

ROCK ISLAND DAM SMOLT MONITORING, 1994 AND 1995

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ABSTRACT

Downstream migrating salmon and steelhead trout (*Oncorhynchus* spp.) smolts were monitored at the Rock Island Dam bypass trap from April 1 - August 31, 1994. This was the tenth consecutive year that the bypass trap was monitored. Data collected included: 1) number of fish caught by species, 2) number of adipose clipped and/or Passive Integrated Transponder (PIT) tagged fish caught by species, 3) daily average riverflow, 4) daily average powerhouse #1 and #2 flows and daily average spill. These data were transmitted to the Fish Passage Center, which manages the Smolt Monitoring Program throughout the Columbia River Basin. The Smolt Monitoring Program is used to manage the "water budget", releasing upstream reservoir water storage allocated to supplement river flows to enhance survival of downstream migrating juvenile salmonids.

The Rock Island Dam trapping facility collected 37,795 downstream migrating salmonids in 1994. Collected fish included 4 yearling and 4 sub-yearling chinook salmon (*O. tshawytscha*) that had been previously PIT tagged to help determine migration rates. Additionally, 1,132 sub-yearling chinook, 4,185 yearling chinook, 6,627 steelhead, (*O. mykiss*) and 422 sockeye (*O. nerka*) with clipped adipose fins were collected. The middle 80% of the 1994 spring migration (excluding sub-yearling chinooks) passed Rock Island Dam during a 34 day period, April 25 - May 28. Passage rates of chinook and steelhead smolts released from hatcheries and the downstream migration timing of all salmonids are presented. The spring migration timing of juvenile salmonids is strongly influenced by hatchery releases above Rock Island Dam.

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INTRODUCTION

The Northwest Power Planning Council, in 1982, 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 for instream flow supplementation to improve migration conditions for juvenile salmon (*Oncorhynchus* spp.) and steelhead trout (*O. mykiss*) on their journey to the ocean. The Council's plan also called for studies to monitor juvenile fish migration timing and survival. The fishery agencies and tribes formed a Water Budget Center (renamed as the Fish Passage Center (FPC)) to direct the use of the water budget and to conduct and coordinate studies related to water budget management and evaluation. The FPC developed a Smolt Monitoring Program (SMP) 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 located downstream from all major salmon and steelhead producing tributaries of the mid-Columbia River Basin (Figure 1).

The 1994 SMP for Rock Island Dam was designed to index the daily number of outmigrating salmonids and to report numbers of adipose clipped and/or previously Passive Integrated Transponder (PIT) tagged juveniles collected. A PIT tagging operation based on parameters not to exceed 3,500 fish/species for yearling chinook, (*O. tshawytscha*) sockeye, (*O. nerka*) and steelhead trout was implemented. Additionally, no more than 5,400 sub-yearling chinook were PIT tagged during the summer outmigration. Data collected under this program allow comparison and evaluation of year to year migration timing and travel time of different races of juvenile salmonids, both hatchery and naturally produced. U.S. Fish & Wildlife Service personnel monitored ATPase levels for assessment of smolt condition for travel time analysis of spring out-migrant salmonids by gill clipping sub-samples of PIT tagged and run-of-the-river fish. Additionally; sub-yearling chinook that were PIT tagged were monitored for ATPase levels by personnel of the Public Utility District No. 1 of Chelan County (the District). Funding of the program, as implemented by the FPC, was provided by the Bonneville Power Administration. The District provided the trapping facility, personnel, and equipment to conduct the monitoring.

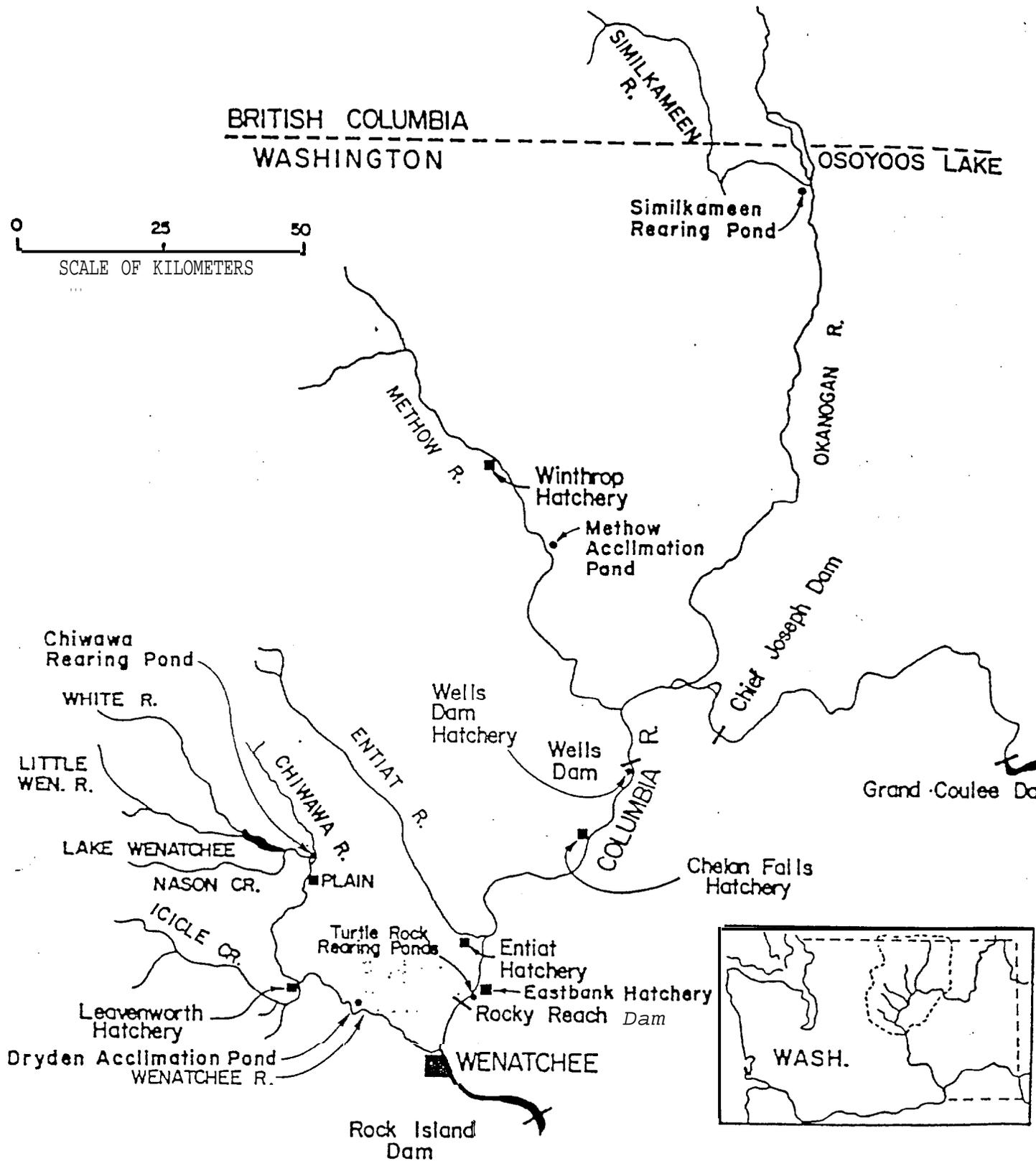


Figure 1. Columbia River between Rock Island and Grand Coulee dams showing major tributaries and hatcheries.

METHODS

Daily sampling data collected at the Rock Island Dam monitoring station included 1) total number of fish caught by species, 2) total number of PIT tagged and/or fin clipped fish caught by species, 3) percent of descaled fish, (alternating days), 4) daily average riverflow, 5) daily average flow through powerhouse #1 (old powerhouse) and powerhouse #2 (new powerhouse) (Figure 2), and daily average spill. The flow data were recorded so that an expanded index of fish passage through powerhouse #2 could be developed based on the bypass collection count in relation to the proportion of total riverflow passing through powerhouse #2.

Travel time between hatchery release points and Rock Island Dam monitoring station were estimated by PIT tagging sub-samples of hatchery fish before release. Additionally, adipose clipped, coded wire tagged yearling and sub-yearling chinook and sockeye were counted.

The overall physical condition of the fish trapped at Rock Island Dam were recorded on alternating days. Qualifying the condition of the fish was based on the degree of descale present; fish with $20\% \leq$ scale loss/side were considered "OK". Fish with $20\% >$ scale loss/side were counted as "Descaled". Evidence of or lack of gas bubble disease and the degree of symptoms was recorded and reported on alternate days. The number of fish that perished within the trap were also counted daily.

Fish were collected from the second powerhouse turbine intake gatewells and fishway attraction water intake. Fish entering the gatewells and attraction water intake passed into a bypass channel through a series of submerged orifices (Figure 3). An inclined screen trap separated the fish from the 100 cfs bypass flow and confined them to a holding flume where they were retained for up to 24 hours before processing (Figure 4). All fish collected in the bypass channel were sampled.

Fish collected by the trap during the 24 hour sampling period (0900-0900) were crowded into an elevator hopper, raised to the upper deck of the dam, and released into a 12' x 4' x 3.5' aluminum holding tank. The holding tank was supplied continuous water flow from the right bank fishladder with a 5 hp. submersible pump.

Before being dipped from the aluminum tank, fish were pre-anesthetized in an isolation chamber of the tank with an alcohol/Benzocaine solution. Groups of 30-50 fish were then dip netted into a flume that passed into the processing trailer where they were further anesthetized with a solution of Tricaine Methane Sulfonate (MS 222) before handling. An ionic salt solution, ProPoly Aqua, was added to all fish processing tubs within the trailer in an attempt to reduce stress during handling and enhance

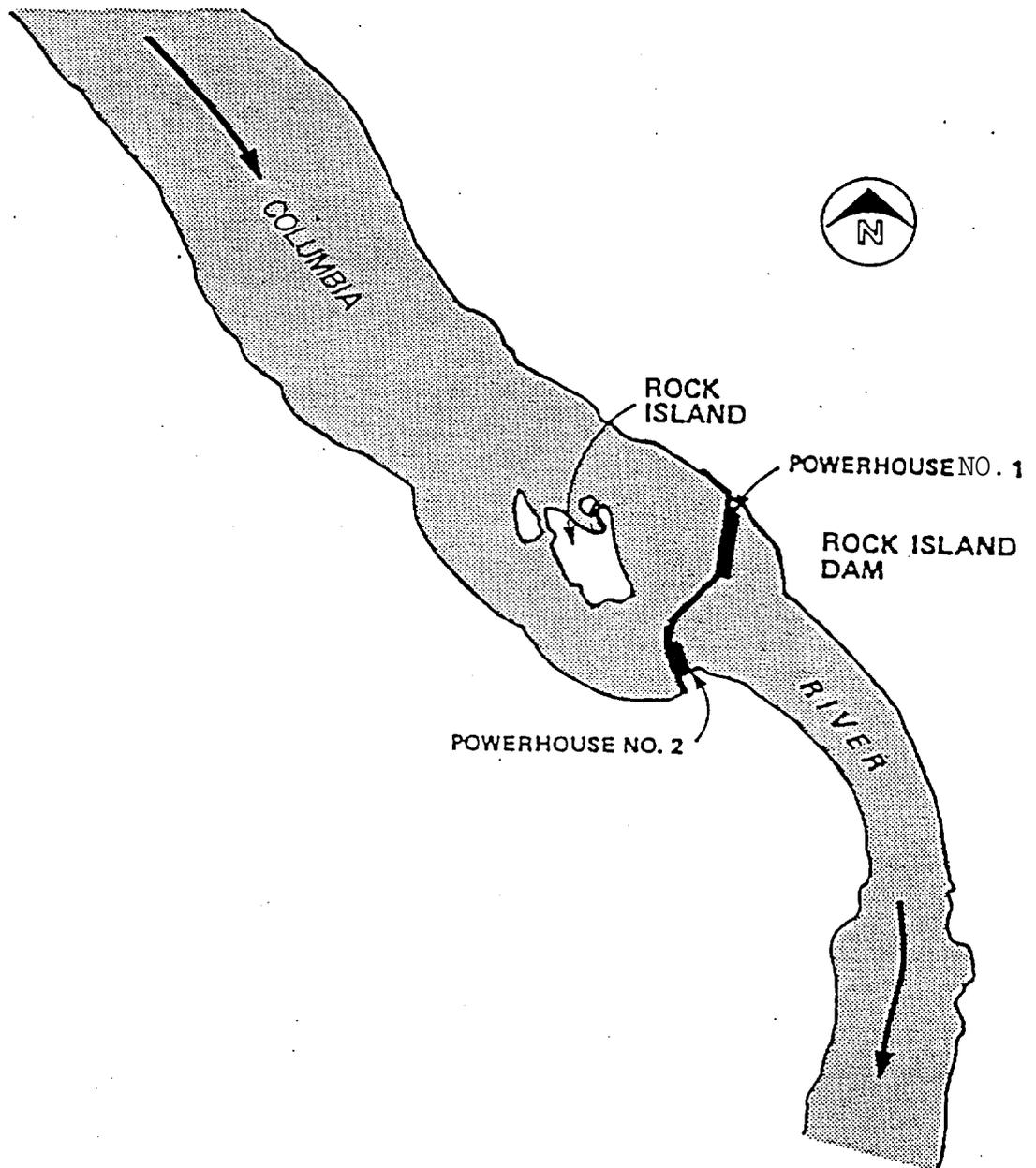


Figure 2. Location of powerhouse #1 and powerhouse #2 of Rock Island hydroelectric project.

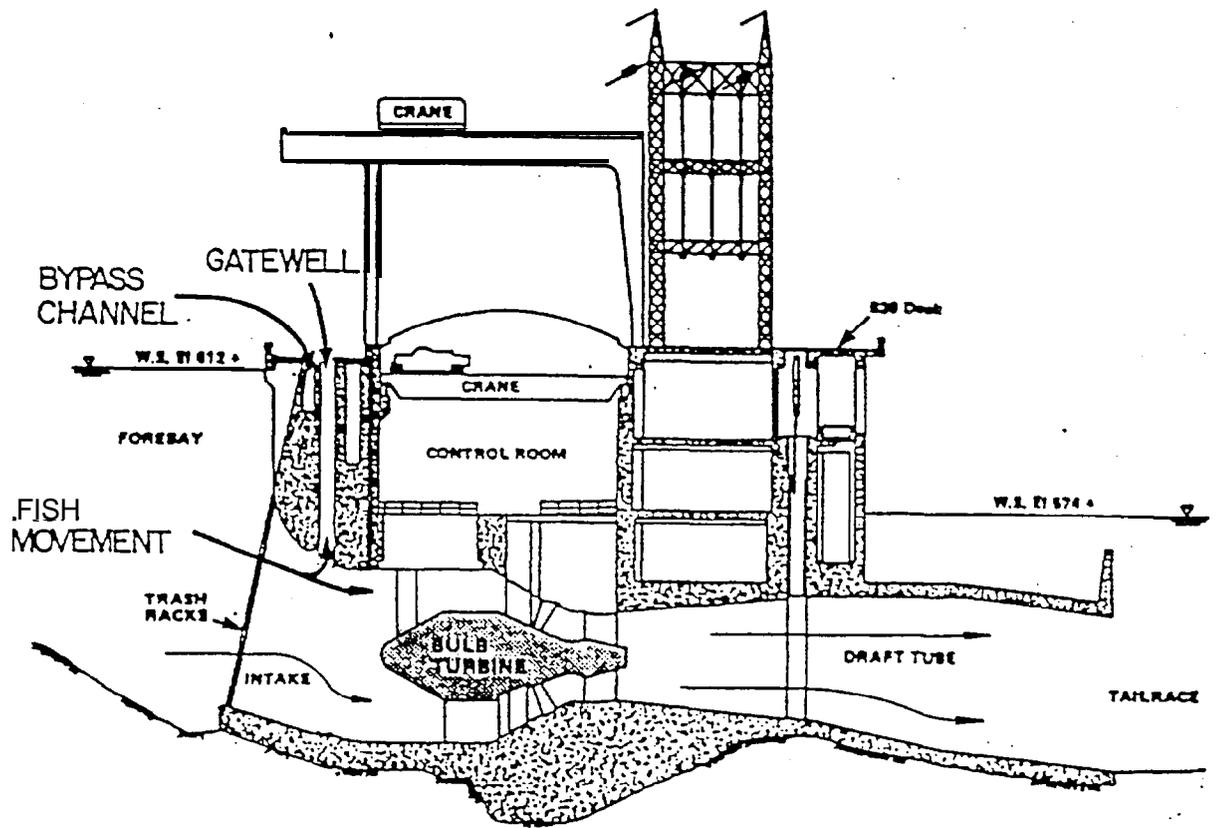


Figure 3. Section through Rock Island Dam second powerhouse indicating fish movement into gatewell system.

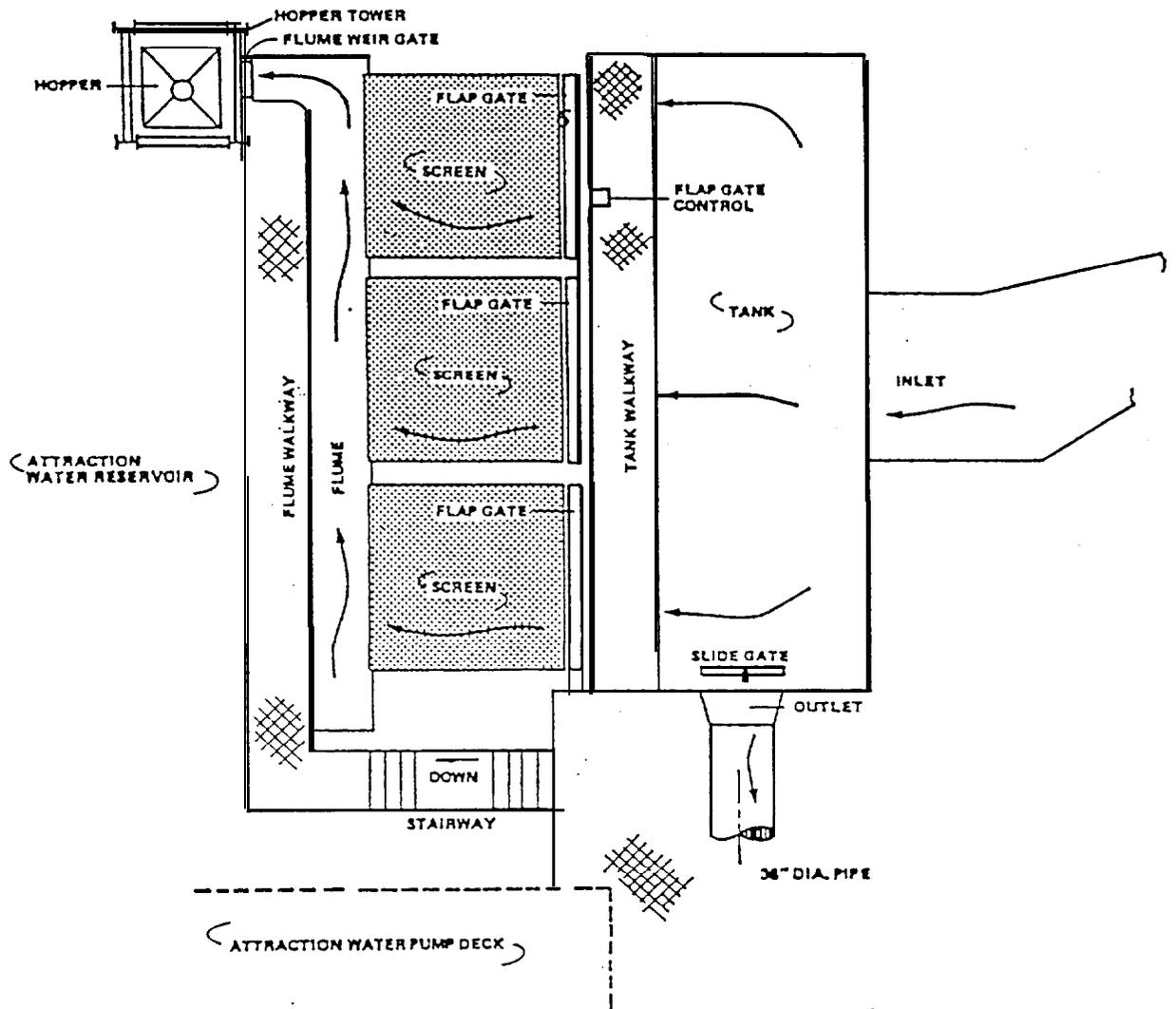


Figure 4. Rock Island Dam juvenile salmon fingerling collection trap.

wound healing from the PIT tagging process. Periodic timing of the pre-anesthetizing, identification, and recovery processes were conducted to insure against overexposure to the anesthetic. All fish were identified by species and scanned for PIT tags, clipped fins, gas bubble disease, and descale.

After the examined fish had fully recovered from the effects of the anesthesia, they were released through a 4" PVC pipe from the recovery section of the tank (elevation 620' m.s.l.) to the tailrace (elevation 574' m.s.l.) (Figure 5). The release area of the tailrace was protected from gull predation with parallel lengths of stainless steel wire at approximately 10 foot intervals overhead of the pipe outlet and across the tailrace area. In addition, an employee of the U. S. Department of Agriculture's Animal Damage Control Division suppressed gull (*Lams spp.*) predation in the tailrace during the middle 80% of the spring migration by various behavior modifying techniques.

Data pertinent to the smolt monitoring program were transferred to the FPC (Portland, OR) daily via a personal computer that was located at the dam.

Fork length measurements and scale samples were taken three times per week from subsamples of sockeye. Steelhead were categorized as "naturally-produced" or "hatchery" according to clipped adipose fin, or if an adipose fin was present, a worn appearance of the dorsal and ventral fins (Peven and Hays 1989). Hatchery produced steelhead released in Washington State waters since 1985 have been adipose fin clipped.

In addition to the smolt monitoring program, subsamples of chinook yearlings, steelhead, and sockeye were injected with PIT tags each day between April 19 and May 31. Beginning on June 15, sub-yearling summer and fall chinook were tagged on a weekday basis until August 31. PIT tags were injected by hand using a medical syringe/pushrod mechanism with a 12 gauge size veterinary needle attached. Syringes and needles were sterilized a minimum of 15 minutes in a bath of 95% ethanol prior to re-use. A random subsample of not more than 150 each of yearling chinook, steelhead, and sockeye were PIT tagged daily. Sub-yearling chinook PIT tagging numbers were not to exceed 200 fish/day. Data were entered into a portable computer and sent to the FPC daily. The fish that were PIT tagged at Rock Island Dam were "recaptured" at the McNary Dam bypass trap, where travel time estimates were recorded. Results of the PIT tagging program will be reported by the FPC.

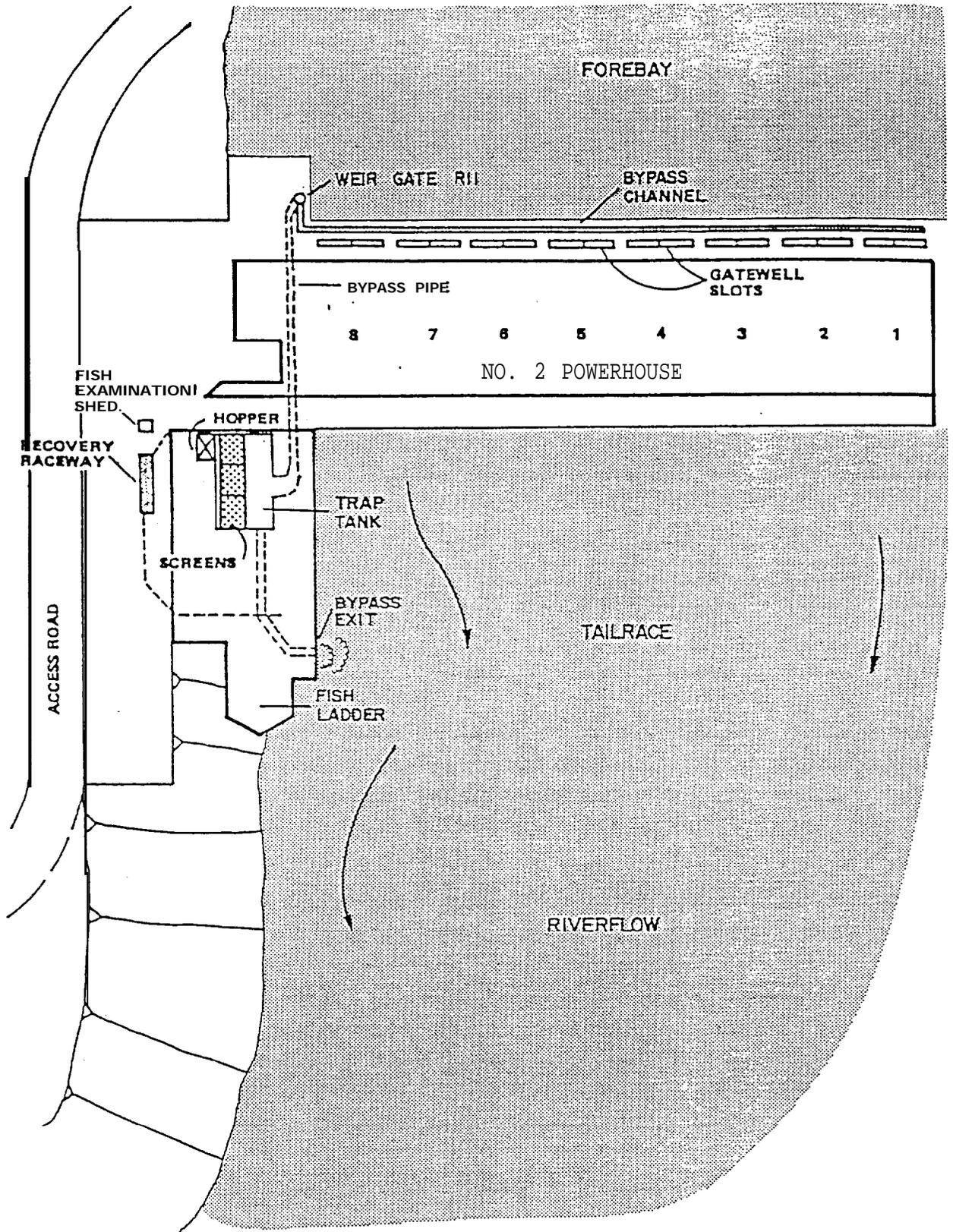


Figure 5. Plan view of juvenile salmonid bypass and collection system at Rock Island Dam second powerhouse (taken from Olson 1983).

U.S. Fish and Wildlife Service personnel monitored ATPase levels weekly from April 19 - May 31 for yearling chinook. Sub-samples of both PIT tagged fish and run-of-the-river fish were sampled to assess the physiological condition of smolts for travel time analysis. From June 15 - August 24, District personnel conducted similar ATPase sampling of PIT tagged sub-yearling chinook three times a week. The results of the sampling were reported to the FPC, providing additional data for managing the fish outmigration.

RESULTS AND DISCUSSION

The Rock Island Dam trapping facility collected 37,795 juvenile salmon and steelhead during the 1994 smolt monitoring program (Appendix A). Hatchery fish collected with adipose clipped fins and coded wire tags accounted for 4,185 yearling chinook, 1,132 sub-yearling chinook, 6,627 steelhead and 422 sockeye.

PIT tagging operations occurred at Rock Island Dam to provide migration timing rates for mid-Columbia juvenile salmonids. Table 1 summarizes the PIT tag marking program, listing the species tagged, rearing type, and number of fish tagged; for both spring and summer out-migrants.

An examination of daily powerhouse #2 turbine flows in proportion to total river flow showed a variance in powerhouse operations during the period of peak salmonid outmigration. Monthly average percent of total river flow through powerhouse #2 for the period of April 1 through June 30 ranged from 66.8 to 76.0 % and daily averages ranged from 19.9 to 85.5% (Table 2).

Average daily hydraulic data for Rock Island Dam were supplied to the FPC, which used it to develop an expansion of Rock Island trap data. The expansion was derived by multiplying the actual trap collection count 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 #2 flow + spill)). A comparison of actual trap collection counts, the expanded index, and the nine year average (1985 - 1993) of actual counts (Table 3) indicated some differences in the smolt run timing.

There were significant differences observed in 1994 smolt abundance for all species captured as compared to the nine year average. Yearling and sub-yearling chinook had substantial differences in abundance comparison between actual collection counts and the nine year average. Both were down 56% from the nine year average. Sockeye collection was down 44% from the nine year average (Table 3).

Table 1, PIT tag marking at Rock Island Dam, April 19 - August 31, 1994.

Spring Marking (April 19 - May 31, 1994)					
Chinook		Steelhead		Sockeye	
Rearing Type	Number Released	Rearing Type	Number Released	Rearing Type	Number Released
Hatchery	1668	Hatchery	1758	Hatchery	190
Unknown	1826	Wild	1249	Wild	3026
Total	3494		3007		3216

Summer Marking (June 15 - August 31, 1994)

Chinook	
Rearing Type	Number Released
Hatchery	631
Unknown	4707
Total	5338

Table 2. Rock Island Dam powerhouse operations expressed in KCFS and percent streamflow,
April 1 -August31,1994.

	Average KC FS				
	April	May	June	July	August
Total River Flow	85.2 (56.0-117.3)	117.1 (87.6-152.8)	147.3 (119.1-175.5)	104.2 (62.7-132.8)	75.4 (41.6-99.7)
Powerhouse #1	15.9 (5.6-58.1)	18.4 (3.1-44.2)	36.8 (13.4-62.5)	18.6 (6.1-33.1)	6.2 (0.5-32.5)
Powerhouse #2	61.2 (19.4-90.1)	77.9 (58.6-109.9)	106.1 (87.2-124.7)	79.4 (55.0-101.6)	68.2 (40-1-89.1)
Spill	(0.0-0.7)	22.8 (0.0-33.4)	3.3 (0.0-8.5)	5.2 (0.0-8.0)	0.0 (0.0-0.2)
	Average Percent of Total Flow				
Powerhouse #1	18.2 (6.7-59.7)	15.3 (3.0-30.7)	24.6 (11.3-36.8)	17.1 (6.1-37.7)	7.7 (0.6-39.3)
Powerhouse/#2	76.0 (19.9-92.1)	66.8 (48.6-85.5)	72.4 (60.4-85.5)	76.8 (58.0-88.6)	90.9 (59.4-98.2)
Spill	5.6 (0.0-21.7)	20.1 (0.0-26.5)	2.3 (0.0-6.8)	5.0 (0.0-10.4)	0.0 (0.0-0.2)

*Monthly ranges appear in parenthesis

Table 3. Comparison of actual, expanded, and the 9 year average (actual counts) of fish counts for passage dates for the Rock Island Dam bypass trap, 1994.

Species		Totals	Numbers			Date		
			10%	50%	90%	10%	50%	90%
<i>Chinook yearling</i>	Actual	8,471	847	4,236	7,624	Apr 22	May 17	Jun 06
	Expanded	32,088	3,209	16,044	28,879	Apr 04	Apr 25	May 25
	9 year avg.	19,448	1,945	9,724	17,503	Apr 21	May 10	Jun 03
<i>Chinook sub-yearling</i>	Actual	10,774	1,077	5,387	9,697	Jun 09	Jun 30	Aug 03
	Expanded	17,523	1,752	8,762	15,771	Apr 10	Jun 26	Jul 29
	9 year avg.	24,534	2,453	12,267	22,080	Jun 03	Jul 04	Aug 03
<i>Steelhead</i>	Actual	9,849	985	4,925	8,864	Apr 28	May 10	May 20
	Expanded	27,783	2,778	13,892	25,005	Apr 23	Apr 30	May 16
	9 year avg.	19,963	1,996	9,982	17,967	May 04	May 16	May 30
<i>Coho</i>	Actual	0	0	0	0	NA	NA	NA
	Expanded	0	0	0	0	NA	NA	NA
	9 year avg.	NA	NA	NA	NA	NA	NA	NA
<i>Sockeye</i>	Actual	8,676	868	4,338	7,808	Apr 25	May 02	May 22
	Expanded	41,356	4,136	20,678	37,220	Apr 17	Apr 25	May 14
	9 year avg.	15,405	1,540	7,702	13,864	Apr 15	May 02	May 29
<i>Total yearlings</i>	Actual	27,021	2,702	13,511	24,319	Apr 25	May 10	May 28
	Expanded	101,163	10,116	50,582	91,047	Apr 10	Apr 27	May 18
	9 year avg.	78,122	7,812	39,061	70,310	Apr 23	May 17	May 31
<i>Total salmonids</i>	Actual	37,795	3,780	18,898	34,016	Apr 25	May 17	Jul 10
	Expanded	118,567	11,857	59,284	106,710	Apr 10	Apr 28	Jun 21
	9 year avg.	102,657	10,266	51,328	92,391	Apr 26	May 21	Jul 10

The difference in capture rates may be in part related to powerhouse operations that took place this spring at Rock Island Dam. During part of April and through most of May, a fish diversion screen was tested at Powerhouse #1. Large amounts of the daily average river flow were directed towards Powerhouse #1 in an effort to obtain adequate sample sizes while testing the screen.

The largest difference in the run timing was a 10 day difference in the 90% passage date for steelhead between the actual counts for 1994, and the nine year average (Table 3). Other differences occurred between the actual and nine year average dates for the 10% passage date for sockeye (10 days). The 50% passage date for yearling chinook and steelhead varied by 7 days later and 6 days earlier, respectively. We used actual count data in our analysis and discussion.

The bypass trapping facility operated without mechanical failure during the smolt monitoring program.

I. MIGRATION TIMING

Yearling chinook

A total of 8,471 chinook yearlings was captured at the bypass trap in 1994 (Appendix A-6). Yearling chinook were present the first day of the smolt monitoring program, April 1, and continued to be present every day until July 14 (Appendix A). The last yearling chinook was collected on August 29 (Appendix A). The 10 and 90% passage dates for yearling chinook were April 22 and June 06, respectively. Peak passage of 307 yearling chinook occurred on May 20, approximately 10 days later than the peak passage date for the nine year average (Appendix B-1). The 90% passage date of chinook yearlings in 1994 was three days later than the nine year average, while the 10% and 50% passage dates were one day and seven days, respectively, later than the nine year average (Table 3, App. B-1).

Sub-yearling chinook

A total of 10,774 chinook sub-yearlings was captured at the bypass trap in 1994 (Appendix A-6). Peak passage of 610 sub-yearling chinook occurred on June 25, 4 days following a 850,000 fish release of sub-yearling fall chinook from Turtle Rock Island. The 10 and 90% passage dates were June 09 and August 03, respectively, while the 50% passage date for sub-yearling chinook was June 30 (Table 3, Appendix B-2).

Sockeye

A total of 8,676 sockeye smolts was collected at the bypass trap in 1994 (Appendix A-6). Naturally produced sockeye accounted for 95% (8,254) of the total collected, with the remaining sample comprised of hatchery fish from the Lake Wenatchee net pen system of the Rock Island hatchery complex. Daily collection of sockeye smolts began

on April 02 and continued until June 06. The last sockeye smolt was trapped on August 31. Peak passage occurred on April 25 when 1,277 sockeye smolts were collected. The 10 and 90% passage dates were April 25 and May 22, respectively, (Table 3.) while 50% of the outmigrating sockeye smolts had passed Rock Island Dam by May 02 (Appendix B-4).

Juvenile sockeye bimodal run timing at Rock Island Dam, (Appendix B-4.) is a result of the two stocks of fish (Wenatchee and Okanogan) that pass the dam on their seaward migration. Wenatchee River outmigrants pass Rock Island Dam primarily in April and Okanogan River smolts are more prevalent at Rock Island Dam in May (Peven 1987).

Steelhead

A total of 9,849 steelhead smolts was collected at the bypass trap in 1994 (Appendix A-6). Hatchery steelhead comprised 67% of the total collected (6,627). Daily collection of steelhead smolts began on April 02 and continued until June 09, after which, steelhead were intermittently collected in low numbers (<10) through August. Peak passage of 620 steelhead occurred on May 11, one day after the 50% passage date. The 10 and 90% passage dates were April 28 and May 20, respectively (Table 3, Appendix B-4).

Total salmonid run

A total of 37,795 juvenile salmonids was collected at the bypass trap in 1994. The total salmonid run timing is represented in Appendix B-5. The peak passage count of 1,587 on April 25 was largely influenced by the collection of 1,277 sockeye (Appendix A).

The effect of sub-yearling chinook was assessed on the 10, 50, and 90% dates for the total cumulative juvenile salmonid migration. A comparison was made between 1994 and the previous nine year average (1985 - 1993) between the total juvenile outmigration past Rock Island Dam and the outmigration excluding sub-yearling chinook. The duration of the middle 80% of the total juvenile salmonid passage (10% date to 90% date) was 77 days, April 25 to July 10 with a 50% passage date on May 17. This was just one day less than the 78 day duration for the nine year average, with 10, 50, and 90% passage dates: April 26, May 21, and July 10, respectively (Table 3). Excluding sub-yearling chinook from this analysis results in a spring migrant run duration of 34 days, April 25 to May 28, with a 50% passage date on May 17 (Appendix B-6). This compares to a 39 day duration for the nine year average, with 10, 50, and 90% passage dates: April 23, May 17, and May 31, respectively (Table 3)'

In summary, in 1994, sub-yearling chinook extended the juvenile migration 90% passage date 43 days: from May 28 (spring migration) to July 10 (total migration). Total run timing in 1994 was 1 day less than the nine year average.

During the SMP this year, we collected one Atlantic salmon (*Salmo salar*). This fish was believed to be an escapee from a net pen operation above Chief Joseph Dam.

II. PIT TAG FISH RELEASE/RECAPTURE

Nine groups of PIT tagged hatchery fish totaling 15,974 fish were released into the Columbia River system upstream from Rock Island Dam (Table 4). These fish were tagged at U. S. Fish and Wildlife and Washington State Dept. of Fish & Wildlife hatcheries. The fish were then released to evaluate the relationships between Columbia River flow rates and travel time. These releases consisted of 3,834 yearling spring chinook, 5,614 sub-yearling summer chinook and 2,972 sub-yearling fall chinook. Recapture of previously PIT tagged fish at the Rock Island Dam monitoring station amounted to 8 fish. The hatcheries from which these fish were released from are as follows: Turtle Rock (4), Winthrop (2), Wells (1) and Entiat (1). (Dave Marvin, FPC, pers. comm.).

Table 4. PIT tagged juvenile chinook released upstream of Rock Island Dam, 1994.

<u>Hatchery Release Site</u>	<u>Agency</u>	<u>Race</u>	<u>Number Released</u>
Similkameen	W.D. F&W	Summer	1462
Carlton	W.D. F&W	Summer	1480
Wells	W.D. F&W	Summer	3549
Dryden	W.D. F&W	Summer	1190
Wells	U.S. F&W	Summer	1482
Winthrop	U.S. F&W	Spring	1479
Entiat	U.S. F&W	Spring	1178
Leavenworth	U.S. F&W	Spring	1177
Turtle Rock	W.D. F&W	Fall	2972
Total			15974

SUMMARY

Between April 1 and August 31, 1994, 37,795 downstream migrating salmonids were collected at the Rock Island Dam bypass trap. Of this total, 4,185 yearling chinook, 1,132 sub-yearling chinook, 6,627 steelhead, and 422 sockeye were collected that had clipped adipose fins.

The middle 80% of the salmonid outmigration passed Rock Island Dam between April 25 and July 10, 1994, a 77 day period. The dates and duration of the outmigration were extended by sub-yearling chinook in 1994. If sub-yearling chinook are excluded from analysis, the middle 80% of the outmigration was April 25 to May 28, a 34 day period. Sub-yearling chinook comprised 28.5% of the fish collected at Rock Island Dam in 1994.

ACKNOWLEDGMENTS

This monitoring effort was funded by the Bonneville Power Administration, U.S. Department of Energy, as a part of the Northwest Power Planning Council's program to protect, mitigate, and enhance fish and wildlife affected by hydroelectric facilities in the Columbia River Basin. The study was coordinated through the Fish Passage Center. Dave Marvin and Larry Basham, of the FPC were very helpful throughout the study. Dave Marvin of FPC assisted in the PIT tagging program. Steve Gray of the U.S. Fish and Wildlife Service conducted the gill clipping/ATPase sampling. Chelan County PUD conducted the smolt monitoring at Rock Island Dam and a number of District employees assisted with the study. Dick Nason and Paul Fielder provided administrative and logistical help as well as information and advisement. Paul Fielder reviewed a previous draft of this report. The following individuals conducted the SMP, PIT tagging, and data input, at the Rock Island Dam sampler: Osmond Heath, Barry Keese, Dave Beardsley, John Heller, Greg Goodman, Mary Jo Bendickson, Eric Gower, Todd Jones, and Lisi Ott.

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Appendix A

Daily salmonid catch, Rock Island Dam bypass trap, April 1 - August 31.

Appendix A-1. Daily salmonid catch, Rock Island bypass trap, April, 1994.

Date	Chinook Yearlings	Chinook Subyear	Steelhead			Coho	Sockeye			Total Salmonid	Total Yearling
			Wild	Hatchery	Total		Wild	Hatchery	Total		
01-Apr	3	21	0	0	0	0	0	0	0	24	3
02-Apr	10	16	1	0	1	0	1	0	1	28	12
03-Apr	29	22	6	1	7	0	15	0	15	73	51
04-Apr	107	8	4	1	5	0	11	0	11	131	123
05-Apr	109	21	3	1	4	0	9	0	9	143	122
06-Apr	74	9	4	0	4	0	7	0	7	94	85
07-Apr	42	5	1	0	1	0	6	0	6	54	49
08-Apr	30	2	8	0	8	0	1	0	1	41	39
09-Apr	19	1	4	0	4	0	1	0	1	25	24
10-Apr	39	8	2	0	2	0	1	0	1	50	42
11-Apr	25	13	0	0	0	0	17	0	17	55	42
12-Apr	17	2	2	1	3	0	4	0	4	26	24
13-Apr	25	13	4	0	4	0	46	0	46	88	75
14-Apr	11	11	3	0	3	0	12	0	12	37	26
15-Apr	17	5	4	0	4	0	29	0	29	55	50
16-Apr	25	3	5	0	5	0	20	0	20	53	50
17-Apr	31	5	2	0	2	0	52	0	52	90	85
18-Apr	34	0	5	0	5	0	63	2	65	104	104
19-Apr	47	8	8	1	9	0	29	1	30	94	86
20-Apr	70	3	35	13	48	0	51	1	52	173	170
21-Apr	69	14	36	43	79	0	234	16	250	412	398
22-Apr	98	6	21	29	50	0	79	1	80	234	228
23-Apr	86	26	48	69	117	0	47	0	47	276	250
24-Apr	77	4	44	61	105	0	52	1	53	239	235
25-Apr	176	8	65	61	126	0	1240	37	1277	1587	1579
26-Apr	73	4	72	80	152	0	434	32	466	695	691
27-Apr	103	7	128	77	205	0	140	7	147	462	455
28-Apr	184	6	121	172	293	0	138	5	143	626	620
29-Apr	161	8	108	162	270	0	505	29	534	973	965
30-Apr	148	5	81	185	266	0	404	12	416	835	830
Totals:	1939	264	825	957	1782	0	3648	144	3792	7777	7513

Appendix A-2. Daily salmonid catch, Rock Island bypass trap, May, 1994.

Date	Chinook Yearlings	Chinook Subyear	Steelhead			Coho	Sockeye			Total Salmonid	Total Yearling
			Wild	Hatchery	Total		Wild	Hatchery	Total		
01-May	84	9	64	152	216	0	434	10	444	753	744
02-May	90	0	71	179	250	0	107	6	113	453	453
03-May	104	2	74	196	270	0	74	2	76	452	450
04-May	69	1	55	301	356	0	26	1	27	453	452
05-May	40	0	43	230	273	0	40	0	40	353	353
06-May	50	1	30	266	296	0	24	0	24	371	370
07-May	83	1	33	240	273	0	75	1	76	433	432
08-May	122	7	57	393	450	0	276	9	285	864	857
09-May	126	6	100	362	462	0	206	10	216	835	829
10-May	253	4	141	426	567	0	286	38	324	1148	1144
11-May	243	4	142	478	620	0	169	8	177	1044	1040
12-May	183	13	114	369	483	0	91	16	107	786	773
13-May	174	8	140	414	554	0	220	19	239	975	967
14-May	164	6	124	310	434	0	140	8	148	752	746
15-May	195	4	128	206	334	0	109	12	121	654	650
16-May	189	5	124	238	362	0	151	8	159	715	710
17-May	242	6	124	179	303	0	257	2	259	810	804
18-May	266	28	123	143	266	0	290	8	298	858	830
19-May	259	21	90	89	179	0	423	12	435	894	873
20-May	307	14	121	102	223	0	198	11	209	753	739
21-May	281	32	69	55	124	0	182	9	191	628	596
22-May	153	25	41	31	72	0	167	10	177	427	402
23-May	172	24	51	32	83	0	69	5	74	353	329
24-May	272	25	52	33	85	0	77	6	83	465	440
25-May	215	11	27	24	51	0	79	2	81	358	347
26-May	151	18	27	12	39	0	29	1	30	238	220
27-May	134	22	25	32	57	0	23	5	28	241	219
28-May	130	23	11	26	37	0	28	1	29	219	196
29-May	80	19	11	6	17	0	11	1	12	128	109
30-May	74	22	10	11	21	0	30	8	38	155	133
31-May	103	12	10	9	19	0	5	0	5	139	127
Totals:	5008	373	2232	5544	7776	0	4296	229	4525	17707	17334

Appendix A-3. Daily salmonid catch, Rock Island bypass trap, June 1995.

Date	Chinook		Steelhead			Coho	Sockeye			Total Salmonid	Total Yearling
	yearlings	subyear	Wild	Hatchery	Total		Wild	Hatchery	Total		
1 June	272	69	43	27	70	0	34	10	44	455	386
2 June	130	30	32	19	51	0	18	1	19	230	200
3 June	103	67	21	11	32	0	15	5	20	222	155
4 June	77	78	18	8	26	0	15	4	19	200	122
5 June	81	60	20	16	36	0	13	3	16	193	133
6 June	95	69	40	24	64	0	11	2	13	241	172
7 June	144	73	32	10	42	0	8	1	9	268	195
8 June	58	77	23	7	30	0	5	2	7	172	95
9 June	30	87	16	5	21	0	4	0	4	142	55
10 June	21	81	13	8	21	0	2	1	3	126	45
11 June	21	84	14	8	22	0	7	2	9	136	52
12 June	24	72	19	2	21	0	3	0	3	120	48
13 June	30	114	8	5	13	0	4	1	5	162	48
14 June	45	72	15	3	18	0	1	0	1	136	64
15 June	28	39	8	1	9	0	1	1	2	78	39
16 June	18	40	5	1	6	0	2	0	2	66	26
17 June	5	21	9	1	10	0	2	0	2	38	17
18 June	9	29	9	3	12	0	1	2	3	53	24
19 June	15	26	3	0	3	0	2	1	3	47	21
20 June	12	39	6	1	7	0	4	0	4	62	23
21 June	8	129	5	1	6	0	3	0	3	146	17
22 June	7	152	7	3	10	0	2	0	2	171	19
23 June	13	762	1	0	1	0	1	0	1	777	15
24 June	6	725	6	5	11	0	1	0	1	743	18
25 June	5	260	1	2	3	0	0	0	0	268	8
26 June	1	184	1	1	2	0	1	2	3	190	6
27 June	2	158	2	1	3	0	1	0	1	164	6
28 June	4	101	2	0	2	0	0	0	0	107	6
29 June	0	71	1	1	2	0	1	0	1	74	3
30 June	3	135	2	0	2	0	0	0	0	140	5
Totals:	1267	3904	382	174	556	0	162	38	200	5927	2023

Appendix A-4. Daily salmonid catch, Rock Island bypass trap, July 1995.

Date	Chinook yearlings	Chinook subyear	Steelhead			CWild	Sockeye			Total Salmonid	Total Yearling
			Wild	Hatchery	Total		Hatchery	Total			
1 July	1	178	3	0	3	0	1	0	1	183	5
2 July	1	176	0	0	0	0	0	0	0	177	1
3 July	0	118	4	1	5	0	0	0	0	123	5
4 July	0	109	2	0	2	0	1	0	1	112	3
5 July	1	137	2	0	2	0	2	1	3	143	6
6 July	2	78	3	0	3	0	0	0	0	83	5
7 July	2	48	1	0	1	0	0	0	0	51	3
8 July	3	45	6	0	6	0	0	0	0	54	9
9 July	4	96	0	1	1	0	0	0	0	101	5
10 July	3	89	4	0	4	0	0	0	0	96	7
11 July	0	186	1	1	2	0	0	0	0	188	2
12 July	3	537	2	2	4	0	1	0	1	545	8
13 July	0	1108	3	0	3	0	0	0	0	1111	3
14 July	0	383	1	2	3	0	1	0	1	387	4
15 July	0	84	0	0	0	0	0	0	0	84	0
16 July	1	89	0	2	2	0	0	0	0	92	3
17 July	0	96	1	0	1	0	0	0	0	97	1
18 July	0	105	0	0	0	0	0	0	0	105	0
19 July	0	65	0	1	1	0	0	0	0	66	1
20 July	1	86	2	0	2	0	0	0	0	89	3
21 July	0	72	0	0	0	0	1	0	1	73	1
22 July	0	76	0	0	0	0	0	0	0	76	0
23 July	0	63	0	0	0	0	0	0	0	63	0
24 July	0	58	1	0	1	0	0	0	0	59	1
25 July	0	93	0	0	0	0	0	0	0	93	0
26 July	0	95	0	0	0	0	1	0	1	96	1
27 July	0	90	0	0	0	0	1	0	1	91	1
28 July	1	160	0	0	0	0	0	0	0	161	1
29 July	0	142	0	0	0	0	1	0	1	143	1
30 July	0	71	1	0	1	0	2	0	2	74	3
31 July	0	96	0	0	0	0	1	0	1	97	1
Totals:	23	4829	37	10	47	0	13	1	14	4913	84

Appendix A-5. Daily salmonid catch, Rock Island bypass trap, August 1995.

Date	Chinook yearlings	Chinook subyear	Steelhead			Coho	Sockeye			Total Salmonid	Total Yearling
			Wild	Hatchery	Total		Wild	Hatchery	total		
1 August	0	85	0	0	0	0	0	0	0	85	0
2 August	1	79	0	0	0	0	0	0	0	80	1
3 August	0	61	0	0	0	0	0	0	0	61	0
4 August	0	61	0	0	0	0	0	0	0	61	0
5 August	0	58	1	0	1	0	0	0	0	59	1
6 August	0	54	0	0	0	0	0	0	0	54	0
7 August	0	41	1	0	1	0	0	0	0	42	1
8 August	0	42	0	0	0	0	0	0	0	42	0
9 August	0	54	0	0	0	0	0	0	0	54	0
10 August	0	17	1	0	1	0	0	0	0	18	1
11 August	0	25	0	0	0	0	0	0	0	25	0
12 August	0	39	0	0	0	0	0	0	0	39	0
13 August	0	31	0	0	0	0	0	0	0	31	0
14 August	0	13	0	0	0	0	0	0	0	13	0
15 August	0	15	0	0	0	0	0	0	0	15	0
16 August	0	22	1	0	1	0	0	0	0	23	1
17 August	0	12	1	0	1	0	0	0	0	13	1
18 August	0	9	0	0	0	0	0	0	0	9	0
19 August	0	7	0	0	0	0	0	0	0	7	0
20 August	0	7	1	0	1	0	0	0	0	8	1
21 August	0	12	0	0	0	0	0	0	0	12	0
22 August	0	10	0	0	0	0	0	0	0	10	0
23 August	0	9	0	0	0	0	0	0	0	9	0
24 August	0	15	0	0	0	0	0	0	0	15	0
25 August	0	10	1	0	1	0	0	0	0	11	1
26 August	0	5	0	0	0	0	0	0	0	5	0
27 August	0	6	0	0	0	0	0	0	0	6	0
28 August	0	5	0	0	0	0	0	0	0	5	0
29 August	0	14	0	0	0	0	0	0	0	14	0
30 August	0	2	1	0	1	0	0	0	0	3	1
31 August	0	6	0	0	0	0	0	0	0	6	0
Totals:	1	826	8	0	8	0	0	0	0	835	9

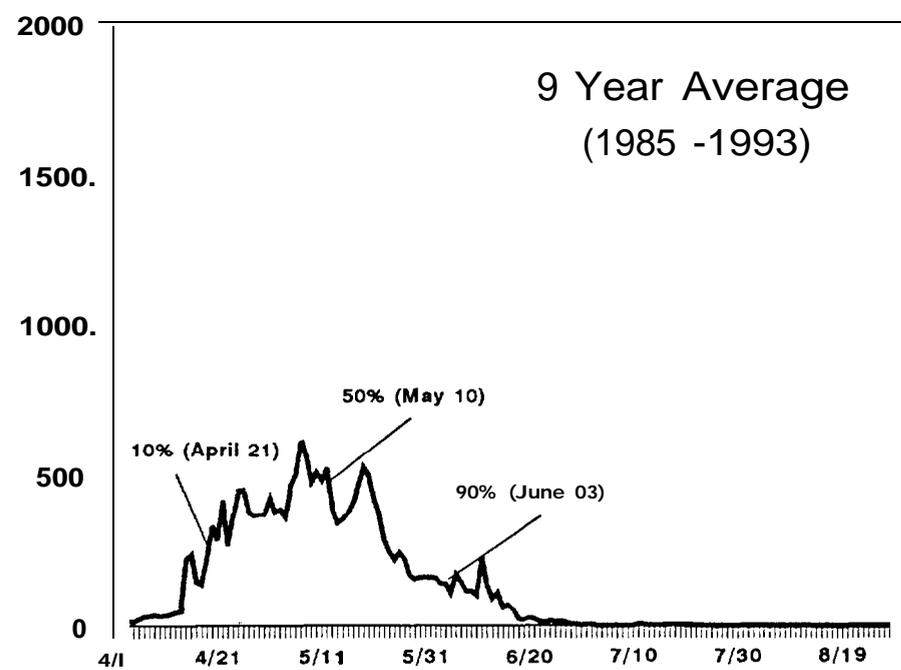
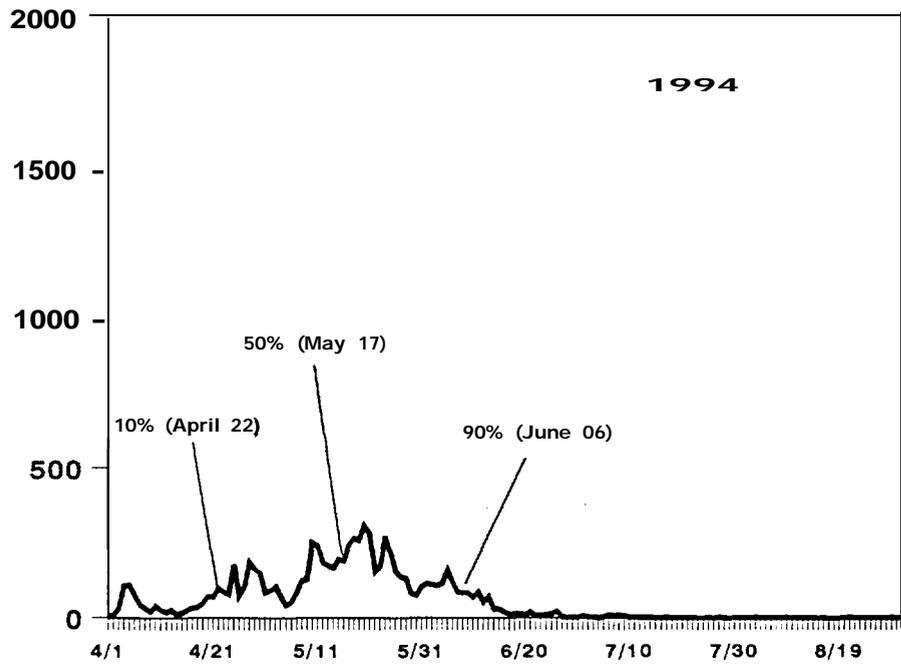
Appendix A-6. Monthly summary of the Rock Island bypass trap catch, April 1 – August 31, 1995.

Month	Chinook	Chinook	Steelhead			Coho	Sockeye			Total Salmonid	Total Yearling
	yearlings	subyear	Wild	Hatchery	Total		Wild	Hatchery	Total		
April	4282	453	238	794	1032	0	13658	80	13738	19505	19052
May	15171	283	2636	8093	10729	0	7011	181	7192	33375	33092
June	1267	3904	382	174	556	0	162	38	200	5927	2023
July	23	4829	37	10	47	0	13	1	14	4913	84
August	1	826	8	0	8	0	0	0	0	835	9
Totals	20744	10295	3301	9071	12372	0	20844	300	21144	64555	54260

Appendix B

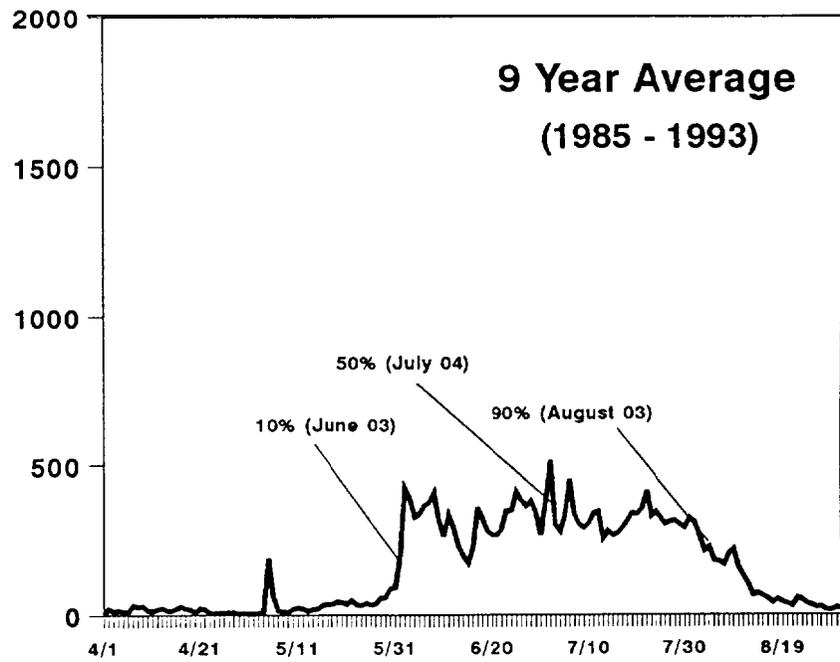
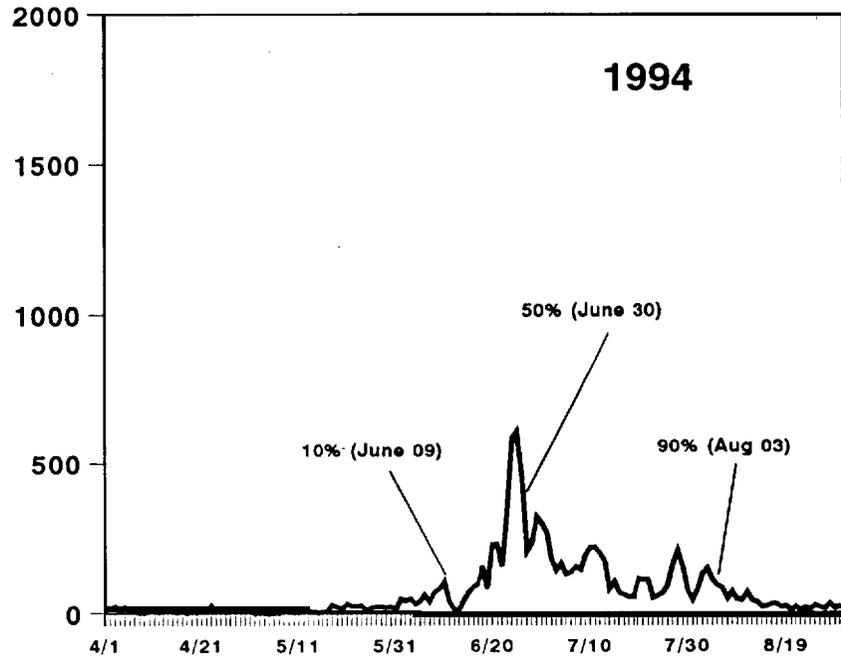
Daily juvenile salmonid run timing for 1994 and the 9 year average

Numbers of Fish/day



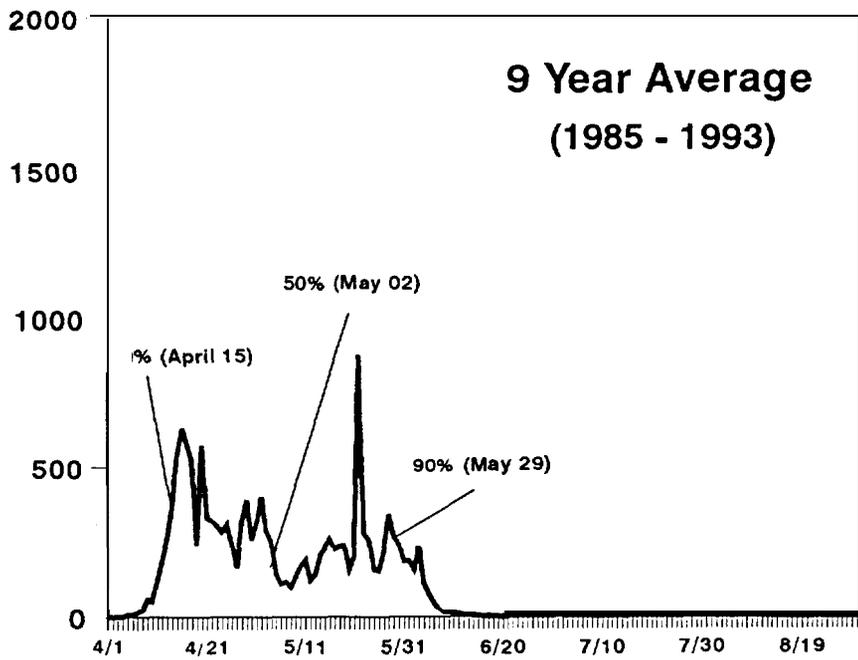
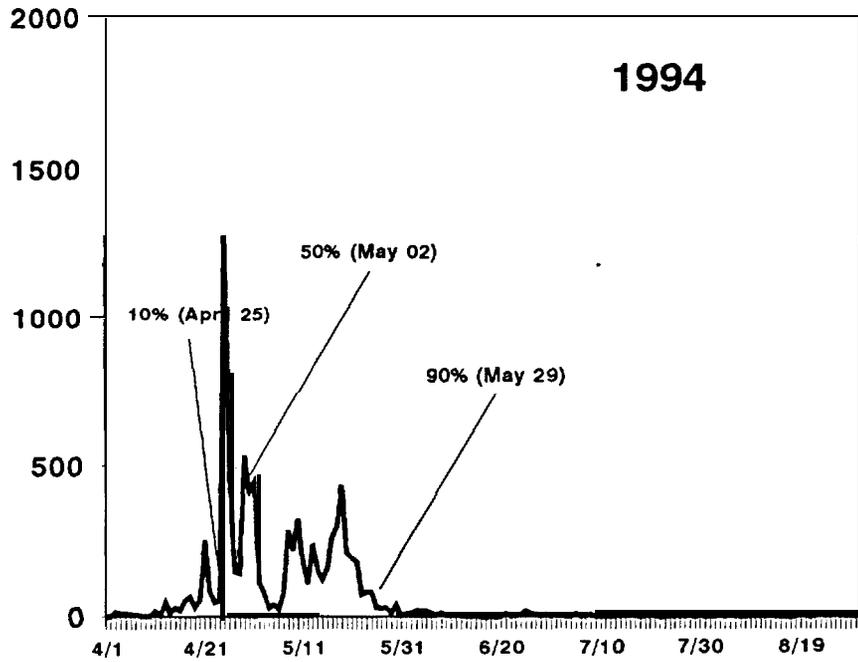
Appendix B-1. Chinook yearling juvenile run timing, Rock Island Dam, 1994 and the 9 year average.

Numbers of Fish/day



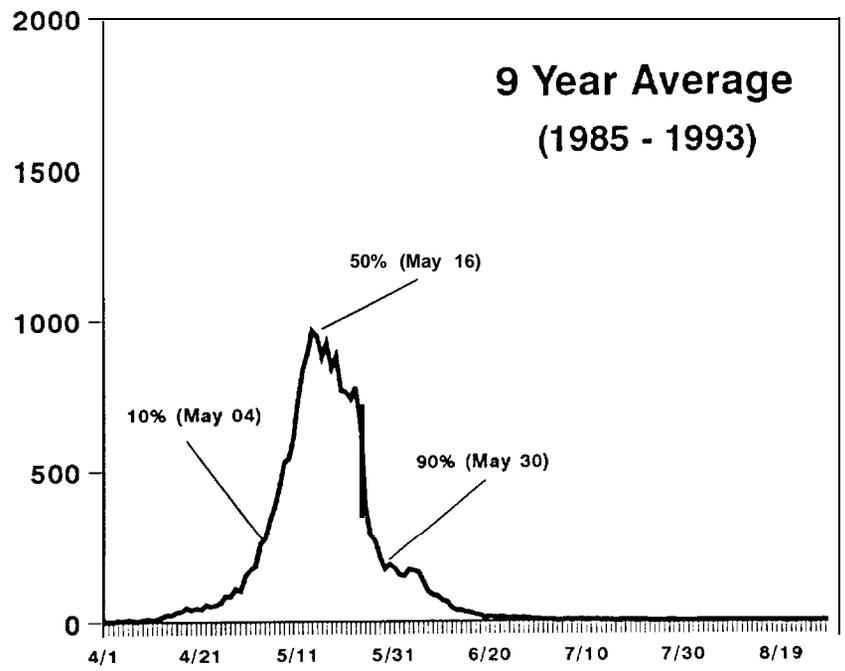
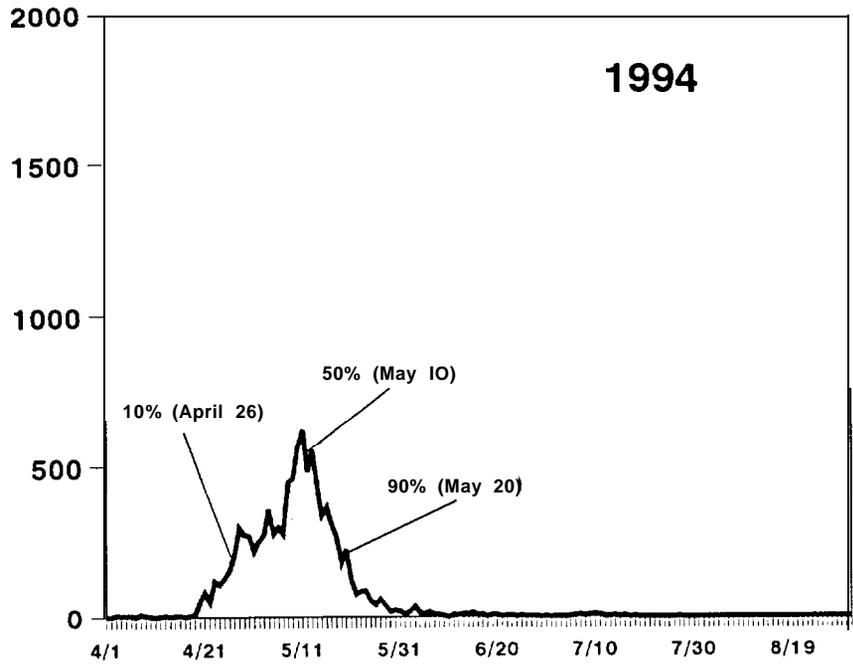
Appendix B-2 Chinook sub-yearling juvenile run timing, Rock Island Dam, 1994 and the 9 year average.

Numbers of Fish / day



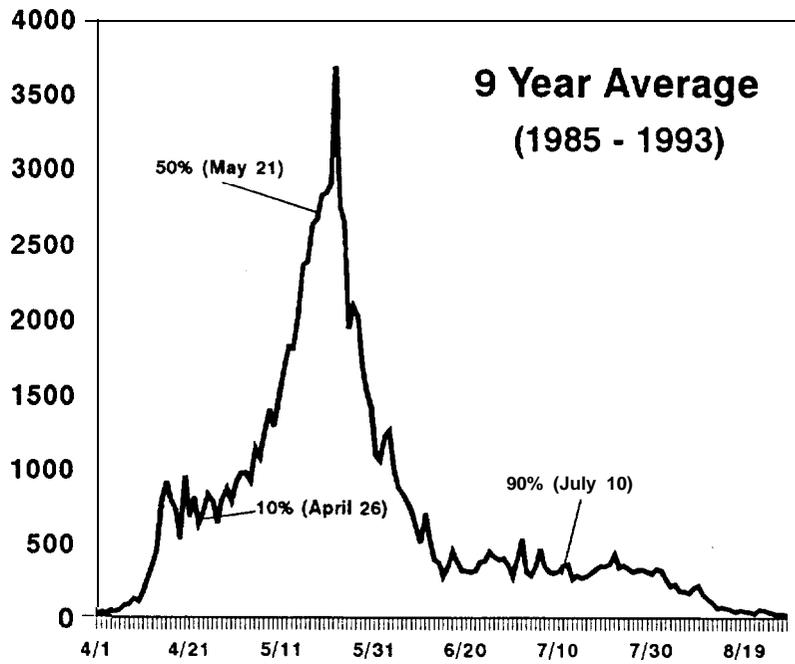
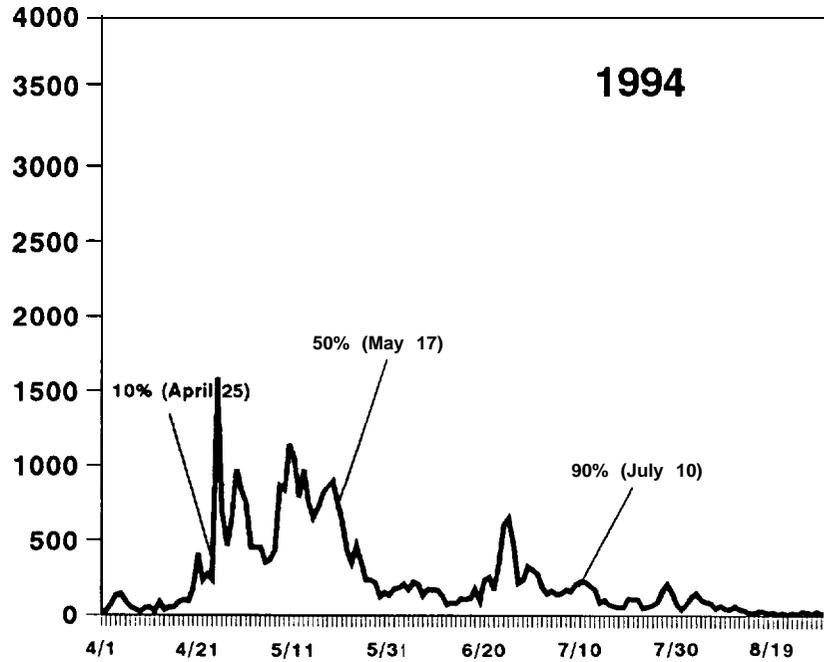
Appendix B-3. Sockeye juvenile run timing, Rock Island Dam, 1994 and the 9 year average.

Numbers of Fish/day



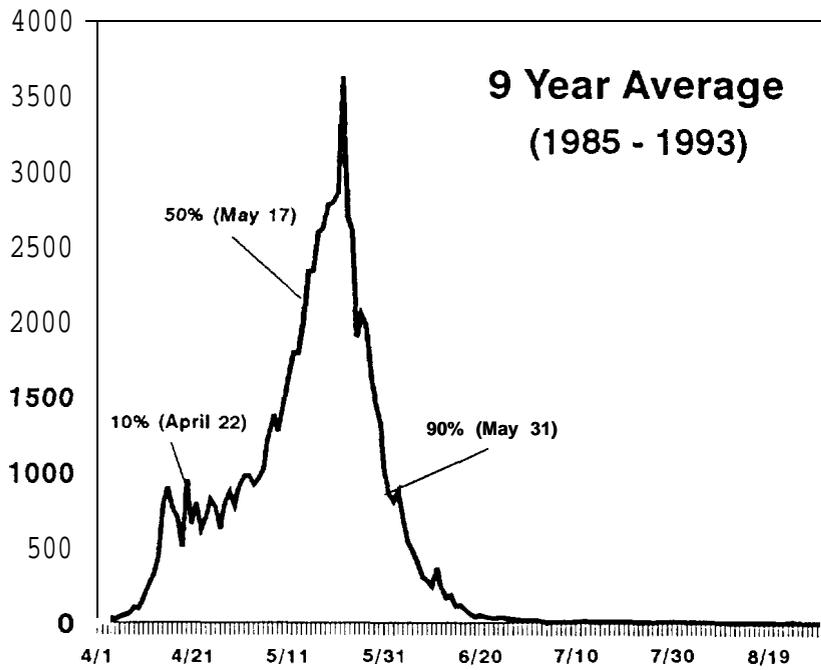
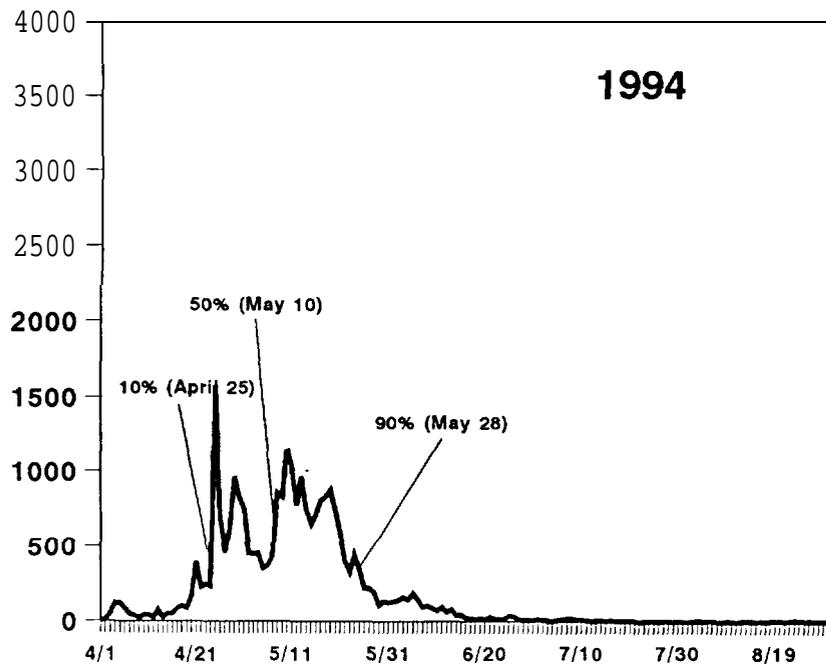
Appendix B-4. Steelhead juvenile run timing, Rock Island Dam, 1994 and the 9 year average.

Numbers of Fish/day



Appendix B-5. Total juvenile salmonid run timing, Rock Island Dam, 1994 and the 9 year average.

Numbers of Fish/day



Appendix B-6. Total yearling juvenile run timing, Rock Island Dam, 1994 and the 9 year average.

ROCK ISLAND DAM SMOLT MONITORING, 1995

Prepared by:

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Power Operations Department
Public Utility District No. 1 of Chelan County
W e n a t c h e e , W A

September 1995

ABSTRACT

Downstream migrating salmon and steelhead trout (*Oncorhynchus* spp.) smolts were monitored at the Rock Island Dam bypass trap from April 1 - August 31, 1995. This was the eleventh consecutive year that the bypass trap was monitored.

Data collected included: 1) number of fish caught by species, 2) number of adipose clipped and/or Passive Integrated Transponder (PIT) tagged fish caught by species, 3) daily average river flow, 4) daily average powerhouse #1 and #2 flows, and 5) daily average spill. These data were transmitted to the Fish Passage Center, which manages the Smolt Monitoring Program throughout the Columbia River Basin. The Smolt Monitoring Program is used to manage the "water budget", releasing upstream reservoir water storage allocated to supplement river flows to enhance survival of downstream migrating juvenile salmonids.

The Rock Island Dam trapping facility collected 64,555 downstream migrating salmonids in 1995. Collected fish included 15 yearling chinook salmon (*O. tshawytscha*) that had been previously PIT tagged to help determine migration rates. The trapping facility also collected 1,412 sub-yearling chinook, 8,501 yearling chinook, 8,744 steelhead (*O. mykiss*) and 280 sockeye (*O. nerka*) with clipped adipose fins.

The middle 80% of the 1995 spring migration (excluding sub-yearling chinooks) passed Rock Island Dam during a 35 day period, April 20 - May 24. Passage rates of chinook and steelhead smolts released from hatcheries and the downstream migration timing of all salmonids are presented.

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INTRODUCTION

The Northwest Power Planning Council, in 1982, 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 for instream flow supplementation to improve migration conditions for juvenile salmon (*Oncorhynchus* spp.) and steelhead trout (*O. mykiss*) on their journey to the ocean. The Council's plan also called for studies to monitor juvenile fish migration timing and survival.

The fishery agencies and tribes formed a Water Budget Center (renamed as the Fish Passage Center (FPC)) to direct the use of the water budget and to conduct and coordinate studies related to water budget management and evaluation. The FPC developed a Smolt Monitoring Program (SMP) 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 located downstream from all major salmon and steelhead producing tributaries of the mid-Columbia River Basin (Figure 1).

The 1995 SMP for Rock Island Dam was designed to index the daily number of outmigrating salmonids and to report numbers of adipose clipped and/or previously Passive Integrated Transponder (PIT) tagged juveniles collected. A PIT tagging operation based on seasonal quotas of 3,750 yearling chinook (*O. tshawytscha*), 3,750 sockeye (*O. nerka*), 3,750 steelhead trout, and 5,400 sub-yearling chinook was implemented. Data collected under this program allow comparison and evaluation of year to year migration timing and travel time of different species and races of juvenile salmonids, both hatchery and naturally produced.

U.S. Fish & Wildlife Service personnel monitored ATPase levels to assess smolt condition for travel time analysis of spring downstream migrating salmonids. They did this by gill clipping subsamples of PIT tagged and run-of-the-river fish. Subyearling chinook that were PIT tagged were monitored for ATPase levels by personnel of the Public Utility District No. 1 of Chelan County (the District).

Funding of the program, as implemented by the FPC, was provided by the Bonneville Power Administration. The District provided the trapping facility, personnel, and equipment to conduct the monitoring.

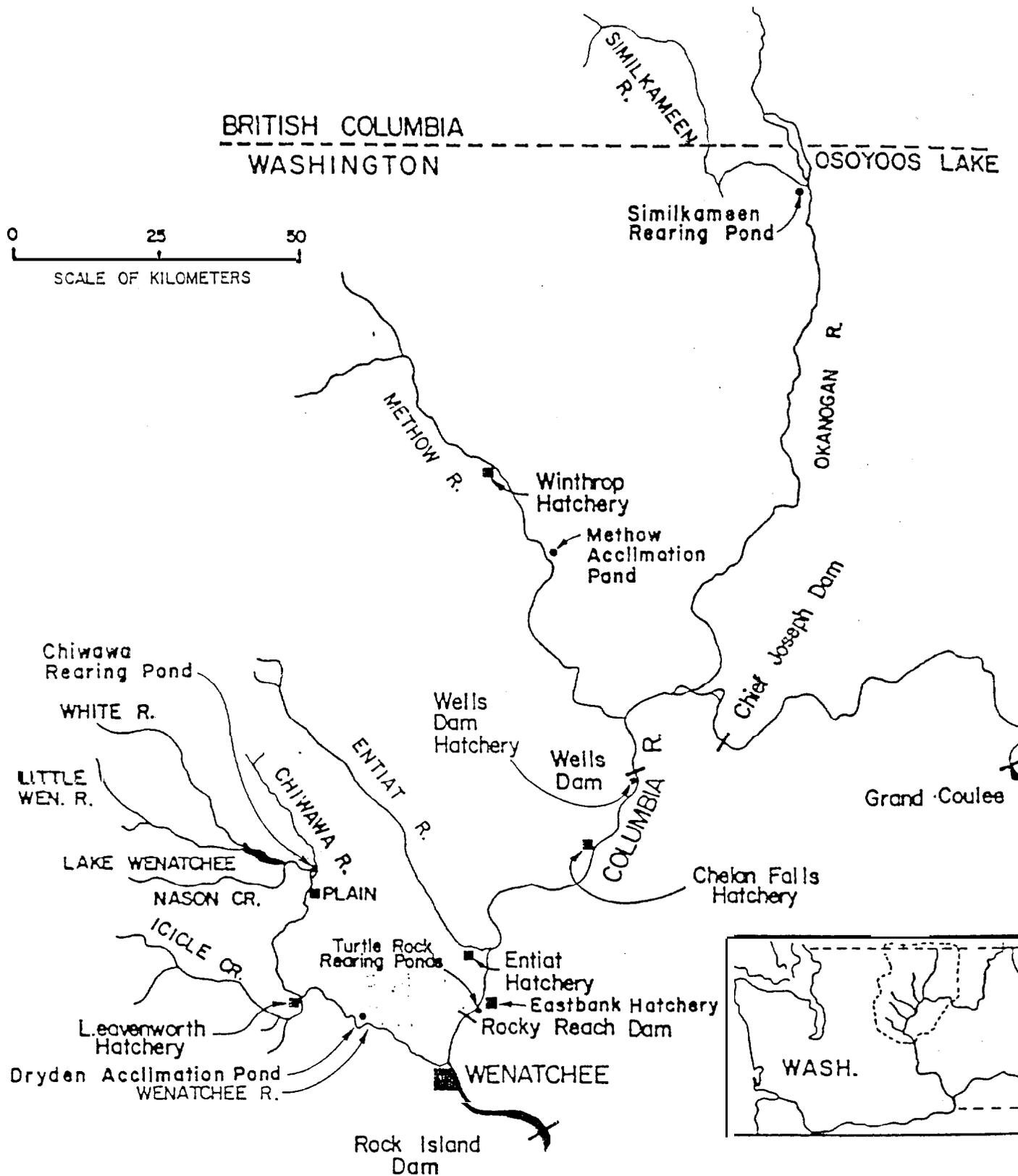


Figure 1. Columbia River between Rock Island and Grand Coulee dams showing major tributaries and hatcheries.

METHODS

Data collected daily at the Rock Island Dam monitoring station included 1) total number of fish caught by species, 2) total number of PIT tagged and/or fin clipped fish caught by species, 3) percent of descaled fish (alternating days), 4) daily average river flow, 5) daily average flow through powerhouse #1 (old powerhouse) and powerhouse #2 (new powerhouse) (Figure 2), and 6) daily average spill. Flow data were recorded so that an expanded index of fish passage through powerhouse #2 could be developed based on the bypass collection count in relation to the proportion of total river flow passing through powerhouse #2.

Travel time between hatchery release points and the Rock Island Dam monitoring station was estimated by PIT tagging subsamples of hatchery fish before release. Additionally, adipose clipped and coded wire tagged yearling chinook, subyearling chinook and sockeye were counted.

The overall physical condition of the fish trapped at Rock Island Dam was recorded on alternating days. Qualifying the condition of the fish was based on the degree of descale present. Fish with 20% or less scale loss/side were considered "ok" while fish with more than 20% scale loss/side were counted as "Descaled". Presence or absence of gas bubble disease and the degree of symptoms were recorded and reported on alternate days. The number of fish that perished within the trap was also counted daily.

Fish were collected from the second powerhouse turbine intake gatewells and fishway attraction water intake. Fish entering the gatewells and attraction water intake passed into a bypass channel through a series of submerged orifices (Figure 3). An inclined screen trap separated the fish from the 100 cfs bypass flow and confined them to a holding flume where they were retained for up to 24 hours before processing (Figure 4). All fish collected in the bypass channel were sampled.

Fish collected by the trap during the 24 hour sampling period (0900-0900) were crowded into an elevator hopper, raised to the upper deck of the dam, and released into a 12'x 4'x 3.5' aluminum holding tank. The holding tank was supplied continuous water flow from the right bank fishladder with a 5 hp. submersible pump.

Before being dipped from the aluminum tank, fish were pre-anesthetized in an isolation chamber of the tank with an alcohol/Benzocaine solution. Groups of 30-50 fish were then dip netted into a flume that passed into the processing trailer where they were further anesthetized with a solution of Tricaine Methane Sulfonate (MS 222) before handling. An ionic salt solution, ProPoly Aqua, was added to all fish processing tubs within the trailer to reduce stress during handling and to enhance wound healing from the PIT tagging process. Periodic timing of the pre-anesthetization, identification, and recovery processes were conducted to insure against overexposure to the anesthetic. All

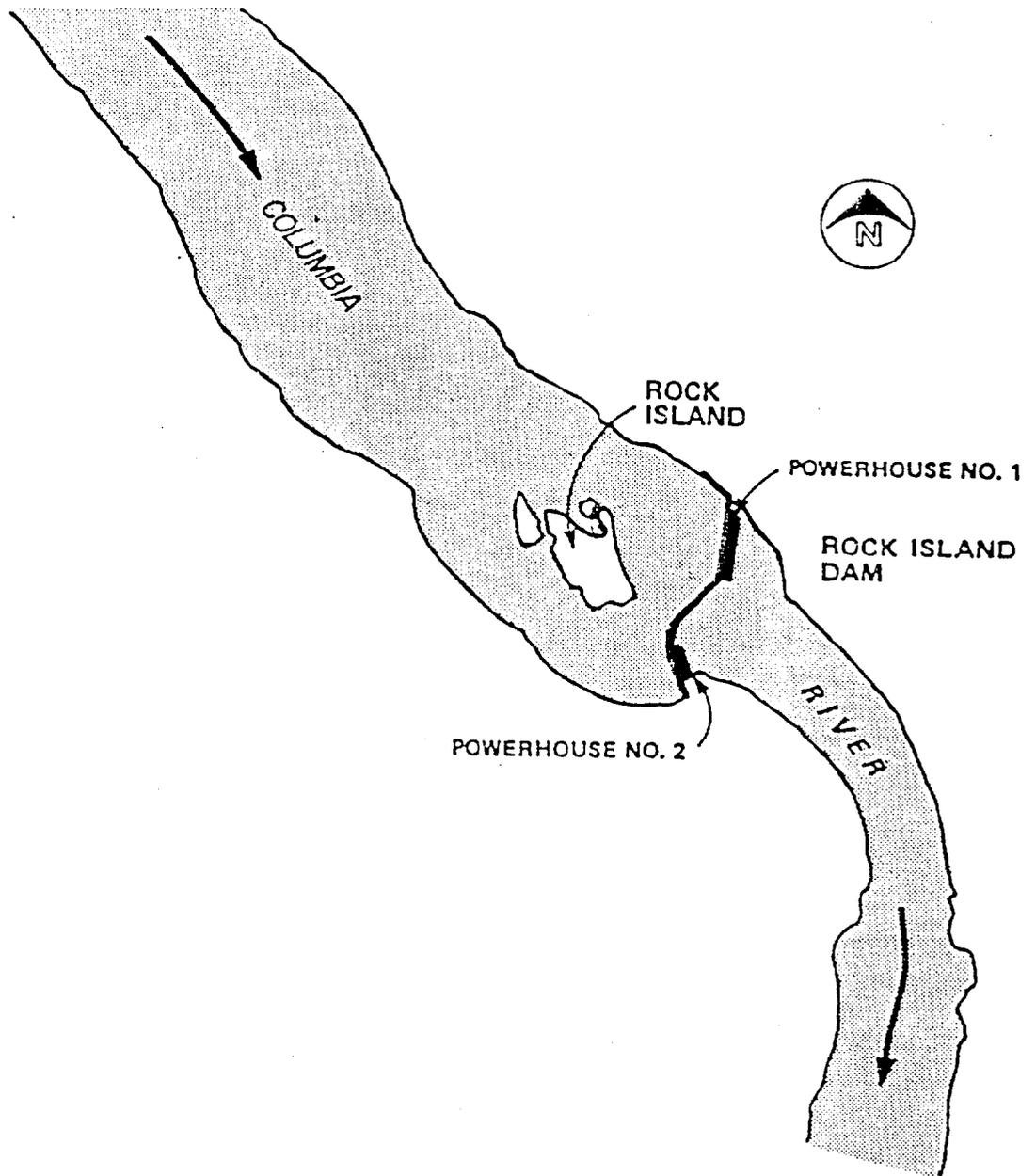


Figure 2. Location of powerhouse #1 and powerhouse #2 of Rock Island hydroelectric project.

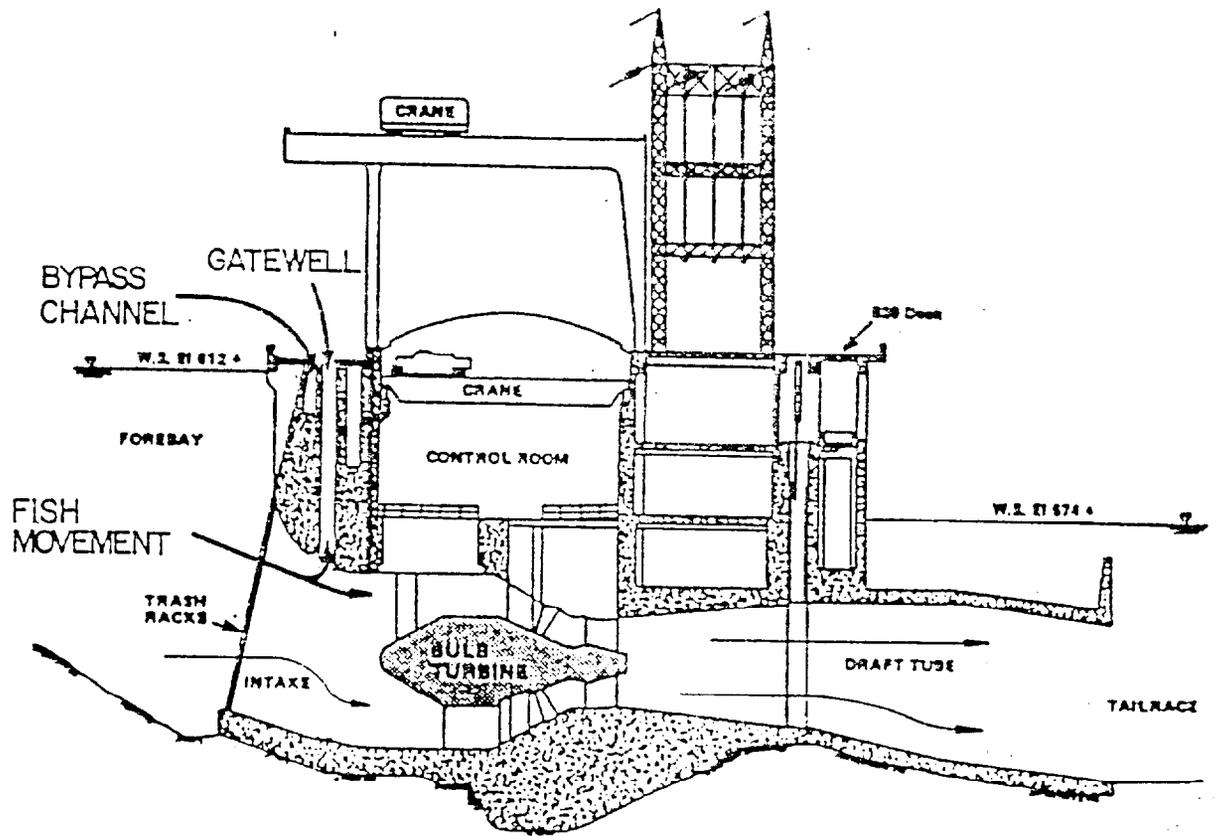


Figure 3. Section through Rock Island Dam second powerhouse indicating fish movement into gateway system.

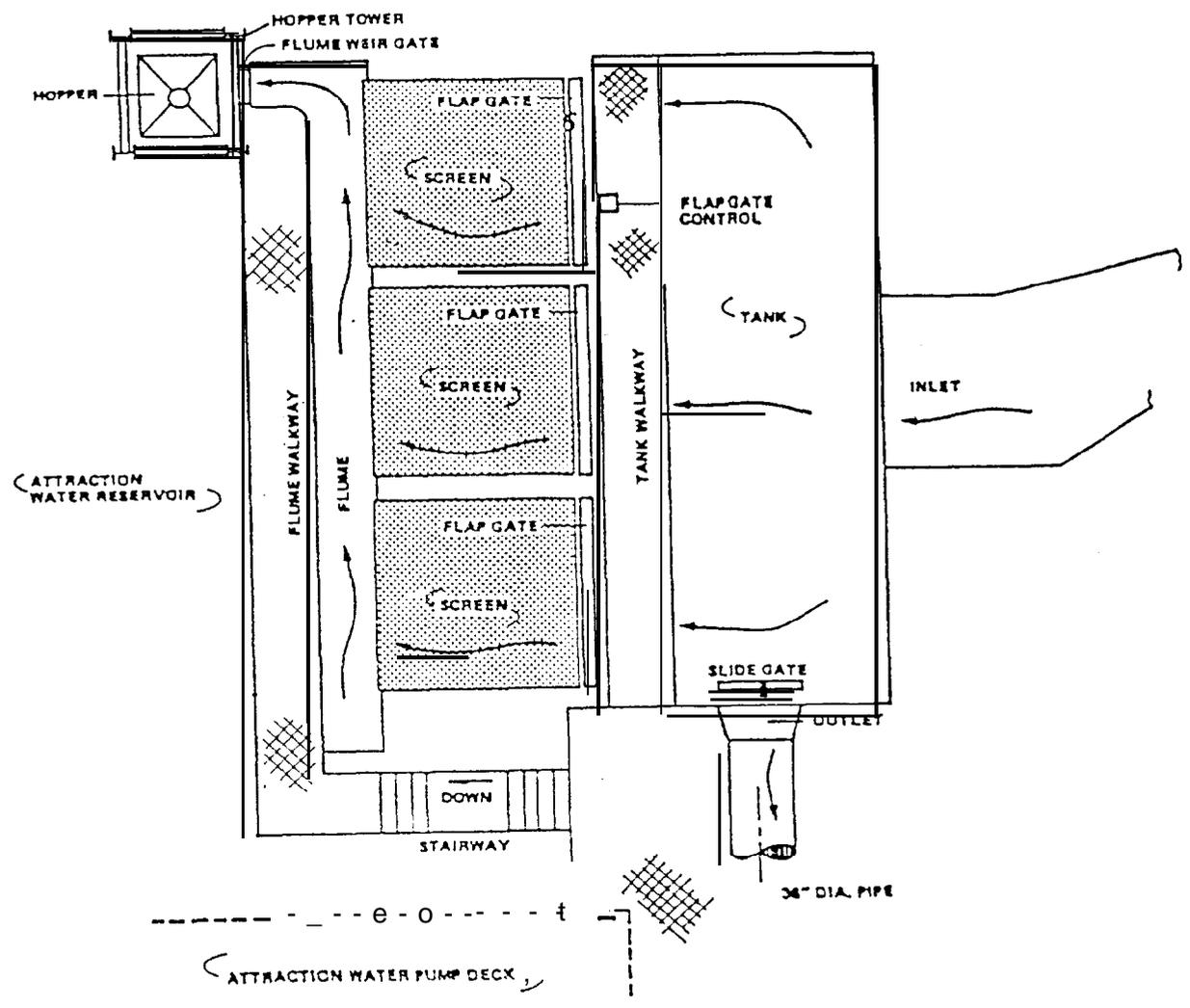


Figure 4. Rock Island Dam juvenile salmonid fingerling collection trap.

fish were identified by species and scanned for PIT tags, clipped fins, gas bubble disease, and descale.

After the examined fish had fully recovered from the effects of the anesthesia, they were released through a 4" PVC pipe from the recovery section of the tank (elevation 620' m.s.l.) to the tailrace (elevation 574' m.s.l.) (Figure 5). The release area of the tailrace was protected from gull predation with parallel lengths of stainless steel wire at approximately 10 foot intervals above the pipe outlet and across the tailrace area. In addition, an employee of the U. S. Department of Agriculture's Animal Damage Control Division suppressed gull (*Larus spp.*) predation in the tailrace during the middle 80% of the spring migration by various behavior modifying techniques.

Fork length measurements and scale samples were taken three times per week from subsamples of sockeye. Steelhead were categorized as "naturally-produced" or "hatchery" according to clipped adipose fin, or if an adipose fin was present, a worn appearance of the dorsal and ventral fins (Peven and Hays 1989). Hatchery produced steelhead released in Washington State waters since 1985 have been adipose fin clipped.

In addition to the smolt monitoring program, subsamples of chinook yearlings, steelhead, and sockeye were injected with PIT tags each day between April 17 and May 26. Beginning on June 24, sub-yearling summer and fall chinook were tagged on a weekday basis until August 15. PIT tags were injected by hand using a medical syringe/pushrod mechanism with a 12 gauge size veterinary needle attached. Syringes and needles were sterilized a minimum of 15 minutes in a bath of 95% ethanol prior to re-use. A random subsample of not more than 150 each of yearling chinook, steelhead, and sockeye were PIT tagged daily. Sub-yearling chinook PIT tagging numbers were not to exceed 150 fish/day. Data pertinent to the smolt monitoring program were transferred to the FPC (Portland, OR) daily via a personal computer that was located at the dam. The fish that were PIT tagged at Rock Island Dam were "recaptured" at the McNary Dam bypass trap, where travel time estimates were recorded. Results of the PIT tagging program will be reported by the FPC.

U.S. Fish and Wildlife Service personnel monitored ATPase levels weekly from April 17 - May 26 for yearling chinook. Subsamples of both PIT tagged fish and run-of-the-river fish were taken to assess the physiological condition of smolts for travel time analysis. From June 24 - August 15, District personnel conducted similar ATPase sampling of PIT tagged sub-yearling chinook three times a week. The results of the sampling were reported to the FPC, providing additional data for managing the fish outmigration.

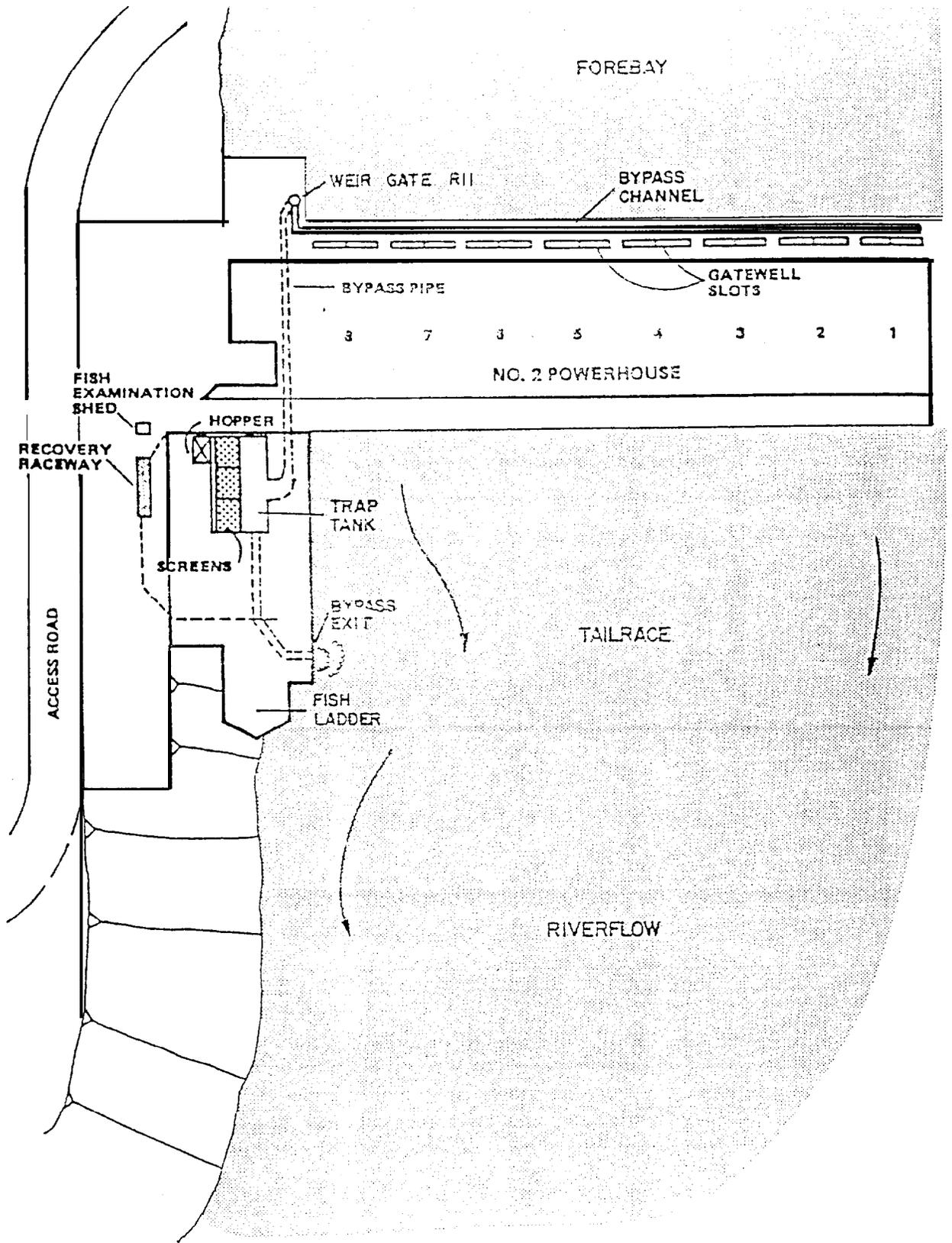


Figure 5. Plan view of juvenile salmonid bypass and collection system at Rock Island Dam second powerhouse (taken from Olson 1983).

RESULTS AND DISCUSSION

FACILITY OPERATION AND HYDRAULIC INFORMATION

The Rock Island Dam bypass trapping facility operated without mechanical failure during the smolt monitoring program. The trapping facility collected 64,555 juvenile salmon and steelhead during the 1995 smolt monitoring program (Appendix A). Hatchery fish collected with clipped adipose fins and coded wire tags accounted for 8,501 yearling chinook, 1,412 sub-yearling chinook, 8,744 steelhead and 280 sockeye.

PIT tagging operations occurred at Rock Island Dam to provide migration timing rates for mid-Columbia juvenile salmonids. Table 1 summarizes the PIT tag marking program, listing the species tagged, rearing type, and number of fish tagged. Both spring and summer out-migrants were included.

An examination of daily powerhouse #2 turbine flows in proportion to total river flow showed a variance in powerhouse operations during the period of peak salmonid outmigration. Monthly average percent of total river flow through powerhouse #2 for the period of April 1 through June 30 ranged from 64.0% to 98.1% and daily averages ranged from 53.2% to 98.1% (Table 2).

Average daily hydraulic data for Rock Island Dam were supplied to the FPC, which used the data to develop an expansion of Rock Island trap data. The expansion was derived by multiplying the actual trap collection count by the inverse proportion of water passing through powerhouse #2 during the sampling period (i.e., $(\text{collection count} \times 100) / (\text{powerhouse \#2 flow} / \text{powerhouse \#1 flow} + \text{powerhouse \#2 flow} + \text{spill})$). A comparison of actual trap collection counts, the expanded index, and the ten year average (1995 - 1994) of actual counts (Table 3) indicated some differences in the smolt run timing. The timing of hatchery releases can influence the timing of the annual smolt migration past Rock Island Dam.

Large differences were observed in abundance of steelhead, chinook subyearlings, and sockeye compared to the ten year average for those species. Chinook sub-yearlings and steelhead were much lower and sockeye were much higher than the ten-year averages (Table 3).

There was little difference (two to three days plus or minus) between the 10% passage dates and the ten year average for chinook yearlings and subyearlings, steelhead and sockeye smolts. However, the 90% passage dates for chinook yearlings and subyearlings and steelhead were five to seven days earlier than the ten year averages (Table 3).

MIGRATION TIMING

Yearling chinook

A total of 20,744 chinook yearlings was captured at the bypass trap in 1995 (Appendix A-6). Yearling chinook were present the

Table 1. PIT tag marking at Rock Island Dam, April - August 31, 1995.

Spring marking (April - May 26, 1995)					
<u>Chinook</u>		<u>Steelhead</u>		<u>Sockeye</u>	
<u>Rearing type</u>	<u>Number released</u>	<u>Rearing type</u>	<u>Number released</u>	<u>Rearing type</u>	<u>Number released</u>
Hatchery		Hatchery	1774	Hatchery	
Unknown	4500	Unknown	1190	Unknown	3930
Total	4500	Total	2964	Total	3930

Summer marking (June __ - August 14, 1995)

<u>Chinook</u>	
<u>Rearing type</u>	<u>Number released</u>
Hatchery	
Unknown	3613
Total	3613

Table 2. Rock Island Dam powerhouse operations expressed in KCFS and percent streamflow, April 1 - August 31, 1995.

	Average KCFS				
	April	May	June	July	August
Total river flow	94.9 (60.1 - 137.4)	128.7 (82.4 - 180.1)	148.7 (93.4 - 185.6)	126.4 (94.7 - 158.5)	97.0 (74.3 - 123.2)
Powerhouse #1	10.0 (0.5 - 34.0)	26.8 (0.5 - 48.9)	37.7 (3.4 - 55.6)	27.1 (3.7 - 47.2)	16.9 (0.5 - 42.7)
Powerhouse #2	79.7 (56.0 - 104.7)	82.4 (64.3 - 100.2)	102.8 (75.0 - 120.8)	93.7 (82.0 - 107.6)	78.5 (65.9 - 92.1)
Spill	4.1 (0.0 - 22.4)	18.0 (8.0 - 33.9)	7.0 (0.0 - 30.6)	4.2 (3.7 - 5.5)	0.5 (0.0 - 4.2)
	Average percent of total flow				
Powerhouse #1	10.5 (0.6 - 26.4)	20.9 (0.6 - 32.5)	25.4 (3.6 - 32.2)	21.4 (3.3 - 32.9)	17.4 (0.6 - 38.0)
Powerhouse #2	84.0 (63.2 - 98.0)	64.0 (54.0 - 84.4)	69.1 (53.2 - 95.3)	74.1 (63.3 - 86.6)	81.0 (61.1 - 98.1)
Spill	4.4 (0.0 - 16.3)	14.0 (5.3 - 22.6)	4.7 (0.0 - 20.8)	3.3 (2.9 - 3.9)	0.5 (0.0 - 4.4)

• Monthly ranges appear in parenthesis

Table 3. Comparison of actual, expanded, and the 10 year average (of actual counts) of fish counts for passage dates for the Rock Island Dam bypass trap, 1995.

Species		Totals	Number			Date		
			10%	50%	90%	10%	50%	90%
Chinook yearlings	Actual	20,744	2,074	10,372	18,670	April 23	May 14	May 29
	Expanded	30,754	3,075	15,377	27,679	April 24	May 16	May 30
	10 year avg.	18,350	1,835	9,175	16,515	April 21	May 10	June 03
Chinook sub-yearlings	Actual	10,295	1,030	5,148	9,266	June 05	July 04	July 29
	Expanded	14,193	1,419	7,097	12,774	June 06	July 02	July 29
	10 year avg.	23,158	2,316	11,579	20,842	June 03	July 03	August 03
Steelhead	Actual	12,372	1,237	6,186	11,135	May 01	May 10	May 23
	Expanded	18,084	1,808	9,042	16,276	May 02	May 11	May 24
	10 year avg.	18,952	1,895	9,476	17,057	May 04	May 16	May 30
Coho	Actual	0	0	0	0	NA	NA	NA
	Expanded	0	0	0	0	NA	NA	NA
	10 year avg.	NA	NA	NA	NA	NA	NA	NA
Sockeye	Actual	21,144	2,114	10,572	19,030	April 17	April 28	May 29
	Expanded	27,066	2,707	13,533	24,359	April 17	April 28	May 15
	10 year avg.	14,732	1,473	7,366	13,259	April 15	May 02	May 29
Total yearlings	Actual	54,260	5,426	27,130	48,834	April 20	May 08	May 24
	Expanded	75,904	7,590	37,952	68,314	April 22	May 10	May 26
	10 year avg.	73,012	7,301	36,506	65,711	April 23	May 17	May 31
Total salmonids	Actual	64,555	6,456	32,278	58,100	April 21	May 11	June 25
	Expanded	90,097	9,010	45,049	81,087	April 23	May 12	June 24
	10 year avg.	96,170	9,617	48,085	86,553	April 26	May 21	July 10

. 10 year average includes the years 1985–1994, but does not include 1995.

first day of the smolt monitoring program, April 1, and continued to be present every day through June 28 (Appendix A). The last yearling chinook was collected on August 2 (Appendix A). The 10% and 90% passage dates for yearling chinook were April 23 and May 23, respectively. Peak passage of 875 yearling chinook occurred on May 17. The 10%, 50%, and 90% passage dates of chinook yearlings in 1995 can be compared to the ten year average in Table 3.

Sub-yearling chinook

A total of 10,295 chinook sub-yearlings was captured at the bypass trap in 1995 (Appendix A-6). Peak passage of 1,108 sub-yearling chinook occurred on July 13. The 10%, 50%, and 90% passage dates of chinook sub-yearlings in 1995 are compared to the ten year average in Table 3.

Sockeye

A total of 21,144 sockeye smolts was collected at the bypass trap in 1995 (Appendix A-6). Naturally produced sockeye accounted for 98.6% of the total collected, with the remaining sample comprised of hatchery fish from the Lake Wenatchee net pen system of the Rock Island hatchery complex. Daily collection of sockeye smolts began on April 1 and continued through June 24. The last sockeye smolt was trapped on July 31. Peak passage occurred on April 17 when 2,546 sockeye smolts were collected. The 10, 50% and 90% passage dates for 1995 are compared to the ten year average in Table 3.

Juvenile sockeye bimodal run timing at Rock Island Dam (Appendix B) is a result of the two stocks of fish (Wenatchee and Okanogan) that pass the dam on their seaward migration. Wenatchee River outmigrants pass Rock Island Dam primarily in April and Okanogan River smolts are more prevalent at Rock Island Dam in May (Peven 1987).

Steelhead

A total of 12,372 steelhead smolts was collected at the bypass trap in 1995 (Appendix A-G). Hatchery steelhead comprised 26.7% of the total collected (12,372). Daily collection of steelhead smolts began on April 13 and continued through July 1, after which steelhead were intermittently collected in low numbers (<10) through August. Peak passage of 798 steelhead occurred on May 13. The 10%, 50%, and 90% passage dates for 1995 can be compared to the ten year average in Table 3.

Total salmonid run

A total of 64,555 juvenile salmonids was collected at the bypass trap in 1995. The total salmonid run timing is represented in Appendix B-5. The peak passage count of 2,721 on April 17 was largely a result of the 2,546 sockeye that were collected that day.

The effect of sub-yearling chinook on the 10, 50, and 90% dates for the total juvenile salmonid migration was assessed. A comparison was made between 1995 and the previous ten year average (1985 - 1994) of the total juvenile downstream migration past Rock

Island Dam and of the migration excluding sub-yearling chinook.

The duration of the middle 50% of the total juvenile salmonid passage (10% date to 90% date) was 66 days (April 21 to June 25) with a 50% passage date on May 11. This was just shorter than and earlier than the ten year average (Table 3). If sub-yearling chinook were excluded from this analysis, the middle 80% of the yearling salmonids would have passed Rock Island Dam during the 35 day period between April 20 and May 24 (Table 3). This compares to a 39 day duration for the ten year average with the middle 80% (of that ten year average) passing Rock Island Dam between April 23 and May 31. The 1995 migration of yearlings and total salmonids past Rock Island Dam was slightly earlier and of shorter duration compared to the ten year average.

During the smolt monitoring program this year we collected no Atlantic salmon (*Salmo salar*). A few of these fish have been collected at the Rock Island trapping facility in past years and are believed to be escapees from a net pen operation above Chief Joseph Dam.

PIT TAG FISH RELEASE/RECAPTURE

Groups of PIT tagged hatchery fish totaling 16,657 fish were released into the Columbia River system upstream from Rock Island Dam (Table 4). These fish were tagged at U. S. Fish and Wildlife and Washington State Dept. of Fisheries hatcheries. The fish were then released to evaluate the relationships between Columbia River flow rates and travel time. These releases consisted of 10,790 yearling spring chinook and 5,867 sub-yearling fall chinook. Recapture of these previously PIT tagged fish at the Rock Island Dam monitoring station amounted to 15 fish. These 15 recovered PIT tagged fish were yearling spring chinook from the releases that totaled 10,790 fish (0.139% recovery rate). None of the 5,867 PIT tagged sub-yearling chinook were recaptured at the Rock Island trapping facility (Dave Marvin, pers. comm.).

SUMMARY

Between April 1 and August 31, 1995, 64,555 downstream migrating salmonids were collected at the Rock Island Dam bypass trap. Of this total, 8,501 yearling chinook, 1,412 sub-yearling chinook, 8,744 steelhead, and 280 sockeye were collected that had clipped adipose fins.

The middle 80% of the salmonid outmigration passed Rock Island Dam between April 21 and June 25, 1995, a 66 day period. The dates and duration of the outmigration were extended by sub-yearling chinook in 1995. If sub-yearling chinook are excluded from analysis, the middle 80% of the outmigration was April 20 to May 24, a 35 day period. Sub-yearling chinook comprised 15.9% of the fish collected at Rock Island Dam in 1995.

Table 4. PIT tagged juvenile chinook salmon released upstream from Rock Island Dam, 1995.

Hatchery release site	Agency	Race	Number released
Chiwawa pond	WA. Dept. F&W	Spring	1,497
Enriat	US F&W Service	Spring	1,194
Leavenworth	US F&W Service	Spring	1,198
Winthrop	US F&W Service	Spring	1,496
Carlton pond	WA. Dept. F&W	Summer	1,485
Dryden pond	WA. Dept. F&W	Summer	1,103
Similkameen pond	WA. Dept. F&W	Summer	1,325
Wells	US F&W Service	Spring	1,492
Wells	US F&W Service	Summer (sub-yearling)	2,988
Turtle Rock	WA. Dept. F&W	Fall (sub-yearling)	2,879
Total			16,657

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Appendix A

Daily salmonid catch, Rock Island Dam bypass trap,
April 1 - August 31, 1995.

Appendix A-I. Daily salmonid catch, Rock Island bypass trap, April 1995

Date	Chinook		Steelhead			Coho	Sockeye			Total Salmonid	Total Yearling
	yearlings	subyear	Wild	Hatchery	Total		Wild	Hatchery	Total		
1 April	1	5	0	0	0	0	1	0	1	7	2
2 April	7	2	0	0	0	0	8	0	8	17	15
3 April	14	24	2	0	2	0	2	0	2	42	18
4 April	25	32	0	0	0	0	1	0	1	58	26
5 April	28	48	0	0	0	0	4	0	4	80	32
6 April	21	30	2	0	2	0	7	0	7	60	30
7 April	18	20	0	0	0	0	6	0	6	44	24
8 April	76	11	5	0	5	0	40	0	40	132	121
9 April	86	19	3	0	3	0	34	0	34	142	123
10 April	41	30	8	0	8	0	34	0	34	113	83
11 April	59	17	1	0	1	0	42	0	42	119	102
12 April	53	15	0	0	0	0	58	0	58	126	111
13 April	48	12	9	1	10	0	66	0	66	136	124
14 April	73	9	11	1	12	0	169	0	169	263	254
15 April	95	23	2	1	3	0	69	0	69	190	167
16 April	103	13	4	1	5	0	65	0	65	186	173
17 April	137	30	8	0	8	0	2532	14	2546	2721	2691
18 April	220	18	5	1	6	0	339	1	340	584	566
19 April	190	10	5	13	18	0	160	0	160	378	368
20 April	221	13	18	16	34	0	315	1	316	584	571
21 April	136	12	6	31	37	0	723	1	724	909	897
22 April	311	12	2	29	31	0	718	2	720	1074	1062
23 April	493	11	18	20	38	0	1740	10	1750	2292	2281
24 April	499	10	10	57	67	0	1789	10	1799	2375	2365
25 April	298	6	7	53	60	0	498	2	500	864	858
26 April	224	7	11	69	80	0	295	2	297	608	601
27 April	279	4	13	126	139	0	758	7	765	1187	1183
28 April	152	8	16	112	128	0	1909	12	1921	2209	2201
29 April	178	0	38	121	159	0	764	11	775	1112	1112
30 April	196	2	34	142	176	0	512	7	519	893	891
Totals:	4282	453	238	794	1032	0	13658	80	13738	19505	19052

Appendix A-2. Daily salmonid catch, Rock Island bypass trap, May 1995.

Date		Chinook yearlings	Chinook subyear	Steelhead			Coho	Sockeye			Total Salmonid	Total Yearling
				Wild	Hatchery	Total		Wild	Hatchery	Total		
1	May	174	3	50	184	234	0	561	2	563	974	971
2	May	568	6	80	393	473	0	296	3	299	1346	1340
3	May	213	4	31	269	300	0	75	2	77	594	590
4	May	251	2	66	404	470	0	187	3	190	913	911
5	May	299	2	68	488	556	0	200	4	204	1061	1059
6	May	308	1	65	460	525	0	205	6	211	1045	1044
7	May	376	5	74	447	521	0	175	8	183	1085	1080
8	May	549	4	72	456	528	0	225	3	228	1309	1305
9	May	629	2	106	690	796	0	264	9	273	1700	1698
10	May	570	2	118	665	783	0	225	7	232	1587	1585
11	May	649	1	123	570	693	0	762	8	770	2113	2112
12	May	602	3	149	595	744	0	801	7	808	2157	2154
13	May	644	10	192	606	798	0	652	23	675	2127	2117
14	May	529	2	209	452	661	0	533	7	540	1732	1730
15	May	695	3	215	357	572	0	567	7	574	1844	1841
16	May	754	2	161	248	409	0	268	14	282	1447	1445
17	May	875	11	101	158	259	0	304	4	308	1453	1442
18	May	691	14	81	111	192	0	154	15	169	1066	1052
19	May	811	14	81	98	179	0	78	10	88	1092	1078
20	May	543	14	83	104	187	0	36	2	38	782	768
21	May	457	5	40	33	73	0	44	4	48	583	578
22	May	518	13	71	58	129	0	35	4	39	699	686
23	May	540	6	44	36	80	0	37	3	40	666	660
24	May	472	8	59	43	102	0	36	3	39	621	613
25	May	487	8	55	41	96	0	30	4	34	625	617
26	May	475	15	40	32	72	0	24	3	27	589	574
27	May	313	8	53	15	68	0	41	2	43	432	424
28	May	256	9	45	10	55	0	95	3	98	418	409
29	May	197	18	25	15	40	0	14	1	15	270	252
30	May	351	45	22	14	36	0	54	6	60	492	447
31	May	375	43	57	41	98	0	33	4	37	553	510
Totals:		15171	283	2636	8093	10729	0	7011	181	7192	33375	33092

Appendix A-3. Daily salmonid catch, Rock Island bypass trap, June, 1994.

Date	Chinook	Chinook	Steelhead			Coho	Sockeye			Total Salmonid	Total Yearling
	Yearlings	Subyear	Wild	Hatchery	Total		Wild	Hatchery	Total		
01-Jun	113	48	5	5	10	0	9	1	10	181	133
02-Jun	110	42	16	3	19	0	10	2	12	183	141
03-Jun	107	49	25	9	34	0	11	9	20	210	161
04-Jun	113	31	6	6	12	0	12	7	19	175	144
05-Jun	156	40	6	5	11	0	9	10	19	226	186
06-Jun	116	62	8	9	17	0	12	1	13	208	146
07-Jun	84	38	5	3	8	0	4	0	4	134	96
08-Jun	83	71	6	3	9	0	8	3	11	174	103
09-Jun	82	81	4	1	5	0	2	1	3	171	90
10-Jun	67	103	0	0	0	0	3	0	3	173	70
11-Jun	86	39	6	2	8	0	2	1	3	136	97
12-Jun	51	12	2	5	7	0	1	2	3	73	61
13-Jun	69	8	5	5	10	0	1	0	1	88	80
14-Jun	28	44	3	7	10	0	1	0	1	83	39
15-Jun	29	69	9	5	14	0	2	1	3	115	46
16-Jun	19	88	5	0	5	0	0	0	0	112	24
17-Jun	12	96	6	2	8	0	0	0	0	116	20
18-Jun	14	157	1	1	2	0	2	0	2	175	18
19-Jun	13	80	4	3	7	0	0	0	0	100	20
20-Jun	9	226	4	2	6	0	0	0	0	241	15
21-Jun	19	227	0	3	3	0	9	1	10	259	32
22-Jun	9	155	4	0	4	0	3	0	3	171	16
23-Jun	8	333	3	1	4	0	4	1	5	350	17
24-Jun	10	589	2	0	2	0	5	1	6	607	18
25-Jun	13	610	4	1	5	0	18	1	19	647	37
26-Jun	22	449	2	0	2	0	9	2	11	484	35
27-Jun	4	205	2	0	2	0	7	0	7	218	13
28-Jun	2	231	2	0	2	0	4	0	4	239	8
29-Jun	2	320	0	0	0	0	7	0	7	329	9
30-Jun	2	300	2	0	2	0	3	0	3	307	7
Totals:	1452	4803	147	81	228	0	158	44	202	6685	1882

Appendix A-4. Daily salmonid catch, Rock Island bypass trap, July, 1994.

Date	Chinook	Chinook	Steelhead			Coho	Sockeye			Total Salmonid	Total Yearling
	Yearlings	Subyear	Wild	Hatchery	Total		Wild	Hatchery	Total		
01-Jul	8	266	1	0	1	0	3	1	4	279	13
02-Jul	4	178	2	0	2	0	2	1	3	187	9
03-Jul	4	141	0	0	0	0	2	0	2	147	6
04-Jul	1	165	1	0	1	0	1	1	2	169	4
05-Jul	3	128	1	1	2	0	9	0	9	142	14
06-Jul	10	135	2	2	4	0	2	0	2	151	16
07-Jul	9	154	0	6	6	0	3	1	4	173	19
08-Jul	10	144	0	3	3	0	6	1	7	164	20
09-Jul	6	195	1	5	6	0	1	0	1	208	13
10-Jul	1	217	1	8	9	0	2	0	2	229	12
11-Jul	2	218	0	6	6	0	2	0	2	228	10
12-Jul	1	198	0	1	1	0	2	0	2	202	4
13-Jul	1	172	2	1	3	0	2	0	2	178	6
14-Jul	1	81	2	3	5	0	2	0	2	89	8
15-Jul	0	103	0	1	1	0	3	0	3	107	4
16-Jul	0	68	3	1	4	0	3	0	3	75	7
17-Jul	1	62	0	0	0	0	4	0	4	67	5
18-Jul	0	55	0	2	2	0	1	0	1	58	3
19-Jul	0	55	0	0	0	0	4	0	4	59	4
20-Jul	0	112	0	0	0	0	4	0	4	116	4
21-Jul	0	110	0	1	1	0	3	0	3	114	4
22-Jul	0	110	0	0	0	0	0	0	0	110	0
23-Jul	0	50	1	0	1	0	1	0	1	52	2
24-Jul	0	57	0	0	0	0	3	0	3	60	3
25-Jul	2	68	0	0	0	0	1	0	1	71	3
26-Jul	0	93	0	0	0	0	2	0	2	95	2
27-Jul	2	164	1	1	2	0	1	0	1	169	5
28-Jul	1	206	0	0	0	0	3	0	3	210	4
29-Jul	0	154	0	0	0	0	0	0	0	154	0
30-Jul	0	74	0	0	0	0	4	0	4	78	4
31-Jul	0	45	0	0	0	0	0	0	0	45	0
Totals:	67	3978	18	42	60	0	76	5	81	4186	208

Appendix A-5. Daily salmonid catch, Rock Island bypass trap, August, 1994.

Date	Chinook	Chinook	Steelhead			Coho	Sockeye			Total Salmonid	Total Yearling
	Yearlings	Subyear	Wild	Hatchery	Total		Wild	Hatchery	Total		
01-Aug	0	78	0	0	0	0	1	0	1	79	1
02-Aug	0	129	0	0	0	0	2	0	2	131	2
03-Aug	1	147	0	1	1	0	4	0	4	153	6
04-Aug	0	108	0	0	0	0	2	0	2	110	2
05-Aug	0	91	0	1	1	0	4	0	4	96	5
06-Aug	0	84	0	0	0	0	4	0	4	88	4
07-Aug	0	49	0	0	0	0	0	0	0	49	0
08-Aug	0	72	0	0	0	0	0	0	0	72	0
09-Aug	1	46	0	0	0	0	2	0	2	49	3
10-Aug	0	44	0	0	0	0	2	0	2	46	2
11-Aug	0	69	0	0	0	0	1	0	1	70	1
12-Aug	0	43	0	1	1	0	1	0	1	45	2
13-Aug	0	37	0	0	0	0	3	0	3	40	3
14-Aug	0	21	0	0	0	0	2	0	2	23	2
15-Aug	0	22	0	0	0	0	1	0	1	23	1
16-Aug	1	30	0	0	0	0	2	0	2	33	3
17-Aug	0	30	0	0	0	0	0	0	0	30	0
18-Aug	0	19	0	0	0	0	3	0	3	22	3
19-Aug	0	24	0	0	0	0	3	0	3	27	3
20-Aug	0	8	0	0	0	0	3	0	3	11	3
21-Aug	1	22	0	0	0	0	0	0	0	23	1
22-Aug	0	10	0	0	0	0	3	0	3	13	3
23-Aug	0	17	0	0	0	0	6	0	6	23	6
24-Aug	0	13	0	0	0	0	3	0	3	16	3
25-Aug	0	26	0	0	0	0	5	0	5	31	5
26-Aug	0	19	0	0	0	0	6	0	6	25	6
27-Aug	0	14	0	0	0	0	3	0	3	17	3
28-Aug	0	31	0	0	0	0	4	0	4	35	4
29-Aug	1	16	0	0	0	0	3	0	3	20	4
30-Aug	0	22	0	0	0	0	2	0	2	24	2
31-Aug	0	15	0	0	0	0	1	0	1	16	1
Totals:	5	1356	0	3	3	0	76	0	76	1440	84

Appendix A-6. Monthly summary of the Rock Island bypass trap catch, April 1 – August 31, 1994.

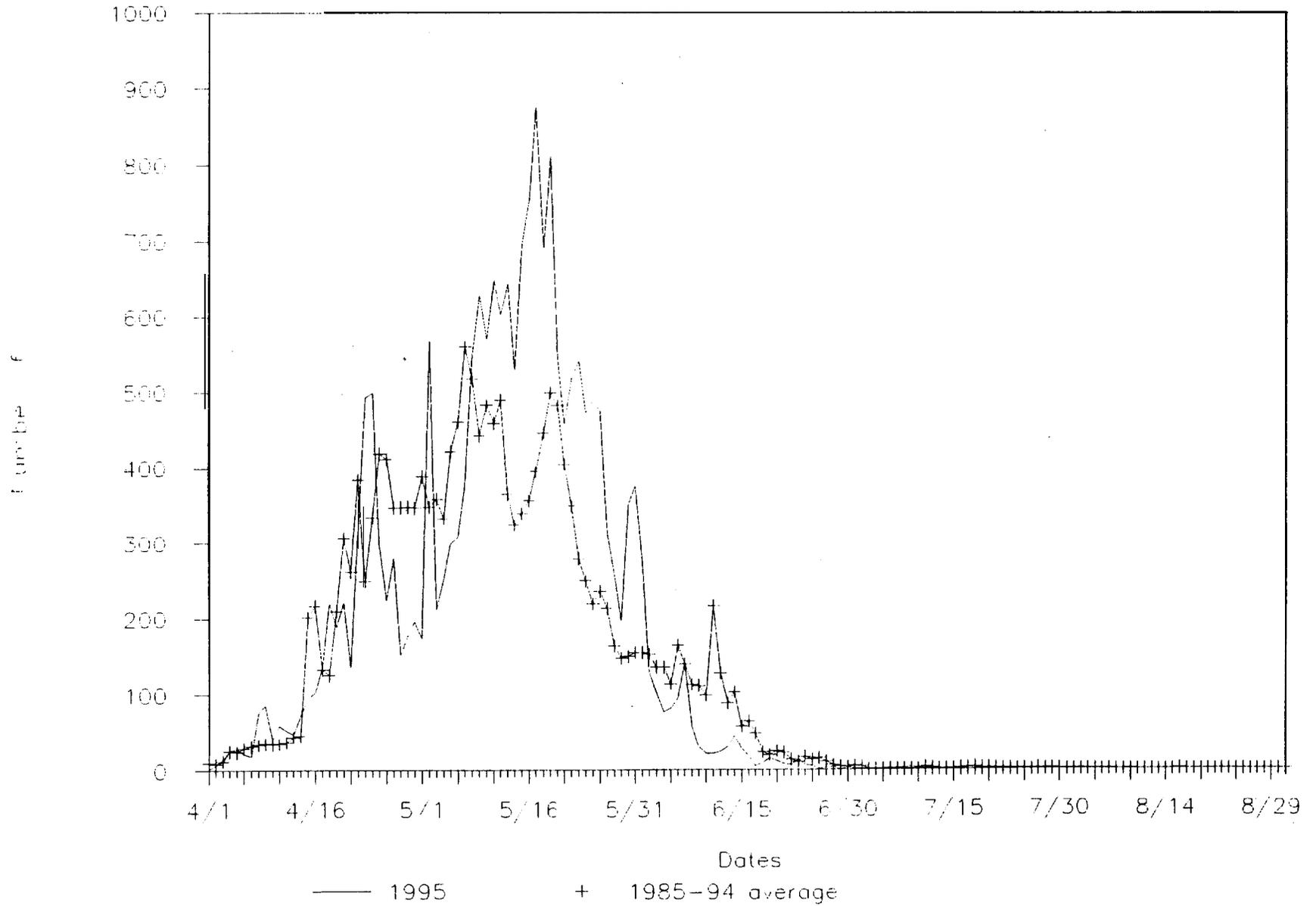
Month	Chinook Yearlings	Chinook Subyear	Steelhead			Coho	Sockeye			Total Salmonid	Total Yearling
			Wild	Hatchery	Total		Wild	Hatchery	Total		
April	1939	264	825	957	1782	0	3648	144	3792	7777	7513
May	5008	373	2232	5544	7776	0	4296	229	4525	17707	17334
June	1452	4803	147	81	228	0	158	44	202	6685	1882
July	67	3978	18	42	60	0	76	5	81	4186	208
August	5	1356	0	3	3	0	76	0	76	1440	84
Totals	8471	10774	3222	6627	9849	0	8254	422	8676	37795	27021

Appendix B

Daily juvenile salmonid run timing for 1995
and the ten year average.

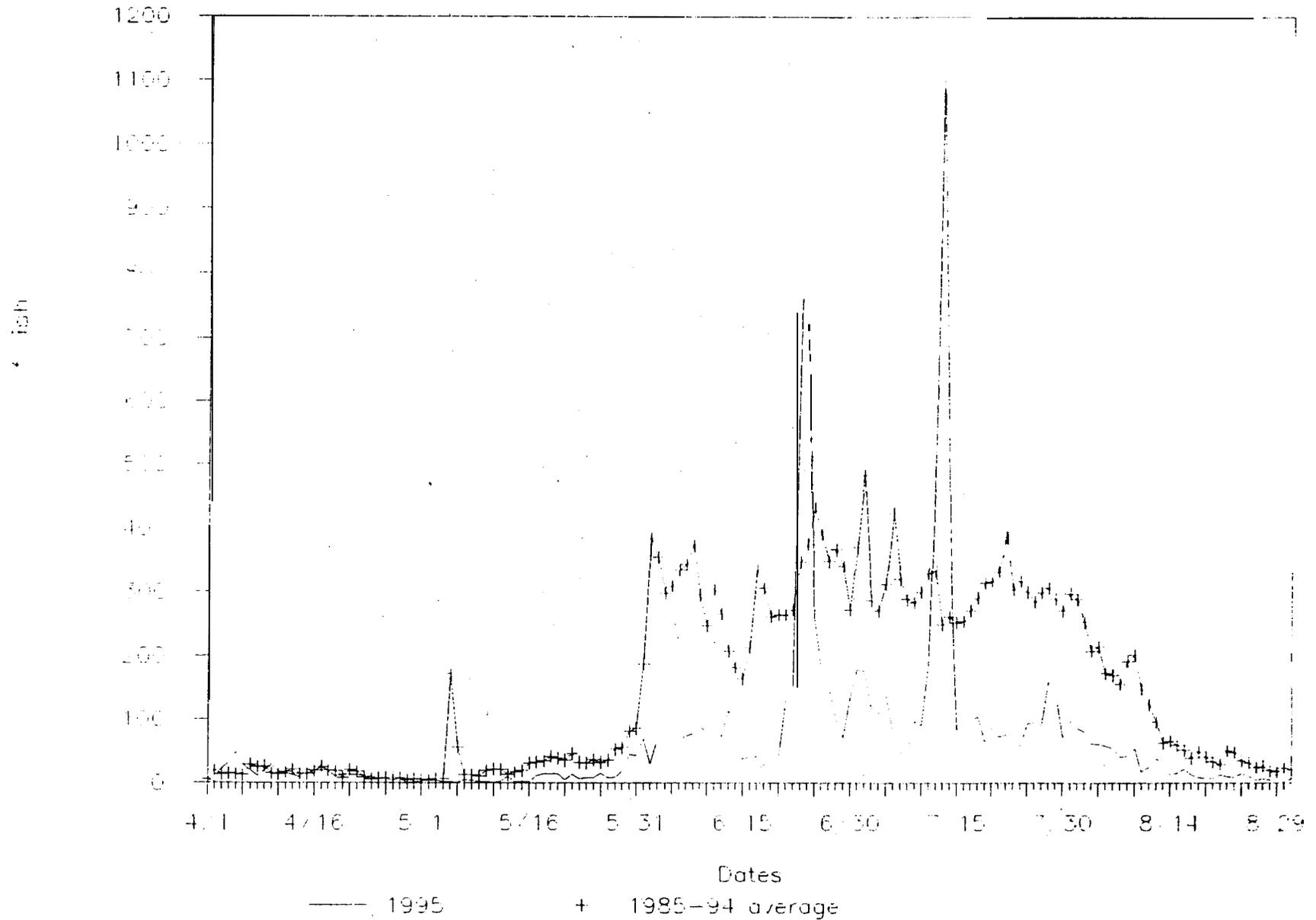
Daily collection of yearling chinook

at Rock Island Dam



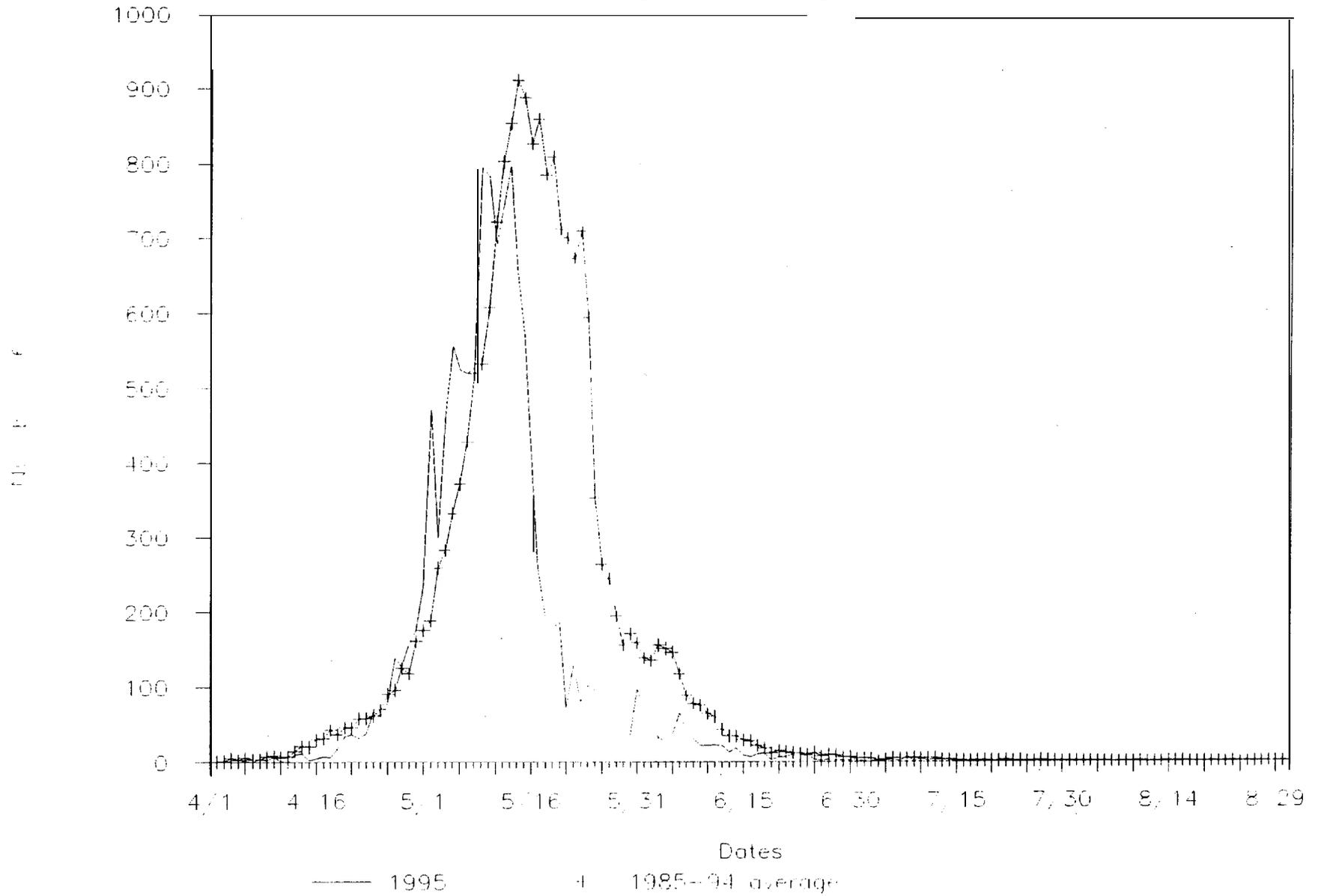
Daily collection of subyearling chinook

at Peck Island Dam



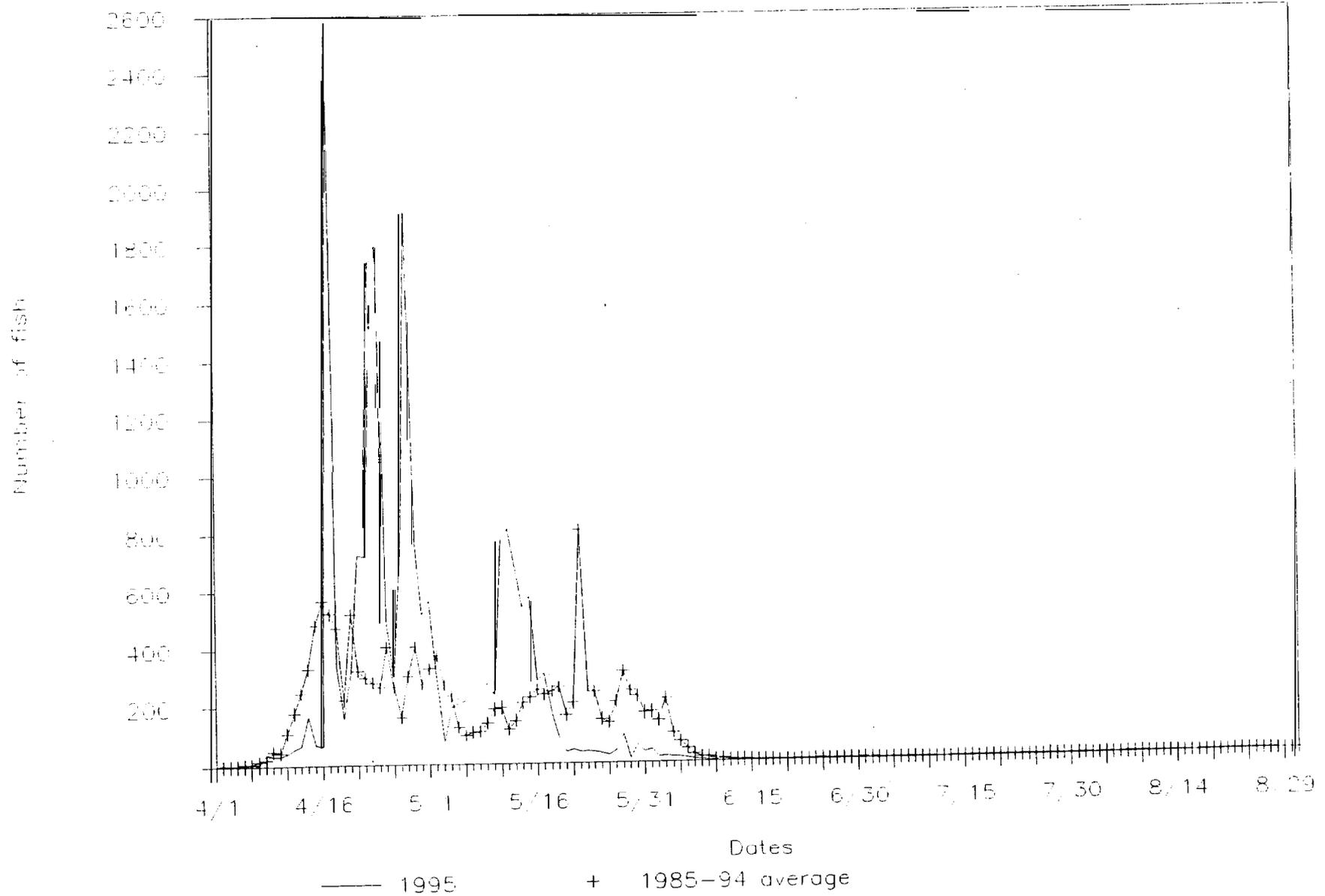
Daily collection of steelhead

at Rock Island Dam



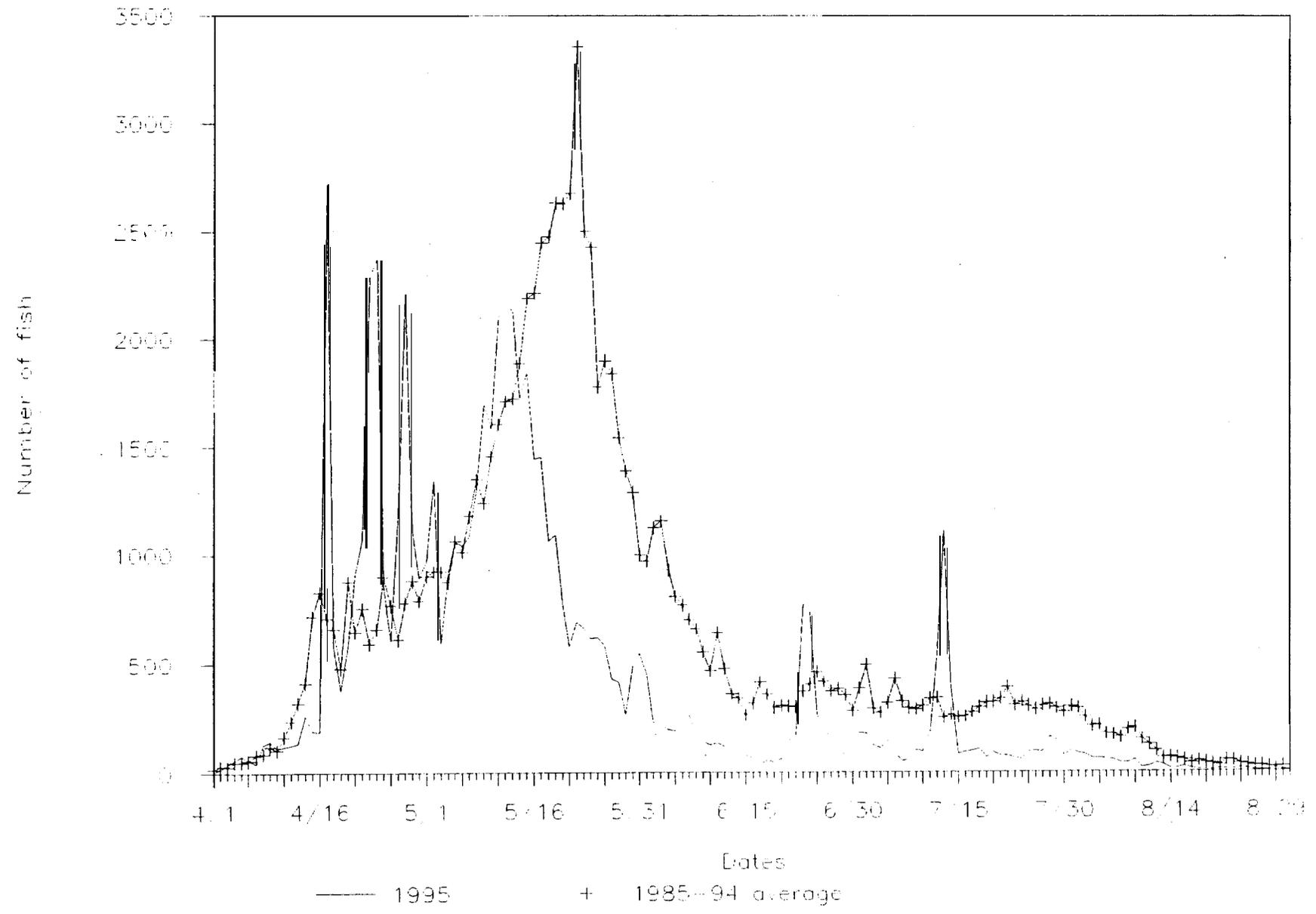
Daily collection of sockeye

at Peck Island Dam



Daily collection of total salmonids

at Rock Island Dam



Daily collection of yearling salmonids

at Rock Island Dam

