

Final Report

**Migrational Characteristics of Juvenile Salmonids
in the Mid-Columbia River During 1976**

Prepared by

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Report of Research

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INTRODUCTION

The development of the mid-Columbia River for hydroelectric production has adversely affected the runs of salmon and steelhead in the area. Priest Rapids, Wanapum, and Rocky Reach Dams, completed in the early 1960's, and Wells Dam, completed in 1967, have created barriers which fish must negotiate. Since 1972, regulation of the river through use of Canadian storage reservoirs has significantly altered the natural flow patterns of the river and reduced river flows and spill at dams during the major juvenile outmigration. Since 1964, daily peaking for power production has affected the portion of the juvenile migration which occurs in July and August, and since 1972 peaking has also affected juvenile migrations that occur in the spring.

Flow regulation in the future will be of an even greater magnitude than previously experienced, especially when the third powerhouse at Grand Coulee Dam is operational. There will be times when the volume of water from Grand Coulee Dam will require heavy spilling at other dams, thus benefiting downstream migrations of salmonids, but there will also be times when no excess water will be available for spilling. This lack of flow and spill will result in migrational delay and also force all fingerlings to pass through the turbines at the various dams.

Currently the following two factors have made the impact of hydroelectric production and flow regulation even more critical to fish production in the area: (1) the runs of native summer chinook and sockeye salmon have been reduced to the point where their very survival is threatened and (2) significant increases in the hatchery production of spring chinook salmon and steelhead trout in the area increase the number of hatchery fish impacted. With this in mind, the National Marine Fisheries Service and the Chelan, Douglas, and Grant County Public Utility Districts of the State of Washington initiated a program in 1976 to define the migrational characteristics of juvenile salmonids in the mid-Columbia River under varying flow conditions and to determine the possible influence of controlled spilling on these migrations. The program had the following specific objectives: (1) define the magnitude and timing of present stocks of juvenile salmonids migrating through the mid-Columbia area, (2) measure the survival of hatchery-reared spring and summer chinook salmon and steelhead trout smolts migrating through the mid-Columbia area, (3) define the diel movement of juvenile salmonids through the forebay and turbines at Priest Rapids Dam, and (4) determine the effect of controlled spilling on the movement of fingerlings in the forebay and into the turbine intake gatewells at Priest Rapids Dam.

METHODS

The downstream migration of juvenile salmon and steelhead trout passing through the mid-Columbia River in 1976 was monitored by dipnetting turbine intake gatewells at Priest Rapids, McNary, and John Day Dams (Figure 1). The forebay of Priest Rapids Dam was also sampled with

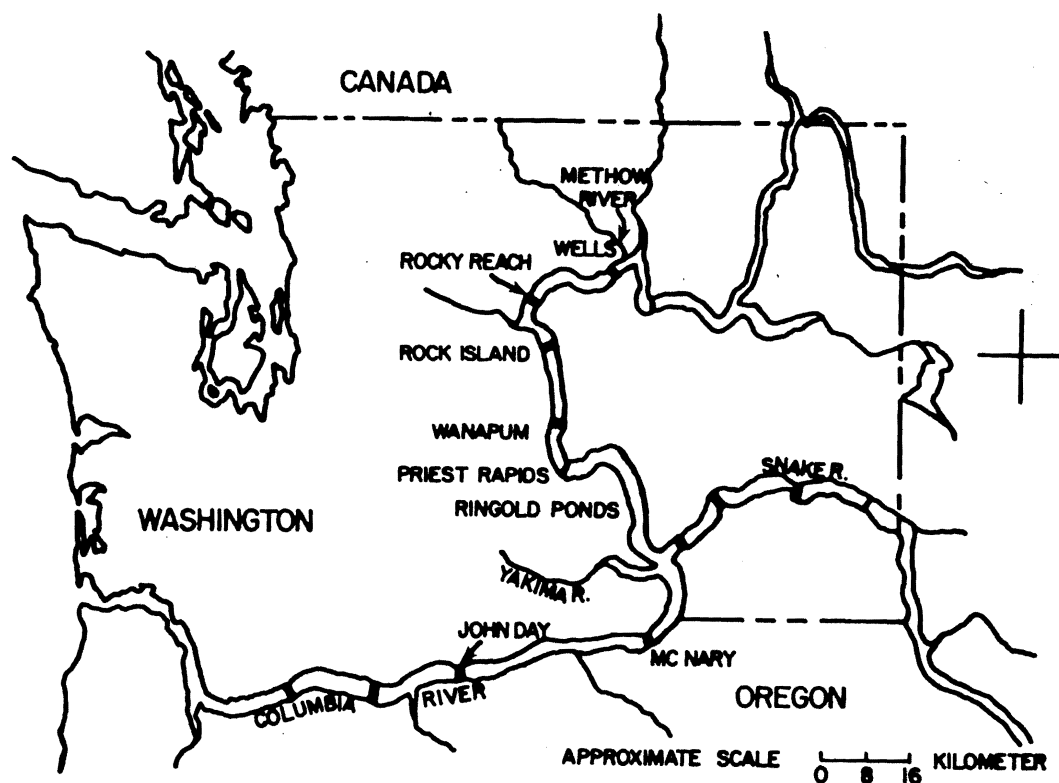


Figure 1.--The Columbia River System showing the area of study.

purse seines. The information obtained was used to define magnitude, timing, survival, and migrational behavior of salmonid smolts in the mid-Columbia.

Sampling periods at the various projects were as follows:

<u>Sample Site</u>	<u>Sample Period</u>
Priest Rapids Dam	4/14 - 9/10
McNary Dam	4/14 - 10/4
John Day Dam	4/16 - 12/15

POPULATION ESTIMATES

The outmigrations of juvenile salmonids passing Priest Rapids Dam in 1976 were defined and enumerated. Population estimates were based on the total numbers of fingerlings collected in gatewells at Priest Rapids Dam as related to recoveries of marked fingerlings previously released into the forebay approximately 12 miles above the dam. Mathematical computations were based on Chapman's formula:--
$$N = \frac{nt}{s}$$

Where: N = Estimated Population

t = Number of marked fish released

n = Gatewell sample size

s = Number of marked fish recovered

TIMING

Timing of the 1976 juvenile salmonid migrations at Priest Rapids Dam was based on population estimates made at the dam. The peak of any given migration was considered to be the date on which 50% of the total estimated population passed the dam.

SURVIVAL ESTIMATES

Paired releases of groups of marked fish were used to define survival of selected stocks of hatchery-reared salmon through the mid-Columbia area--test fish were released at the upriver sites and controls were released in the tailrace of Priest Rapids Dam. Estimates of relative survival were based on recovery ratios of test and control fish in the gatewells at McNary Dam. Experimental fish were cold-branded at the respective hatcheries by NMFS personnel. To ensure mixing, control releases below Priest Rapids Dam were not made until test fish began to show in gatewell catches at the dam.

Marked chinook salmon smolts released in the forebay and tailrace of Priest Rapids Dam and recovered at McNary Dam were used to define fish passage mortality at Priest Rapids Dam.

MIGRATIONAL BEHAVIOR

Fish were dipnetted from the turbine intake gatewells at Priest Rapids Dam at 2-hour intervals over 30-hour test periods to define movement patterns for migrants at the dam. Similar sampling was conducted with purse seines in the forebay of Priest Rapids Dam to define movement patterns for migrants in the reservoir.

The effect of controlled spilling on passage behavior of smolting salmonids at Priest Rapids Dam was evaluated by comparing the distribution of fish, based on gatewell catches, across the powerhouse during test periods of spill pattern manipulation.

RESULTS

Turbine intake gatewells were dipnetted on a 3-day-per-week schedule at Priest Rapids Dam from April 14th through September 10th, 1976. Purse seine sampling in the Priest Rapids forebay was conducted from April 22nd through September 1st on a 2-day-per-week schedule. Fingerlings taken from the gatewells totaled 37,588 fall and/or summer chinook salmon ("0"-age class), 31,976 spring chinook salmon ("1"-age class), 6,694 steelhead trout, 26,635 sockeye salmon, and 11,797 coho salmon. Purse seine sampling provided an additional 1,115 fall and/or summer chinook salmon, 783 spring chinook salmon, 262 steelhead trout, 642 sockeye salmon, and 65 coho salmon. Approximately 33,000 chinook salmon smolts were cold-branded and released in the upper forebay of Priest Rapids Dam to determine sampling efficiency. An additional 31,488 branded chinook salmon smolts were released in the tailrace below the dam to provide a measure of mortality at Priest Rapids Dam.

All data collected during 1976 have been compiled and analyzed. Sampling and marking summaries are presented in Tables 1 to 4 of the appendix. Detailed results are presented and discussed in appropriate sections of this report.

MAGNITUDE AND TIMING

Magnitude and timing of salmonid outmigrations at Priest Rapids Dam were enumerated and defined. In Tables 1 and 2, these data are compared to similar information collected for the period 1965 through 1967 (Park).

Table 1.--Estimated numbers of juvenile salmonids passing Priest Rapids Dam in 1965, 1966, 1967, and 1976.

Year ^{1/}	Spring Chinook	Fall & Summer Chinook	Coho	Sockeye	Steelhead
1965	170,000	1,700,000	220,000	2,900,000	270,000
1966	350,000	1,400,000	1,170,000	4,000,000	240,000
1967	270,000	1,500,000	1,170,000	1,000,000	266,000
1976	1,600,000	2,300,000	600,000	1,600,000	400,000

1/ 1965, 66, & 67 data from Donn L. Park, unpublished report.

Table 2.--Timing (Peak of migration) of juvenile salmonid migrations at Priest Rapids Dam, 1965, 1966, 1967, & 1976.

Year ^{1/}	Spring Chinook	Fall & Summer Chinook	Coho	Sockeye	Steelhead
1965	May 19	August 11	May 12	May 3	May 20
1966	May 17	August 12	April 29	May 1	May 25
1967	May 23	August 8	May 20	May 1	May 18
1976	May 14	August 11	May 19	May 19	May 14

^{1/} 1965, 66, & 67 data from Donn L. Park, unpublished report.

Spring Chinook Salmon

Approximately 1.6 million spring chinook salmon smolts were estimated to have passed Priest Rapids Dam in 1976. This represents a six-fold increase over the size of the outmigrations measured by Park in 1965 through 1967. This increase is a result of the increased production of spring chinook salmon at various hatcheries in the mid-Columbia area. In 1976, the outmigration of spring chinook salmon began in mid-April, peaked on May 14th, and was essentially over by July 1st (Figure 2).

Fall and/or Summer Chinook

In 1976, the outmigration of "0"-age chinook salmon at Priest Rapids Dam was estimated at 2.3 million fish; up from the 1.5 to 1.7 million fish measured in the mid-sixties. This increase also reflects increased hatchery production. Smolting "0"-age chinook salmon began to arrive at Priest Rapids Dam in mid-July (Figure 3). The outmigration peaked on August 11th and was still in progress when sampling was terminated on September 10th.

Steelhead Trout

The effect of increased hatchery production of steelhead trout in the mid-Columbia was also evident in 1976. An outmigration of 400,000 smolts was estimated at Priest Rapids Dam--a significantly larger number than the 250,000 average for smolt outmigrations of the mid-sixties. The outmigration of steelhead trout began in mid-April, peaked on May 14th, and was over by the first week in July (Figure 4).

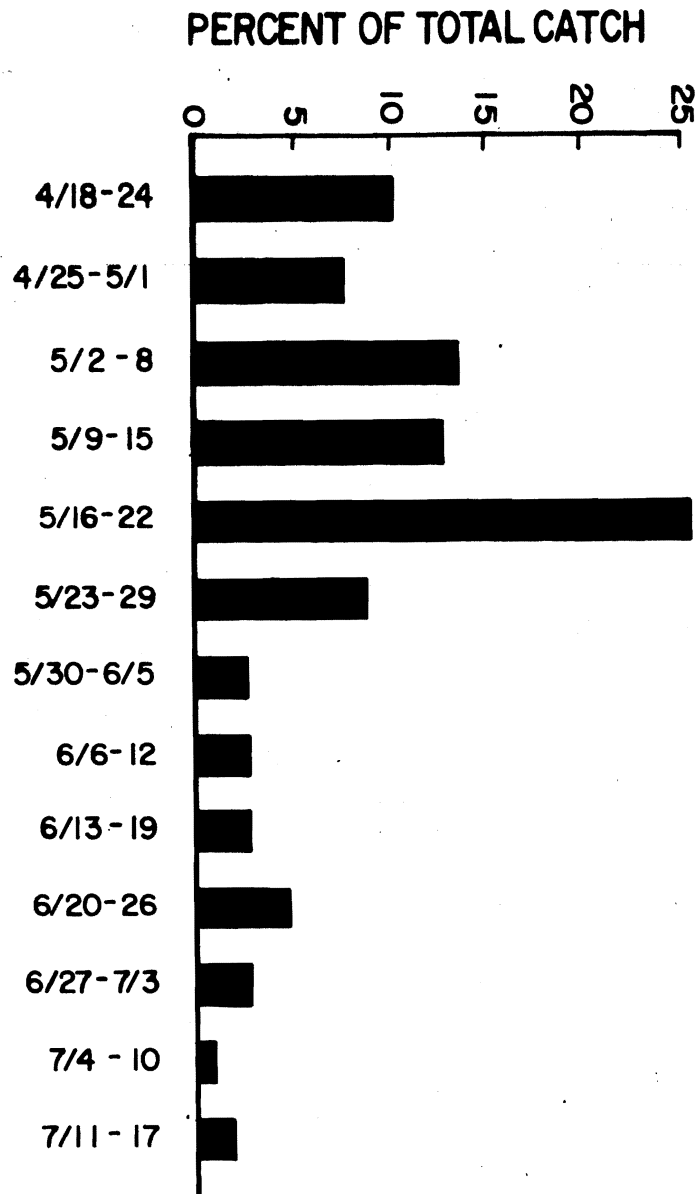


Figure 2.--Temporal distribution of juvenile spring chinook salmon catches in the turbine intake gatewells at Priest Rapids Dam in 1976.

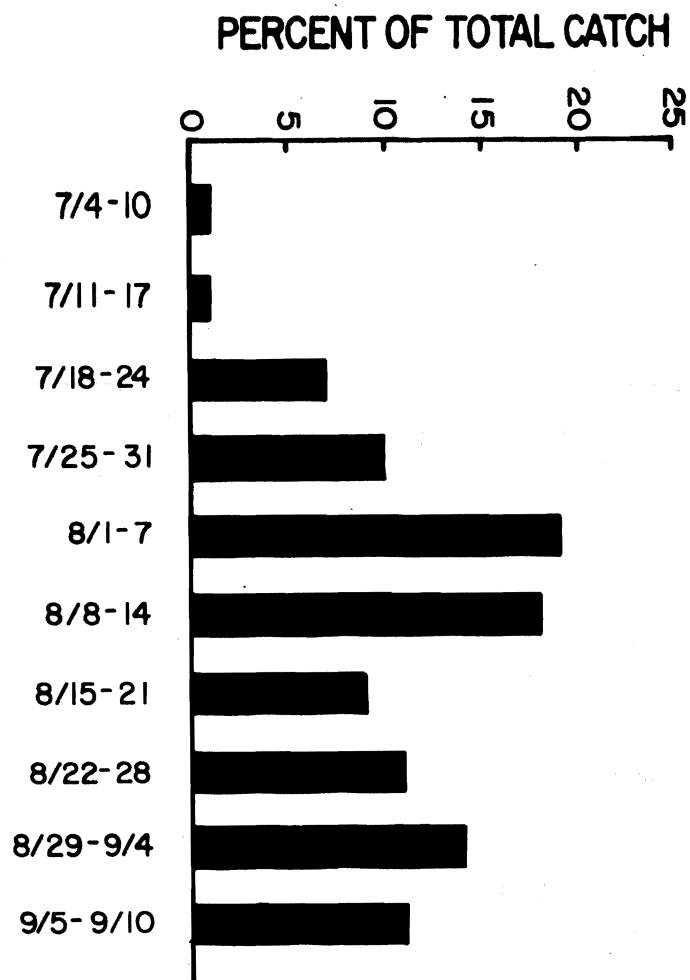


Figure 3.--Temporal distribution of "0"-age chinook salmon catches in the turbine intake gatewells at Priest Rapids Dam in 1976.

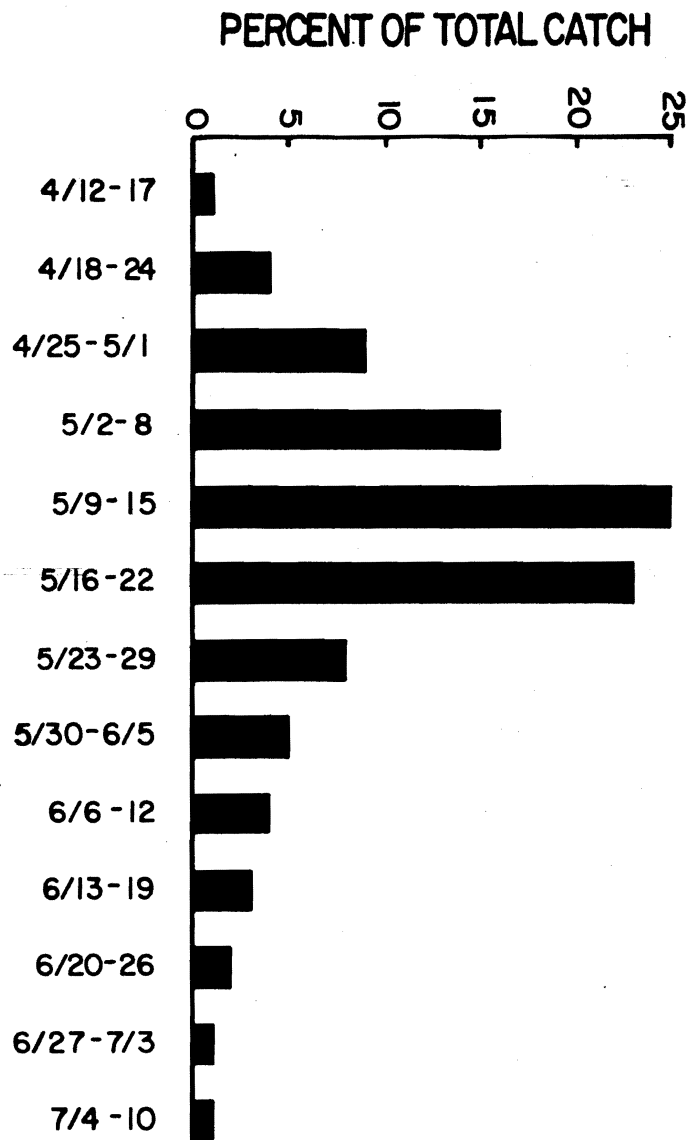


Figure 4.--Temporal distribution of steelhead trout catches in the turbine intake gatewells at Priest Rapids Dam in 1976.

Sockeye Salmon

The outmigration of sockeye salmon at Priest Rapids Dam was estimated at 1.6 million smolts in 1976--somewhat smaller than the 1965-67 average. The outmigration in 1976 was bimodal (Figure 5). The primary outmigration began in mid-April, peaked on May 19th, and was over by July 1st. A small secondary group migrated past Priest Rapids Dam during the 5-week period from mid-July through mid-August.

Coho Salmon

The outmigration of coho salmon smolts clearly reflected the change in the output of the National Fish Hatchery at Leavenworth, Washington from coho salmon to spring chinook salmon. Only 600,000 coho salmon smolts are estimated to have reached Priest Rapids Dam in 1976. In 1966 and 1967, when the hatchery at Leavenworth was concentrating on coho salmon production, outmigrations of more than 1.1 million fish were measured. The 1976 outmigration of coho salmon at Priest Rapids Dam began on May 16th, peaked four days later, and was over by June 1st (Figure 6).

SMOLT SURVIVAL

Favorable passage conditions existed for salmonid smolts in the mid-Columbia in 1976. High runoff resulted in little delay in passage through reservoirs, low water temperatures, and spill late into the summer at most projects. Even so, significant mortalities of juveniles occurred (Tables 3 and 4). Steelhead trout released into the Methow River by the Washington Department of Game and summer

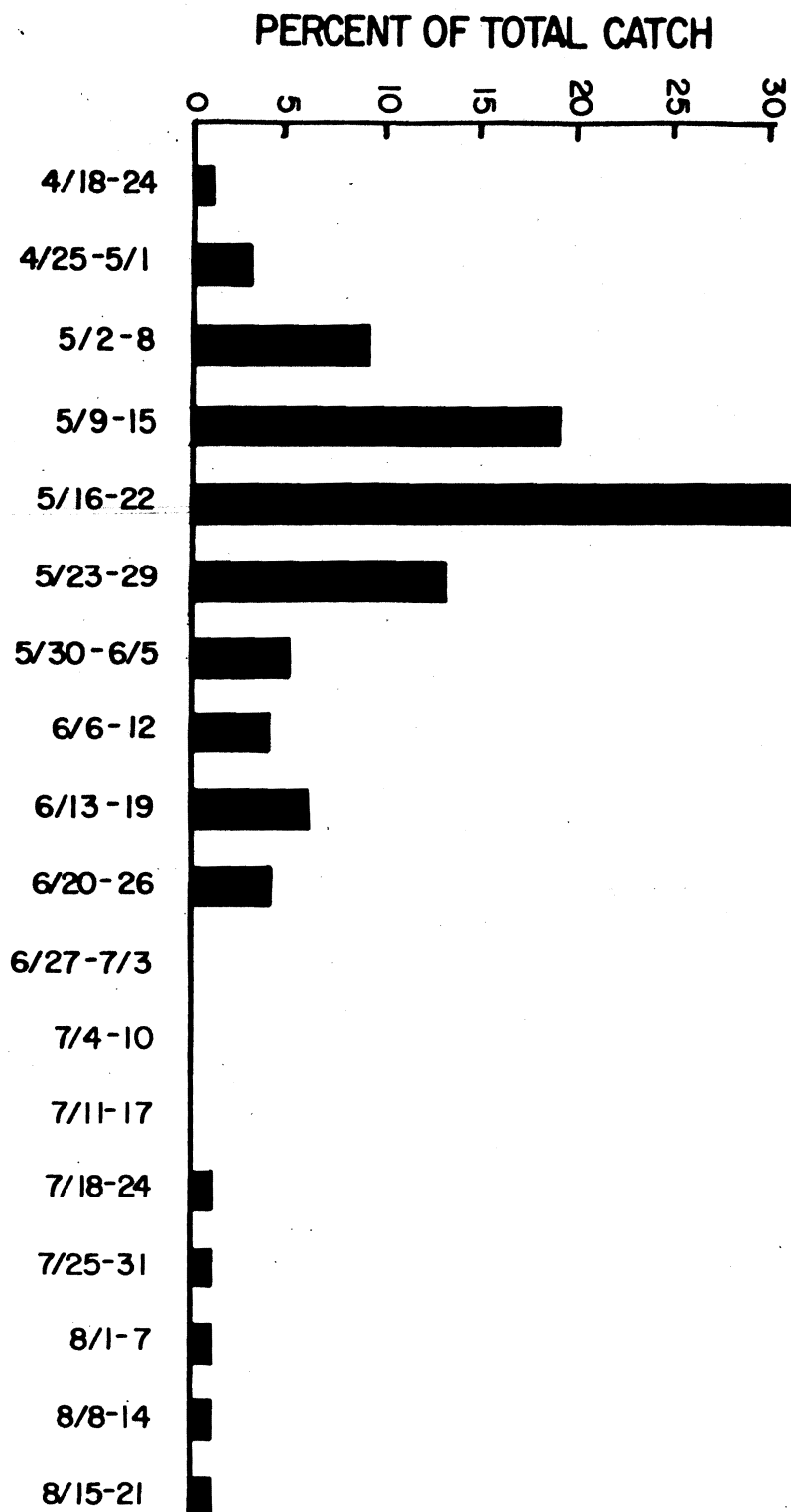


Figure 5.--Temporal distribution of sockeye salmon catches in the turbine intake gatewells at Priest Rapids Dam in 1976.

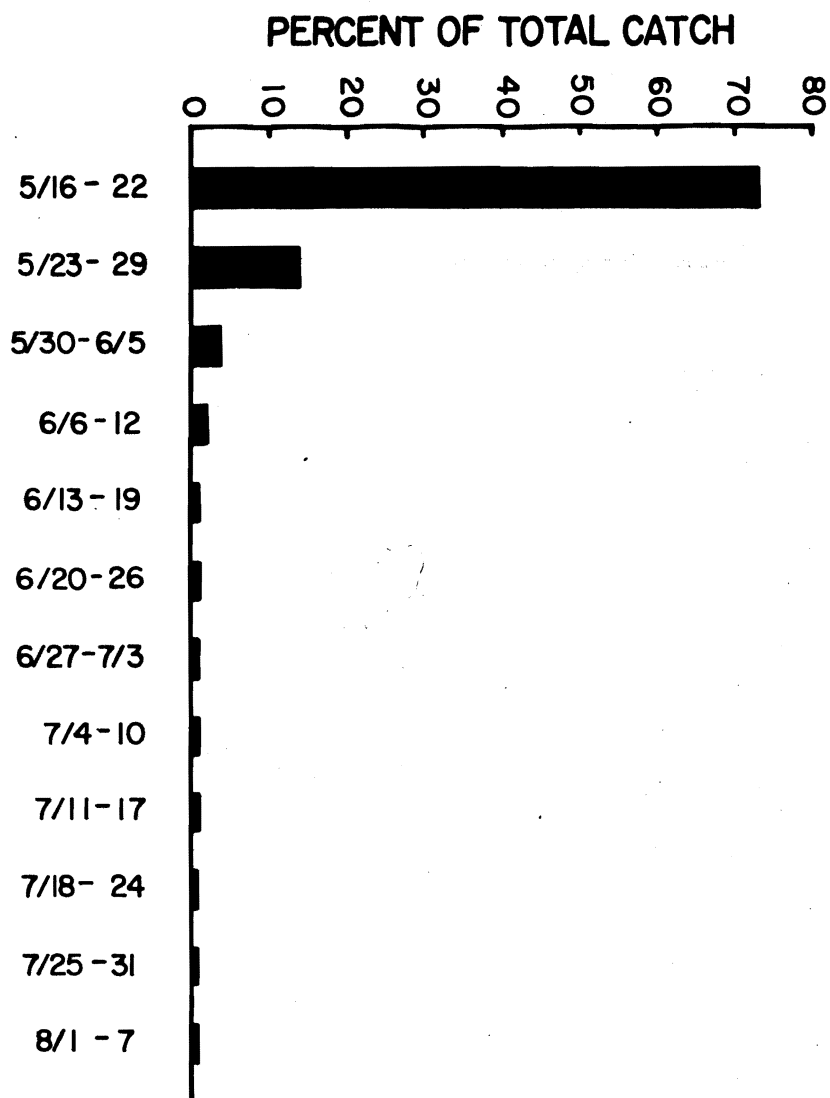


Figure 6.--Temporal distribution of coho salmon catches in the turbine intake gatewells at Priest Rapids Dam in 1976.

Table 3.--Results of mark and recovery experiments conducted in the mid-Columbia River in 1976.

Stock and species	Release site	Release Date	Number Released	McNary Dam and John Day Dam Recoveries		Relative Survival %
				Number	Percent	
Wells steelhead	Methow River ✓	4/8	25,724	144	0.56	23
Ringold steelhead	Ringold Rearing Ponds	4/22	25,290	609	2.41	100
Leavenworth spring chinook	Leavenworth Hatchery	4/23	50,695	145	0.29	54
Leavenworth spring chinook	Priest Rapids Dam tailrace	5/10	50,507	274	0.54	100
Wells summer chinook	Wells Spawning Channel	6/22	50,491	59	0.12	13
Wells summer chinook	Priest Rapids Dam tailrace	6/29	40,843	390	0.96	100

Table 4.--Mortality of smolts at Priest Rapids Dam in 1976 based
upon releases of marked chinook salmon smolts above and below the dam.

Priest Rapids Dam Release Site	Number Released	McNary Dam Recoveries		Relative Mortality %
		Number	Percent	
<u>Chinook "1"s</u>				
Forebay Releases	17195	148	0.86	8
Tailrace Releases	16522	153	0.93	0
<u>Chinook "0"s</u>				
Forebay Releases	15754	73	0.46	27
Tailrace Releases	14966	95	0.63	0

chinook salmon released at Wells Dam by the Washington Department of Fisheries apparently suffered severe losses in passing five dams before reaching McNary Dam. Relative survival was estimated at only 23% for the steelhead trout and 13% for the summer chinook salmon. The outmigration of spring chinook salmon from Leavenworth Hatchery was more successful--passing three dams with relative survival estimated at 54% to McNary Dam. The mortality of spring chinook salmon and "0"-age chinook salmon at Priest Rapids Dam was estimated to be 8 and 27%, respectively.

DIEL MOVEMENT PATTERNS

Diel movement patterns of spring chinook salmon, "0"-age chinook salmon, steelhead trout, and sockeye salmon were examined at Priest Rapids Dam in 1976 (See appendix table 5). Tests conducted on May 13 and 14 showed that approximately 60% of the spring chinook salmon smolts entered the turbine intake gatewells after dark; peak movement occurred between midnight and 2:00 a.m. (Figure 7). Night movement at Priest Rapids Dam was considerably less than at John Day Dam where similar tests showed 80% of all movement occurred after dark.

Diel movement patterns of "0"-age chinook salmon at Priest Rapids Dam were more precise. Two tests, conducted between July 28 and August 5, indicated night movement at 75%, with more than one-third of all fish entering the gatewells between 10:00 p.m. and midnight.

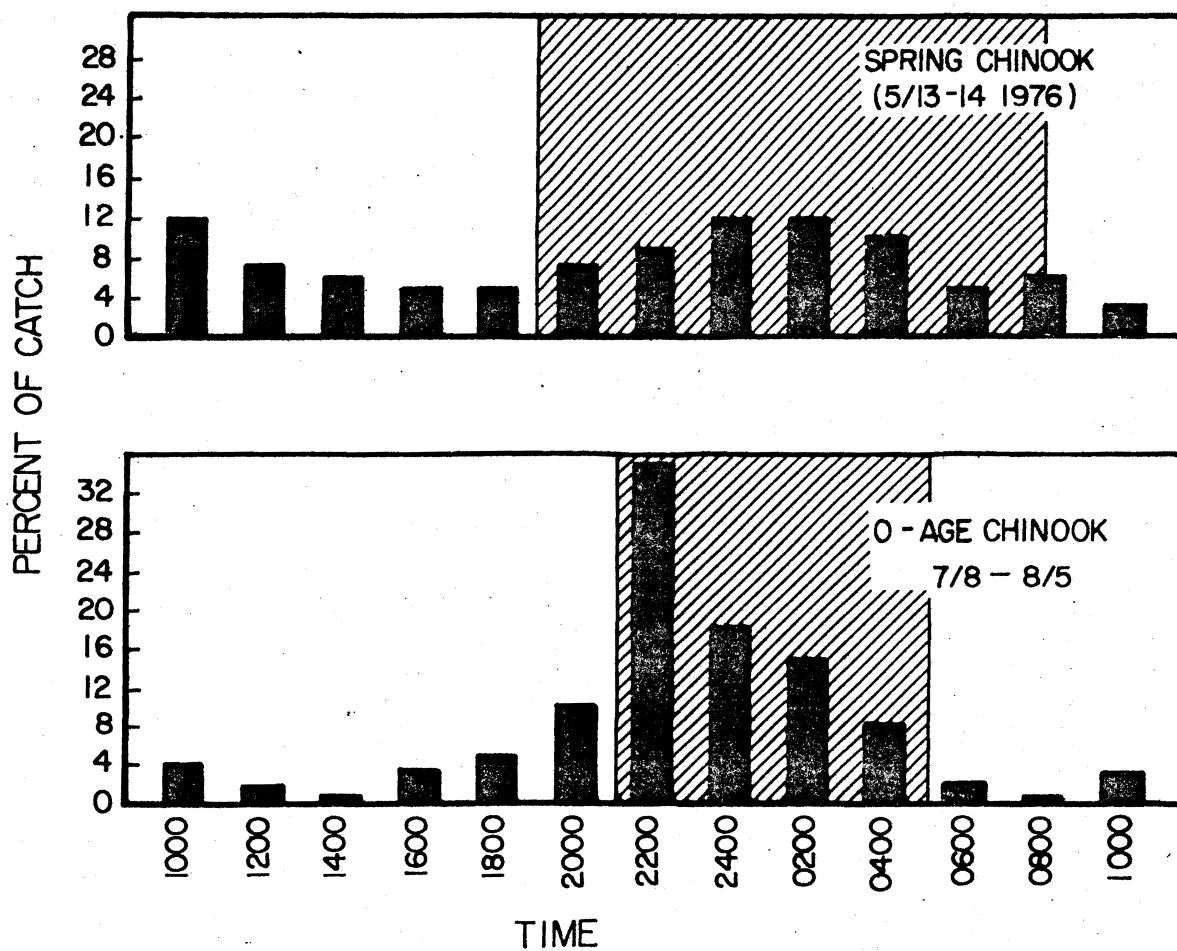


Figure 7.--Diel movement patterns of spring and "0"-age chinook salmon smolts at Priest Rapids Dam in 1976.

Diel movement of steelhead trout at Priest Rapids Dam was almost identical to movement of spring chinook salmon. Sixty-one percent entered the turbine intake gatewells after dark, and peak movement occurred between 10 p.m. and 2 a.m.

Movement patterns of sockeye salmon were quite different from all other species measured. Peak movement was in the afternoon, between 2 and 4 p.m., and only 50% entered the gatewells after dark.

The coho salmon outmigration was over by the time of our first diel tests, therefore no measure of their movement patterns was possible.

EFFECT OF SPILL

The effect of spill manipulation on smolt movement patterns was examined at Priest Rapids Dam in 1976. Gatewell catch distribution was measured under two test conditions: (1) the first three spillbays adjacent to the powerhouse spilling and (2) the first 3 spillbays adjacent to the powerhouse not spilling. Under test condition (2), spill was confined to the five spillbays farthest from the powerhouse when possible.

Two separate tests were conducted during the spring chinook salmon outmigration in May. Spill discharge varied from 23,383 cfs to 31,454 cfs during the first test and from 9,300 cfs to 24,400 cfs during the second. Results are presented in Figure 8. No significant change in the pattern of movement for smolts entering the gatewells was indicated at the spill levels prevailing during the tests.

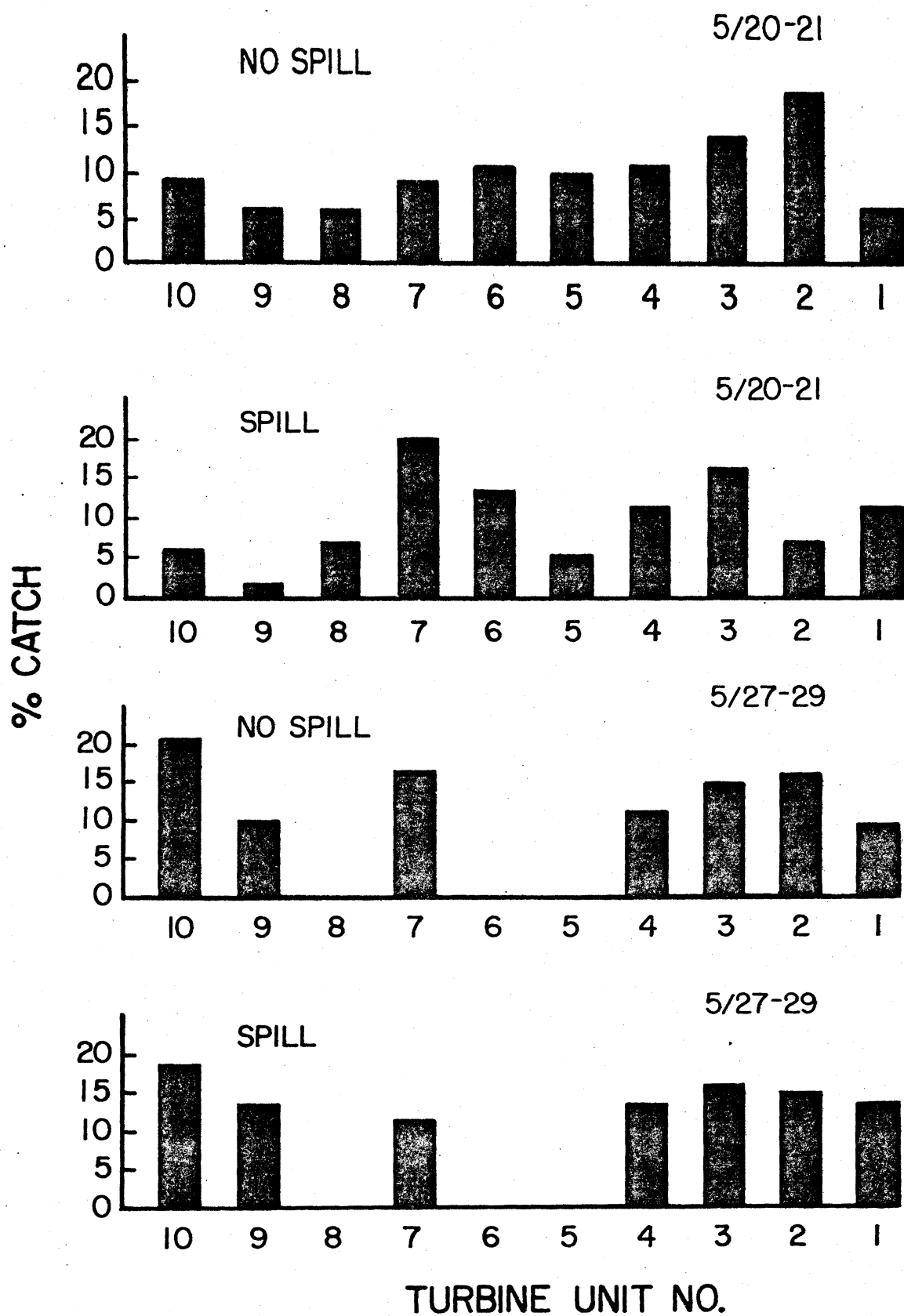


Figure 8.--Turbine intake gatewell catch distribution during periods of spill and no spill in the first three spillbays adjacent to the powerhouse at Priest Rapids Dam in 1976.

We were not able to have the spill shut off completely during our tests. To realistically define spill-fish movement relationship, future tests should be based on a strict spill vs. no-spill situation. This will require considerably more control over spillway operation than was possible during the 1976 tests.

SUMMARY

Juvenile salmonid migrations were sampled in the mid-Columbia River by dipnetting turbine intake gatewells at Priest Rapids, McNary, and John Day Dams in 1976. Purse seines were used to provide supplemental sampling in the forebay of Priest Rapids Dam. Estimates of magnitude, timing, and survival were made, and migrational movement characteristics were examined.

Results from the 1976 study are summarized as follows:

1. The outmigration of spring chinook salmon smolts at Priest Rapids Dam was estimated at 1.6 million fish with the peak occurring on May 14th.
2. An estimated 2.3 million summer and/or fall chinook salmon smolts reached Priest Rapids Dam. The outmigration began in mid-July, peaked on August 11th, and was still in progress when the sampling was terminated on September 10th.
3. A downstream migration of 400,000 steelhead trout was estimated at Priest Rapids Dam. Movement began in mid-April, peaked on May 14th, and was over by early July.
4. The sockeye salmon outmigration at Priest Rapids Dam was estimated at 1.6 million smolts and peaked on May 19th.

5. The coho salmon migration at Priest Rapids Dam was estimated at 600,000 smolts and peaked on May 20th.
6. Survival to below Priest Rapids of steelhead trout from the Wells Spawning Channel (WDG) released into the Methow River was estimated at 23% (passage through 5 dams and reservoirs).
7. Survival of spring chinook salmon smolts from Leavenworth Hatchery (FWS) to below Priest Rapids Dam was estimated at 54% (passage through 3 dams and reservoirs).
8. Survival of "0"-age chinook salmon smolts from Wells Spawning Channel (WDF) to below Priest Rapids Dam was estimated at 13% (passage through 5 dams and reservoirs).
9. Mortality of spring and summer chinook salmon smolts at Priest Rapids Dam was estimated at 8 and 27%, respectively.
10. Sixty percent of the spring chinook salmon smolts and 75% of the "0"-age chinook salmon smolts migrated by Priest Rapids Dam after sunset and before sunrise. Night movement of steelhead trout and sockeye salmon was measured at 61 and 50%, respectively.
11. No measurable change in the movement patterns of salmonids resulted from manipulating spill patterns at Priest Rapids Dam.

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Figure 4.--Temporal distribution of steelhead trout catches in the turbine intake gatewells at Priest Rapids Dam in 1976.

Figure 5.--Temporal distribution of sockeye salmon catches in the turbine intake gatewells at Priest Rapids Dam in 1976.

Figure 6.--Temporal distribution of coho salmon catches in the turbine intake gatewells at Priest Rapids Dam in 1976.

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Table 4.--Mortality of smolts at Priest Rapids Dam in 1976 based upon

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APPENDIX

Appendix Table 1.--Dipnet catches from turbine intake gatewells at Priest Rapids Dam in 1976.

Appendix Table 2.--Purse seine catches at Priest Rapids Dam in 1976.

Appendix Table 3.--Recoveries of cold branded chinook smolts released into the Priest Rapids Dam forebay during 1976.

Appendix Table 4.--Recoveries of cold branded chinook smolts released in the tailrace at Priest Rapids Dam in 1976.

Appendix Table 5.--Catches of juvenile salmonids from the gatewells at Priest Rapids Dam during diel tests in 1976.

Appendix Table 1.--Dipnet catches from turbine intake gatewells at Priest Rapids Dam in 1976.

Date	Number Gatewells Sampled	Number fish taken				
		"0"-age Chinook	"1"-age Chinook	Steelhead	Sockeye	Coho
April						
14	16		2316	6	30	2
16	24		1265	16	24	7
19	24		932	42	83	0
20	6		573	53	20	2
21	24		913	94	109	0
23	24		954	102	80	0
26	24		931	235	297	4
27	24		476	127	194	4
29	24		468	182	145	7
30	24		322	98	74	2
May						
3	30		1230	396	204	5
5	30		1461	411	910	0
7	30		1278	344	1366	0
10 ^{1/}	30		1096	482	2245	0
13 ^{1/}	6		1545	190	396	2
14 ^{1/}	6		219	182	443	0
14	30		830	468	1688	1
17	30	5	1413	687	3683	3141
19	30	4	2104	335	2126	2571
20	30	9	1469	261	1411	1403
21	30	2	978	143	759	591
22	30	5	1420	204	454	897
24	30	4	382	82	251	215
27	30	0	871	164	1076	743
28	30	0	499	161	1113	366
29	30	4	712	190	977	343

^{1/} Diel test-unit 10 ABC & 4 ABC dipped every 2 hours from 0600 5/13 to 1200 5/14.

Appendix Table 1.--Dipnet catches from turbine intake gatewells at Priest Rapids Dam in 1976 (Continued).

Date	Number Gatewells Sampled	Number fish taken				
		"0"-age Chinook	"1"-age Chinook	Steelhead	Sockeye	Coho
June						
1	30	1	122	65	311	52
3	30	1	372	179	814	213
4	30	2	216	88	252	63
7	30	1	338	114	453	149
9	30	1	275	89	294	85
10	30	5	139	50	385	51
14	30	2	215	85	724	28
16	30	16	297	82	549	33
18	30	17	278	40	209	7
21	30	5	280	53	228	33
22	22	6	263	18	262	35
23	30	6	210	14	179	9
24	30	21	379	25	233	37
25	30	18	282	6	108	15
28	30	24	373	11	95	15
29	30	15	301	21	76	34
30	30	15	148	10	26	8
July						
2	30	10	112	7	33	4
6	30	2	54	10	6	26
7	30	4	52	6	12	26
9	30	12	47	2	13	25
12	30	57	133	4	19	47
14	30	61	131	6	17	20
16	30	84	151	1	10	17
19	30	310	19	2	36	26
20	30	275	16	0	25	23
21	30	559	40	3	43	53
22	30	567	5	0	28	34
23	30	769	12	7	32	39
26	30	620	11	2	38	25
27	30	434	8	0	19	23
29 ^{2/}	9	2082	30	31	49	33
30 ^{2/}	9	473	2	0	6	3
30	30	255	7	0	29	12

^{2/} Diel test 7 ABC, 5 ABC and 4 ABC.

Appendix Table 1.--Dipnet catches from turbine intake gatewells at Priest Rapids Dam in 1976 (Continued).

Date	Number Gatewells Sampled	Number fish taken				
		"0"-age Chinook	"1"-age Chinook	Steelhead	Sockeye	Coho
August						
2	30	1434	1	1	75	22
4 ^{3/}	6	3010	0	0	35	24
5 ^{3/}	6	1269	0	0	25	7
6	30	1541	0	0	98	37
9	30	3620	0	1	132	33
11	30	1529	0	1	75	23
12	30	1156	0	3	69	12
13	30	267	0	0	20	6
16	30	290	0	0	21	5
17	30	596	0	0	26	7
19	30	907	0	0	27	4
20	30	1670	0	0	38	3
23	30	1320	0	2	40	3
24	30	658	0	0	16	0
26	30	1221	0	0	27	1
27	30	838	0	0	24	0
30	30	1077	0	0	18	1
31	30	825	0	0	7	0
Sept						
1	30	218	0	0	5	0
2	30	1880	0	0	20	0
3	30	1413	0	0	9	0
7	30	1268	0	0	16	0
8	30	1021	0	0	15	0
9	30	1038	0	0	16	0
10	30	759	0	0	10	0
TOTALS		37588	31976	6694	26635	11797

3/ Diel test 7 ABC and 4 ABC.

Appendix Table 2.--Purse seine catches at Priest Rapids Dam in 1976.

Date	Number Sets	"0"-age Chinook	"1"-age Chinook	Steelhead	Sockeye	Coho
April						
22	3	0	19	6	5	0
May						
4	5	0	191	22	62	10
6	6	0	114	34	55	8
11	3	0	188	73	186	6
12	4	0	124	72	128	1
26	3	3	35	14	116	30
June						
8	5	0	19	7	20	5
15	6	0	7	17	11	1
17	5	0	71	16	32	1
July						
1	5	2	12	1	10	1
15	5	0	3	0	0	1
August						
3	4	295	0	0	4	0
10	6	173	0	0	1	0
18	5	252	0	0	4	1
25	5	172	0	0	3	0
Sept						
1	5	218	0	0	5	0
TOTALS	75	1115	783	262	642	65

Appendix Table 3.--Recoveries of cold branded chinook smolts released into the Priest Rapids forebay during 1976.

Release Date	Brand	Number Released	Priest Rapids Recoveries		McNary Recoveries	
			Number	Percent	Number	Percent
<u>Spring Chinook</u>						
4/21-23	LAIY	1095	32	2.92	8	0.73
4/26-5/3	LAXI	2600	21	0.81	15	0.58
5/5-7	LAXI	2343	48	2.05	17	0.73
5/10	LAIY	902	16	1.77	5	0.55
5/19-21	LDIY	6137	154	2.51	52	0.85
5/24-28	LDAI	1385	18	1.30	18	1.30
6/1-4	LDAI	435	5	1.15	7	1.61
6/9	LDIY	346	3	0.87	5	1.45
6/14-18	LPIY	511	9	1.76	6	1.17
6/22-24	LPIY	704	6	0.85	9	1.28
6/28-30	LPAI	529	15	2.83	4	0.76
7/14	RAIY	208	8	3.85	2	0.96
TOTALS		17,195	335	1.95	148	0.86
<u>"0"-age Chinook</u>						
7/19-21	RAAI	996	22	2.21	8	0.80
7/27-30	RAAI	724	6	0.83	3	0.41
8/4-5	RAIY	4011	34	0.85	21	0.52
8/9-13	RDIY	3679	71	1.93	21	0.57
8/16-19	RDAI	1152	29	2.52	7	0.61
8/23-26	RDAI	2420	56	2.31	7	0.29
8/30-9/2	RDIY	2772	42	1.52	6	0.22
TOTALS		15,754	260	1.65	73	0.46

Appendix Table 4.--Recoveries of cold branded chinook smolts released
in the tailrace at Priest Rapids Dam in 1976.

Release Date	Brand	Number Released	McNary Recoveries	
			Number	Percent
<u>Spring Chinook</u>				
5/13-14	LA1F	2470	16	0.65
5/17-22	LA1F	9381	82	0.87
5/27-6/3	LA1F	1953	10	0.51
6/7-11	LA1F	650	18	2.77
6/16	LD1F	328	9	2.74
6/21-25	LD1F	817	8	0.98
6/29-7/2	LD1F	449	5	1.11
7/12-16	LP1F	474	5	1.05
TOTALS		16,522	153	0.93
<u>"0"-age Chinook</u>				
7/20-22	LP1F	904	8	0.88
7/26-30	LP1F	3030	35	1.56
8/2-6	LP1F	2862	7	0.24
8/11-12	RA1F	2620	22	0.84
8/17	RA1F	569	9	1.58
8/20-27	RA1F	3000	8	0.27
8/31-9/3	RA1F	1981	6	0.30
TOTALS		14,966	95	0.63

Appendix Table 5.--Catches of juvenile salmonids from the gatewells
at Priest Rapids Dam during diel tests in 1976.

Time	CATCH							
	^{1/} "1"-age Chinook		^{2/} "0"-age Chinook		^{1/} Steelhead		^{1/} Sockeye	
	No.	%	No.	%	No.	%	No.	%
10 a.m.	40	13	137	4	25	7	26	4
12 p.m.	24	8	85	2	27	7	23	3
2 p.m.	18	6	47	1	36	10	104	14
4 p.m.	16	5	100	3	20	5	100	14
6 p.m.	17	5	177	5	18	5	60	8
8 p.m.	24	8	375	10	24	7	50	7
10 p.m.	29	9	1172	31	56	15	78	11
12 a.m.	40	13	671	18	46	13	73	10
2 a.m.	39	12	556	15	48	13	73	10
4 a.m.	32	10	288	8	33	9	41	6
6 a.m.	15	5	78	2	14	4	47	6
8 a.m.	19	6	56	1	17	5	51	7
TOTALS	313	100	3742	100	364	100	726	100

1/ 5/13-14 - one test only

2/ 7/29-30 & 8/4-5 - two tests