUMMARY

Between 1 April and 31 August, 1986, 176,188 downstream migrating salmonids were collected at the Rock Island Dam bypass trap. Freeze branded fish collected consisted of 901 chinook salmon and 1,502 steelhead trout. In addition, 2,290 chinook and 22,506 steelhead were collected that had clipped adipose fins.

The middle 80% of the salmonid outmigration passed Rock Island Dam between 5 May and 2 July, 1986, a 59 day period. The dates and duration of the outmigration was influenced by sub-yearling chinook. If sub-yearling chinook are excluded from

Table 4. Ulcerated steelhead brands observed at Rock Island bypass trap, 15 - 31 May, 1986 (percentages in parentheses).

Date	Brands					
	LA/7N/1		LA/7N/3		LD/7N/1	
5-15-86	6	(17)	11	(18)	2	(8)
5-16-86	4	(15)	11	(20)	3	(11)
5-18-86	3	(16)	2	(7)		0
5-19-86	2	(12)	1	(4)	1	(7)
5-20-86	4	(17)	3	(23)	2	(20)
5-21-86	3	(14)	2	(13)	3	(12)
5-22-86	4	(21)	6	(40)	4	(24)
5-23-86	5	(42)	4	(19)	3	(15)
5-24-86	3	0	2	(20)	5	(33)
5-25-86		(40)	2	(18)	1	(17)
5-26-86	2	0	1	(17)	1	(14)
5-27-86		(33)	1	0		0
5-30-86	1			(100)		0
5-31-86		0	3			0
Totals (averages):	37	(22)	49	(25)	25	(16)

analysis, the middle 80% of the outmigration was 29 April to 30 May, a 32 day period. Sub-yearling chinook comprised 25% of the fish collected at Rock Island Dam.

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APPENDIX

A-1 Daily samples from the Rock Island smolt monitoring program, April 1986.
A-2 Daily samples from the Rock Island smolt monitoring program, May 1986.
A-3 Daily samples from the Rock Island smolt monitoring program, June 1986.
A-4 Daily samples from the Rock Island smolt monitoring program, July 1986.
A-5 Daily samples from the Rock Island smolt monitoring program, August 1986.
A-6 Monthly summary of the Rock Island smolt monitoring program, April - August 1986.

B-1 Daily summary of marked chinook and steelhead sampled from the Rock Island bypass trap, April 1986.
B-2 Daily summary of marked chinook and steelhead sampled from the Rock Island bypass trap, May 1986.
B-3 Daily summary of marked chinook and steelhead sampled from the Rock Island bypass trap, June 1986.
B-4 Daily summary of marked chinook and steelhead sampled from the Rock Island bypass trap, July 1986.
B-5 Daily summary of marked chinook and steelhead sampled from the Rock Island bypass trap, August 1986.
B-6 Monthly summary of marked chinook and steelhead sampled from the Rock Island bypass trap, 1 April - 31 August 1986.

C-1 Chinook yearling run timing, Rock Island Dam, 1 April - 31 August, 1986.
c-2 Chinook sub-yearling run timing, Rock Island Dam, 1 April - 31 August, 1986.
c-3 Steelhead srolt run timing, Rock Island Dam, 1 April- 31 August, 1986.
c-4 Sockeye smolt run timing, Rock Island Dam, 1 April -- 31 August, 1986.
C-5 Coho smolt run timing, Rock Island Dam, 1 April - 31 August, 1986.
C-6 Total juvenile salmonid run timing, Rock Island Dam, 1 April through 31 August, 1986.

Appendix A-1. Daily salmonid catch, Rock Island bypass trap, April, 1986.

STOP DATE/TIME	CHINOOK YEARLING	CHINOOK SUB-YEAR.	STLHD.	COHO	SOCKEYE	TOTAL SALMONIDS
4-01-86/0900	50	0	11	0	2	63
4-02-86/0900	41	0	10	0	2	53
4-03-86/0900	51	0	4	0	12	67
4-04-86/0900	53	2	26	0	10	91
4-05-86/0900	42	2	6	0	48	98
4-06-86/0900	44	0	5	0	38	87
4-07-86/0900	67	0	6	0	82	155
4-08-86/0900	38	1	5	0	78	122
4-09-86/0900	47	0	13	0	42	102
4-10-86/0900	49	1	17	0	96	163
4-11-86/0900	45	0	11	0	284	340
4-12-86/0900	34	0	14	0	142	190
4-13-86/0900	36	0	24	0	40	100
4-14-86/0900	37	1	39	0	54	131
4-15-86/0900	29	0	32	0	77	138
4-16-86/0900	24	0	34	0	47	105
4-17-86/0900	37	1	31	0	32	101
4-18-86/0900	43	0	20	0	36	99
4-19-86/0900	24	0	24	0	224	272
4-20-86/0900	49	1	8	0	3218	3276
4-21-86/0900	36	0	26	0	530	592
4-22-86/0900	30	0	21	0	176	227
4-23-86/0900	45	0	32	0	398	475
4-24-86/0900	983	0	64	0	622	1669
4-25-86/0900	979	0	46	0	306	1331
4-26-86/0900	713	0	79	0	301	1093
4-27-86/0900	693	0	47	0	135	875
4-28-86/0900	520	0	57	0	129	706
4-29-86/0900	512	0	69	0	238	819
4-30-86/0900	509	0	54	0	389	952
Monthly Totals:	5860	9	835	0	7788	14492

Appendix A-3. Daily salmonid catch, Rock Island bypass trap, June, 1986.

STOP DATE/TIME	CHINOOK YEARLING	CHINOOK SUB-YEAR.	STLHD.	COHO	SOCKEYE	TOTAL SALMONIDS
6-01-86/0900	112	787	268	274	977	2418
6-02-86/0900	110	2505	224	375	1107	4321
6-03-86/0900	69	2359	154	220	1830	4632
6-04-86/0900	24	1635	127	82	680	2548
6-05-86/0900	27	1429	69	32	505	2062
6-06-86/0900	14	1723	57	18	307	2119
6-07-86/0900	6	1640	28	10	135	1819
6-08-86/0900	5	1773	38	3	31	1850
6-09-86/0900	3	1097	22	4	38	1164
6-10-86/0900	3	1124	18	4	33	1182
6-11-86/0900	12	1410	60	8	27	1517
6-12-86/0900	11	1007	45	6	10	1079
6-13-86/0900	3	844	37	1	18	903
6-14-86/0900	7	665	16	1	14	703
6-15-86/0900	5	557	17	3	8	590
6-16-86/0900	2	504	10	1	2	519
6-17-86/0900	0	547	10	0	6	563
6-18-86/0900	0	435	18	3	5	461
6-19-86/0900	1	394	19	3	2	419
6-20-86/0900	2	288	10	0	2	302
6-21-86/0900	3	180	10	0	0	193
6-22-86/0900	3	318	12	0	1	334
6-23-86/0900	6	362	10	1	2	381
6-24-86/0900	0	322	4	1	2	329
6-25-86/0900	0	607	11	1	4	623
6-26-86/0900	0	598	5	0	2	605
6-27-86/0900	0	502	8	1	2	513
6-28-86/0900	10	415	2	0	0	427
6-29-86/0900	11	429	4	0	1	445
6-30-86/0900	0	400	8	1	1	410
Monthly Totals:	449	26856	1321	1053	5752	35431

Appendix A-2. Daily salmonid catch, Rock Island bypass trap, May, 1986.

STOP DATE/TIME	CHINOOK YEARLING	CHINOOK SUB-YEAR.	STLHD.	COHO	SOCKEYE	TOTAL SALMONIDS
5-01-86/0900	723	1	51	0	497	1272
5-02-86/0900	420	1	80	0	236	737
5-03-86/0900	364	0	80	1	69	514
5-04-86/0900	417	0	79	0	30	526
5-05-86/0900	473	1	102	0	88	664
5-06-86/0900	1049	0	208	22	201	1480
5-07-86/0900	1513	2	220	121	218	2074
5-08-86/0900	828	2	292	147	142	1411
5-09-86/0900	734	1	293	135	133	1296
5-10-86/0900	862	1	522	240	422	2047
5-11-86/0900	808	0	450	186	549	1993
5-12-86/0900	613	1	822	204	362	2002
5-13-86/0900	432	2	866	330	238	1868
5-14-86/0900	349	3	916	537	168	1973
5-15-86/0900	418	5	1420	1706	739	4288
5-16-86/0900	370	2	1123	1751	1093	4339
5-17-86/0900	277	1	1686	2138	1026	5128
5-18-86/0900	310	0	1448	2147	1086	4991
5-19-86/0900	297	3	1884	2998	677	5859
5-20-86/0900	400	2	2242	4728	389	7761
5-21-86/0900	416	0	2479	5866	432	9193
5-22-86/0900	283	3	2180	3587	351	6404
5-23-86/0900	200	3	1771	3488	278	5740
5-24-86/0900	251	2	2004	3283	504	6044
5-25-86/0900	129	2	1164	2119	319	3733
5-26-86/0900	157	9	1119	3434	359	5078
5-27-86/0900	259	23	1055	3102	1207	5646
5-28-86/0900	272	17	858	2134	2423	5704
5-29-86/0900	243	29	563	1567	1598	4000
5-30-86/0900	156	75	461	897	1146	2735
5-31-86/0900	141	83	421	592	599	1836
Monthly Totals:	14164	274	28859	47460	17579	108336

Appendix A-4. Daily salmonid catch, Rock Island bypass trap, July, 1986.

STOP DATE/TIME	CHINOOK YEARLING	CHINOOK SUB-YEAR.	STLHD.	COHO	SOCKEYE	TOTAL SALMONIDS
7-01-86/0900	0	253	2	0	2	257
7-02-86/0900	0	255	1	0	1	257
7-03-86/0900	0	190	6	0	4	200
7-04-86/0900	0	227	2	0	1	230
7-05-86/0900	0	302	2	0	2	306
7-06-86/0900	0	156	0	0	2	158
7-07-86/0900	0	250	1	0	1	252
7-08-86/0900	0	564	3	0	3	570
7-09-86/0900	2	575	7	0	2	586
7-10-86/0900	2	902	10	0	12	926
7-11-86/0900	0	975	7	0	3	985
7-12-86/0900	1	857	3	0	8	869
7-13-86/0900	0	433	3	0	1	437
7-14-86/0900	0	427	4	0	2	433
7-15-86/0900	0	369	2	1	3	375
7-16-86/0900	0	258	4	0	4	266
7-17-86/0900	0	281	3	0	4	288
7-18-86/0900	0	313	2	0	2	317
7-19-86/0900	0	342	3	0	7	352
7-20-86/0900	0	383	1	0	12	396
7-21-86/0900	0	683	1	0	9	693
7-22-86/0900	0	920	8	0	5	933
7-23-86/0900	0	685	1	1	2	689
7-24-86/0900	0	760	2	1	17	780
7-25-86/0900	0	416	0	0	19	435
7-26-86/0900	0	376	0	0	3	379
7-27-86/0900	0	523	0	0	6	529
7-28-86/0900	0	474	2	0	4	480
7-29-86/0900	0	367	2	0	4	373
7-30-86/0900	0	301	0	0	3	304
7-31-86/0900	0	316	0	0	1	317
Monthly Totals:	5	14133	82	3	149	14372

Appendix A-5. Daily salmonid catch, Rock Island bypass trap, August, 1986.

STOP DATE/TIME	CHINOOK YEARLING	CHINOOK SUB-YEAR.	STLHD.	COHO	SOCKEYE	TOTAL SALMONIDS
8-01-86/0900	0	207	0	0	0	207
8-02-86/0900	0	340	2	0	1	343
8-03-86/0900	0	339	0	0	1	340
8-04-86/0900	0	204	0	0	2	206
8-05-86/0900	0	233	0	0	0	233
8-06-86/0900	0	305	1	0	4	310
8-07-86/0900	0	272	0	0	1	273
8-08-86/0900	0	126	0	0	0	126
8-09-86/0900	0	94	0	0	1	95
8-10-86/0900	0	103	0	0	0	103
8-11-86/0900	0	148	0	0	0	148
8-12-86/0900	1	150	0	0	2	153
8-13-86/0900	0	89	0	0	0	89
8-14-86/0900	0	127	2	0	0	129
8-15-86/0900	0	115	0	0	2	117
8-16-86/0900	0	91	0	0	0	91
8-17-86/0900	0	69	2	0	1	72
8-18-86/0900	0	86	1	0	1	88
8-19-86/0900	0	79	2	0	2	83
8-20-86/0900	0	51	0	0	0	51
8-21-86/0900	0	33	1	0	0	34
8-22-86/0900	0	26	0	0	0	26
8-23-86/0900	0	34	0	0	0	34
8-24-86/0900	0	18	0	0	1	19
8-25-86/0900	0	15	0	0	0	15
8-26-86/0900	0	31	1	0	0	32
8-27-86/0900	0	51	0	0	0	51
8-28-86/0900	0	25	0	0	0	25
8-29-86/0900	0	16	0	0	0	16
8-30-86/0900	0	22	0	0	0	22
8-31-86/0900	0	15	0	0	0	15
Monthly Totals:	1	3514	12	0	19	3546

Appendix A-6. Monthly summary of salmonid catch at Rock Island Dam, 1 April - 31 August, 1986.

MONTH	CHINOOK YEARLING	CHINOOK SUB-YEAR.	STLRD.	COHO	SOCKEYE	TOTAL SALMONIDS
April	5860	9	835	0	7786	14492
May	14164	274	28859	47460	17579	108336
June	449	26869	1321	1053	5751	35443
July	5	14133	81	3	149	14371
August	1	3514	12	0	19	3546
Yearly Totals:	20479	44799	31108	48516	31286	176188

Appendix B-1. Daily summary of marked chinook and steelhead sampled from the Rock Island bypass trap, April, 1986.

	CHINOOK BRANDS						STEELHEAD BRANDS									
DATE	RA/7C/1	RA/7C/3	LA/7T/1	RA/7T/3	RD/S/1	AD CLIP	LA/7N/1	LA/7N/3	LD/7N/1	LA/N7/3	LA/N7/1	LD/N7/1	RA/P7/1	RA/P7/3	RD/P7/1	AD CLIP
04/01/86						10										
04/02/86						1										1
04/03/86						6										
04/04/86						1										1
04/05/86						3										
04/06/86						1										1
04/07/86						2										
04/08/86						2										
04/09/86						5										
04/10/86						2										2
04/11/86						7										1
04/12/86						9										3
04/13/86						1										3
04/14/86						4										4
04/15/86																6
04/16/86						1										3
04/17/86						3										3
04/18/86						4										3
04/19/86						2										1
04/20/86						4										9
04/21/86						7										2
04/22/86						5										6
04/23/86						5										17
04/24/86						4										7
04/25/86			8			1										15
04/26/86	1		8			3										8
04/27/86			8			2										5
04/28/86	3		9			2										7
04/29/86	3	2	8			2										8
04/30/86	2		3													
Monthly Totals:	9	2	44	0	0	99	0	0	0	0	0	0	0	0	0	118

Appendix B-2. Daily summary of marked chinook and steelhead sampled from the Rock Island bypass trap, May, 1986.

	CHINOOK BRANDS						STEELHEAD BRANDS									
DATE	RA/7C/1	RA/7C/3	LA/7T/1	RA/7T/3	RD/S/1	AD CLIP	LA/7N/1	LA/7N/3	LD/7N/1	LA/N7/3	LA/N7/1	LD/N7/1	RA/P7/1	RA/P7/3	RD/P7/1	AD CLIP
05/01/86	1		8													9
05/02/86	2	1	5													27
05/03/86	2	1	4	1		6										33
05/04/86	4	1	4	2		7										32
05/05/86		2	6			7	4									43
05/06/86	5	1	7	3		279	13									120
05/07/86	9	9	20	5		295	33									157
05/08/86	4	1	9	3		135	42									195
05/09/86	5	3	10	3		87	52	3								228
05/10/86	5	5	14	5		101	67	55								424
05/11/86	4	2	19	1		93	40	31								259
05/12/86	2	4	12	5		85	55	85								614
05/13/86	5	5	7	2		44	60	75	2							628
05/14/86	3	2	5	5		36	32	53	10							682
05/15/86	5	1	9	3		37	36	60	25							1063
05/16/86	2	1	7	2		40	26	55	28							962
05/17/86	3	1	2	3		26	28	40	21							1383
05/18/86	4	1	3	3		41	19	27	16							1223
05/19/86	2	2	1	1		24	17	25	14							1539
05/20/86	6	7	12	6		33	23	13	10							1984
05/21/86	4	2	6	4		23	21	16	26	2	2			1		1975
05/22/86	3	6	6	8		10	19	15	17	2	1		1			1546
05/23/86	4	6	5	3		4	12	21	20		1		1	2		1287
05/24/86	7	7	3	4		1	14	10	15		1	1				1508
05/25/86	1	1	4			8	5	11	6							793
05/26/86	2	2	4	3		7	5	6	7			1				702
05/27/86	5	5	6	5		9	6	4	4							619
05/28/86	8	4	8	4		8	2	1	4		1					562
05/29/86	5	10	1	4		4	2					1				326
05/30/86	6	5	3	9		3	3	1								268
05/31/86	3	4		5		1	2	3	2					1		271
Monthly Totals:	121	102	210	102	0	1454	638	610	227	4	6	3	2	4	0	21562

Appendix B-3. Daily summary of marked chinook and steelhead sampled from the Rock Island bypass trap, June, 1986.

	CHINOOK BRANDS						STEELHEAD BRANDS									
DATE	RA/7C/1	RA/7C/3	LA/7T/1	RA/7T/3	RD/S/1	AD CLIP	LA/7N/1	LA/7N/3	LD/7N/1	LA/N7/3	LA/N7/1	LD/N7/1	RA/P7/1	RA/P7/3	RD/P7/1	AD CLIP
06/01/86	2	1		4		6				1	2					200
06/02/86	2	3				1					1					128
06/03/86				1	4	4										103
06/04/86					14	12					1					79
06/05/86		1			18	47			1							45
06/06/86					17	42			1							38
06/07/86					15	33										14
06/08/86					10	53										21
06/09/86					16	23					1					15
06/10/86					12	28										9
06/11/86					35	57										29
06/12/86					12	12										28
06/13/86					12	12										19
06/14/86					1	3										3
06/15/86					2	5										5
06/16/86					2	2										4
06/17/86					2	3										5
06/18/86																4
06/19/86																11
06/20/86						2										4
06/21/86					1	1										5
06/22/86																4
06/23/86																4
06/24/86					1	1										1
06/25/86						6										5
06/26/86					3	5										1
06/27/86					5	4										4
06/28/86					1	1										1
06/29/86						1										
06/30/86					2	2										5
Monthly Totals:	4	5	0	5	185	366	0	0	2	1	5	0	0	0	0	794

Appendix B-4. Daily summary of marked chinook and steelhead sampled from the Rock Island bypass trap, July, 1986.

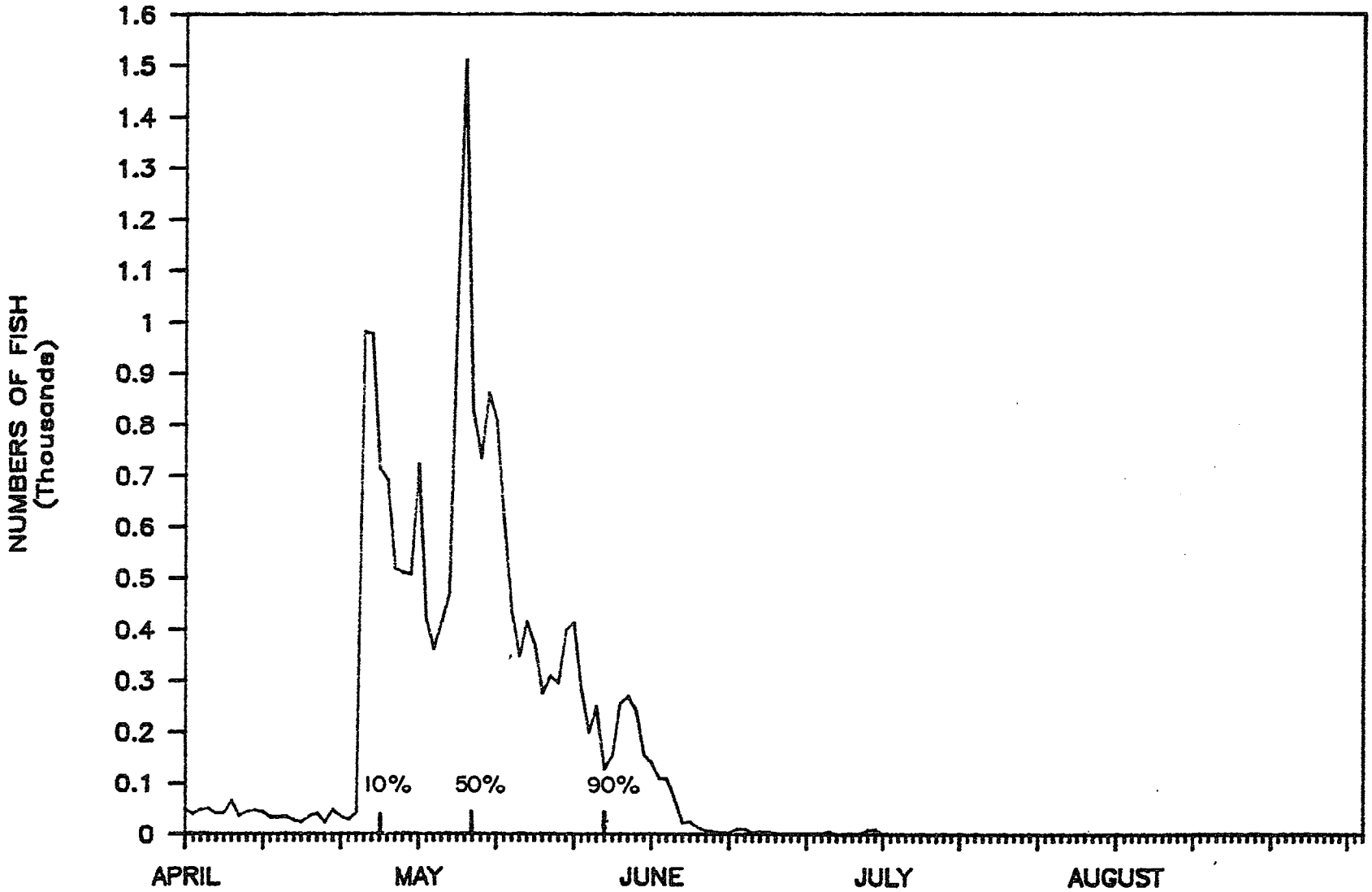
	CHINOOK BRANDS						STEELHEAD BRANDS									
DATE	RA/7C/1	RA/7C/3	LA/7T/1	RA/7T/3	RD/S/1	AD CLIP	LA/7N/1	LA/7N/3	LD/7N/1	LA/N7/3	LA/N7/1	LD/N7/1	RA/P7/1	RA/P7/3	RD/P7/1	AD CLIP
07/01/86					2	1										
07/02/86																
07/03/86																4
07/04/86						2										1
07/05/86						7										
07/06/86						3										
07/07/86					2	1										
07/08/86						11										
07/09/86					4	17										1
07/10/86					26	36										4
07/11/86					24	58										4
07/12/86					17	61										
07/13/86					4	13										
07/14/86					1	2										3
07/15/86						3										2
07/16/86					2	8										4
07/17/86					1	2										2
07/18/86					1	6										2
07/19/86					4	5										
07/20/86					2	14										
07/21/86					7	25										1
07/22/86					4	24										
07/23/86					2	20										1
07/24/86					6	8										
07/25/86						5										
07/26/86					2	2										
07/27/86						3										
07/28/86					1	1										
07/29/86																1
07/30/86																
07/31/86																
Monthly Totals:	0	0	0	0	112	338	0	0	0	0	0	0	0	0	0	30

Appendix B-5. Daily summary of marked chinook and steelhead sampled from the Rock Island bypass trap, August, 1986.

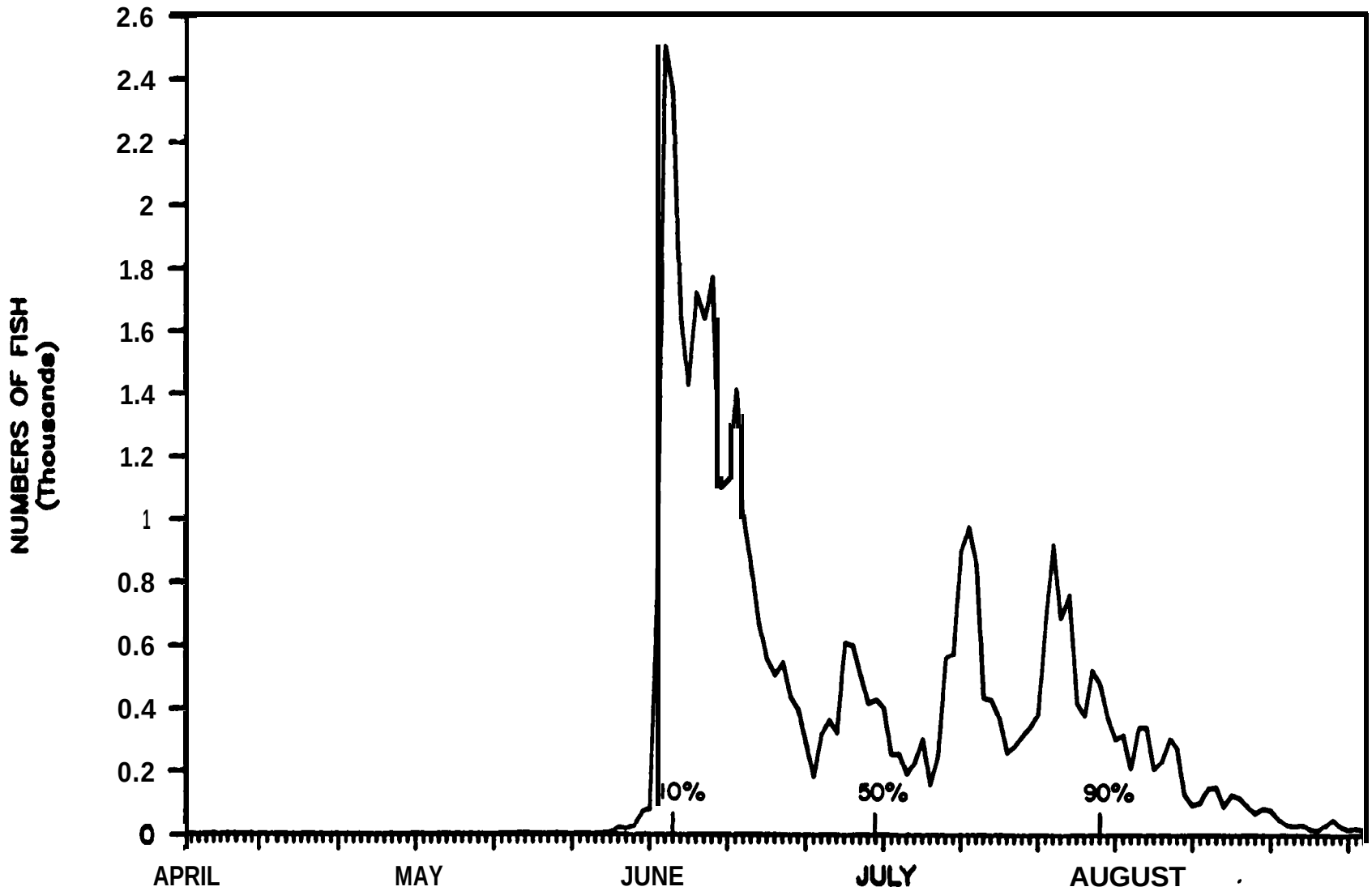
	CHINOOK BRANDS						STEELHEAD BRANDS									
DATE	RA/7C/1	RA/7C/3	LA/7T/1	RA/7T/3	RD/S/1	AD CLIP	LA/7N/1	LA/7N/3	LD/7N/1	LA/N7/3	LA/N7/1	LD/N7/1	RA/P7/1	RA/P7/3	RD/P7/1	AD CLIP
08/01/86																
08/02/86																1
08/03/86						1										
08/04/86						1										
08/05/86						2										
08/06/86						1										1
08/07/86						8										
08/08/86						2										
08/09/86						1										
08/10/86						2										
08/11/86						3										
08/12/86						2										
08/13/86																
08/14/86																
08/15/86						1										
08/16/86						3										
08/17/86																
08/18/86						1										
08/19/86						2										
08/20/86						1										
08/21/86																
08/22/86																
08/23/86																
08/24/86																
08/25/86						1										
08/26/86																
08/27/86						1										
08/28/86																
08/29/86																
08/30/86																
08/31/86																
Monthly Totals:	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	2

Appendix B-6. Monthly summary of marked chinook and steelhead sampled from the Rock Island bypass trap, 1 April - 31 August, 1986.

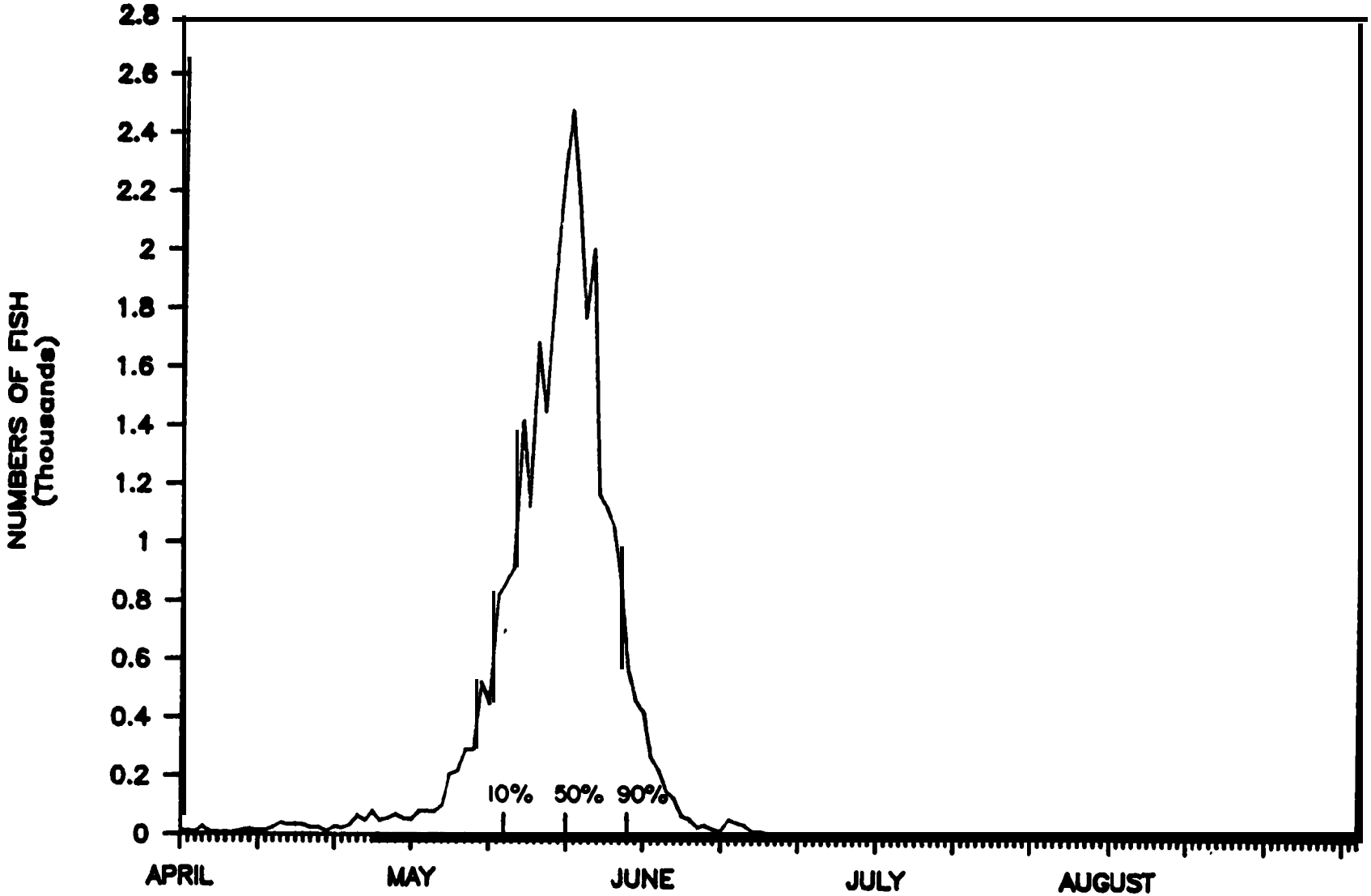
	CHINOOK BRANDS						STEELHEAD BRANDS									
MONTH	RA/7C/1	RA/7C/3	LA/7T/1	RA/7T/3	RD/S/1	AD CLIP	LA/7N/1	LA/7N/3	LD/7N/1	LA/N7/3	LA/N7/1	LD/N7/1	RA/P7/1	RA/P7/3	RD/P7/1	AD CLIP
April	9	2	44	0	0	99	0	0	0	0	0	0	0	0	0	118
May	121	102	210	102	0	1454	638	610	227	4	6	3	2	4	0	21562
June	4	5	0	5	185	366	0	0	2	1	5	0	0	0	0	794
July	0	0	0	0	112	338	0	0	0	0	0	0	0	0	0	30
August	0	0	0	0	0	33	0	0	0	0	0	0	0	0	0	2
Yearly Totals:	134	109	254	107	297	2290	638	610	229	5	11	3	2	4	0	22506



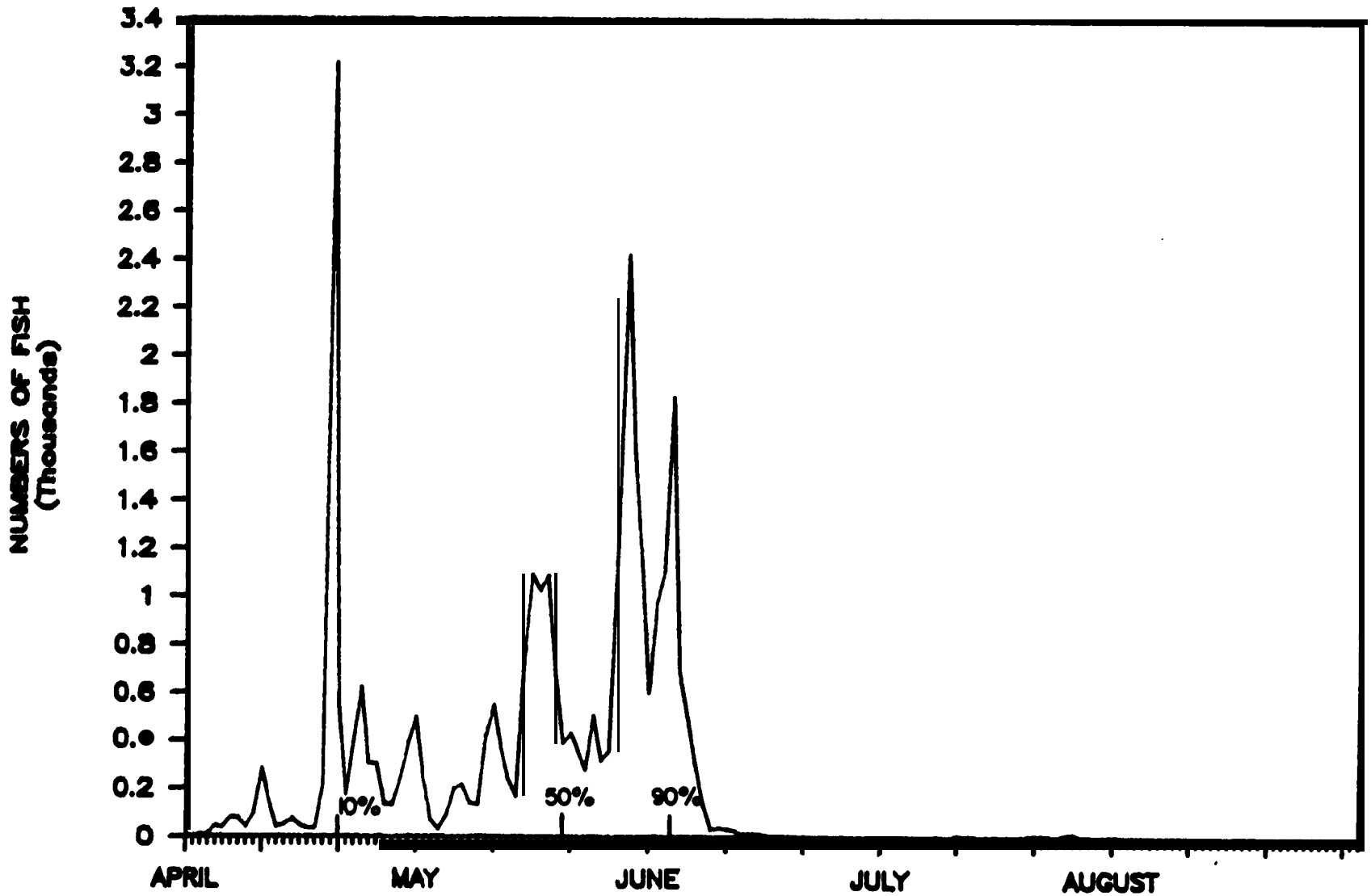
Appendix C-1. Chinook yearling run timing, Rock Island Dam, 1 April - 31 August, 1986.



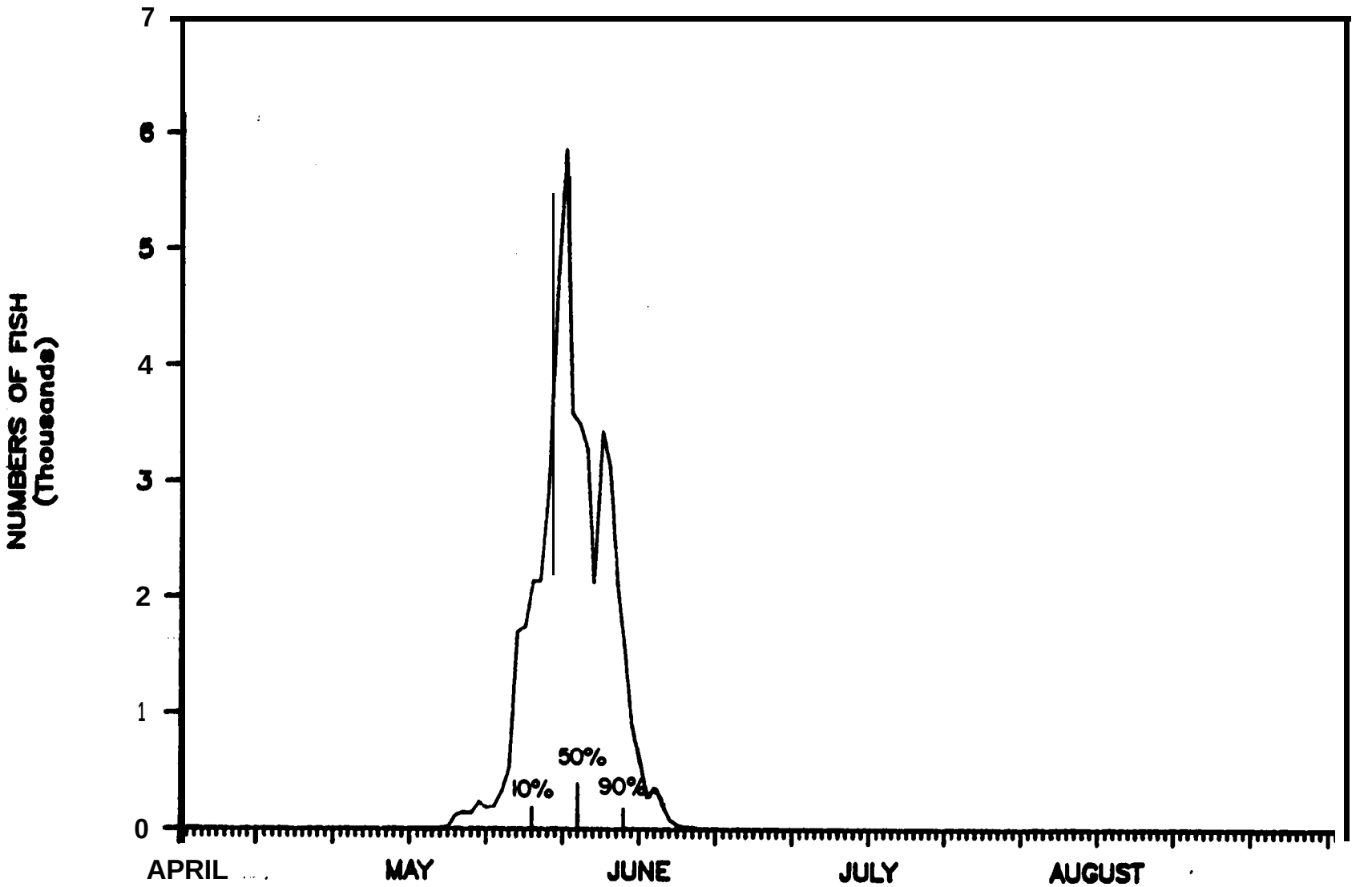
Appendix C-2. Chinook sub-yearling run timing, Rock Island Dam, 1 April - 31 August, 1986.



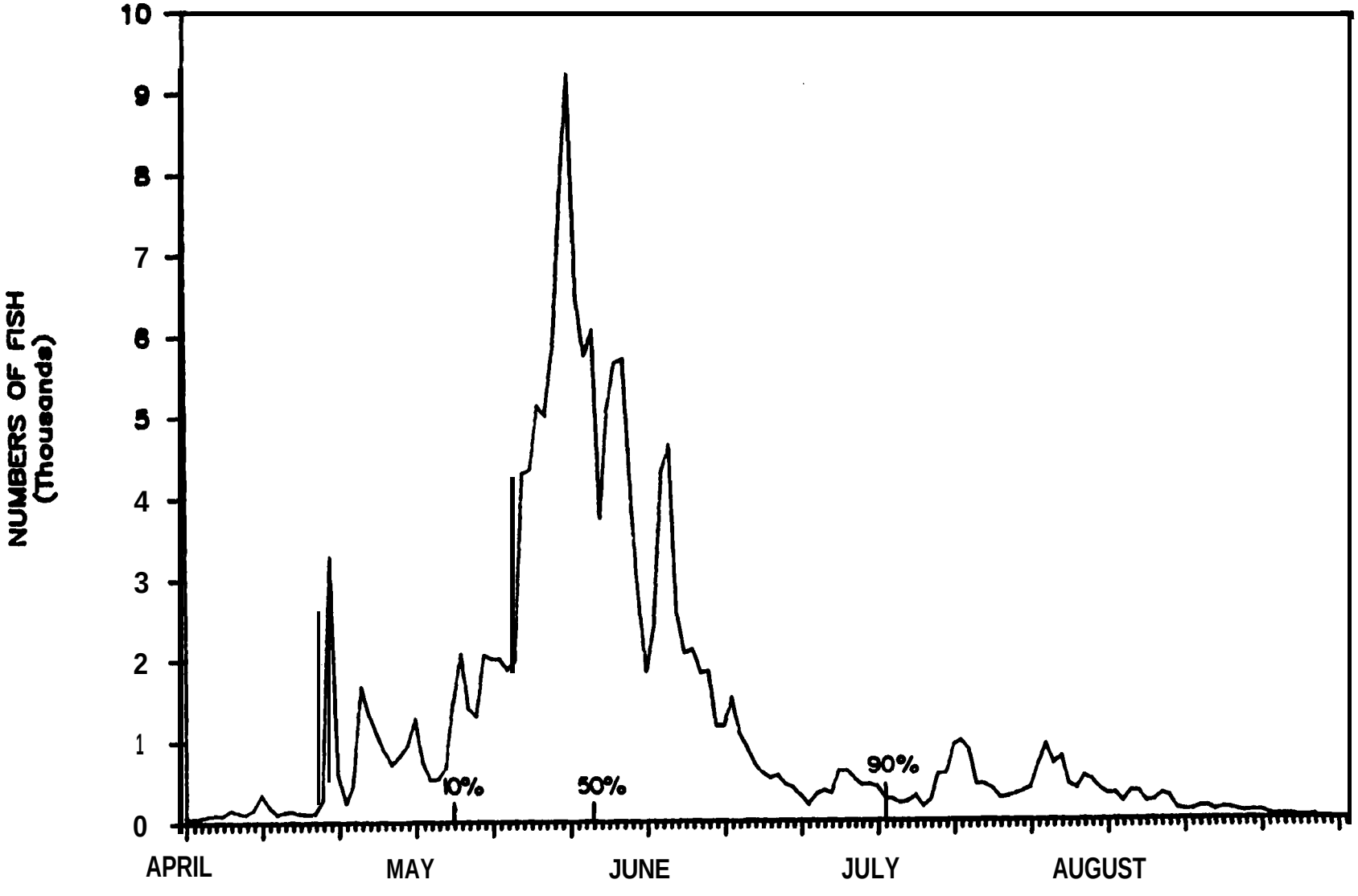
Appendix C-3. Steelhead smolt run timing, Rock Is and Dam, 1 April - 31 August, 1986.



Appendix C-4. Soc eye smolt run timing, Rock Island Dam, 1 April - 31 August, 1986.



Appendix C-5. Coho smolt run timing, Rock Island Dam, 1 April - 31 August, 1986.



Appendix C-6. Total juvenile salmonid run timing, Rock Island Dam, 1 April 31 August, 6.