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Evaluation of the Juvenile Fish Collection and Bypass Systems at Bonneville Dam-1987

by
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August 1988

COASTAL ZONE AND ESTUARINE STUDIES

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INTRODUCTION

Studies to evaluate the Bonneville Dam Second Powerhouse fingerling collection and bypass system began during the 1983 field season. Results from these initial tests indicated that fish guiding efficiency (FGE) of the submersible traveling screens (STS) was very poor (<30%) for yearling chinook salmon (*Oncorhynchus tshawytscha*) (Krcma et al. 1984). By 1986, sufficient modifications were made to the powerhouse to achieve FGE values nearly 70% through the use of a lowered STS, streamlined trashracks, and intake ceiling extensions (Gessel et al. 1987).

In 1987, the National Marine Fisheries Service in conjunction with the U.S. Army Corps of Engineers continued to evaluate the fingerling collection and bypass systems at Bonneville Dam. The 1987 research had the following objectives:

1) Conduct FGE and vertical distribution tests to evaluate the following methods of improving FGE and STS effectiveness:
   a. streamlined trashracks,
   b. lowered STSs,
   c. intake ceiling extensions,
   d. illuminated trashracks, and
   e. small external deflectors.
2) Operate the First and Second Powerhouse downstream migrant (DSM) facilities to obtain information on fish quality related to the FGE studies and collect data for the continued evaluation of the collection and bypass systems.

3) Determine if the temporal distribution of smolt migrations passing Bonneville Dam can be defined through the use of the existing collection facilities at the First and Second powerhouses.

EVALUATION OF METHODS TO IMPROVE STS EFFECTIVENESS AT THE SECOND POWERHOUSE

Approach

The FGE and vertical distribution tests were conducted during two phases: 1) early, 21 April to 3 June, targeting yearling chinook and coho salmon and 2) late, 14 July to 1 August, targeting subyearling chinook salmon. Data for other species were collected as available. [Subyearling chinook salmon were also captured during late May - June. Fish guidance efficiency for these fish is higher than that for late summer migrants and can approach FGEs of yearling chinook salmon, as indicated by studies at Bonneville Dam First Powerhouse in 1981 (Krcma et al. 1982). Also, the major portion of the subyearling smolt migration passes Bonneville Dam during the late summer. For these reasons and to remain consistent with past Bonneville Dam reports, we will continue to separate and designate yearling chinook and coho salmon as the early phase fish and subyearling chinook salmon as the fish.]

Testing for FGE was conducted in Units 12A and 12B, while vertical distribution data, to calculate theoretical fish guiding efficiency (TFGE), were collected in Unit 13B. The test unit was turned on at about 2000 hours which was about an hour prior to fish movement into the test unit. The duration of the test was dependent upon fish numbers, but generally was 1.5-3.0 hours. Unit discharge was approximately 18,000 cfs during the early phase, but due to low tailwater levels, tests during the late phase were conducted with a discharge of about 14,000 cfs. All testing was done with existing fyke nets and net frames,

and all tests were conducted using principles and guidelines developed during past STS studies (Gessel et al. 1986,1987).

Three series of tests were conducted with yearlings. The first compared the best 1986 test condition [lowered STS, streamlined trashracks, and intake ceiling extensions in adjacent gatewells (11C, 12A, 12B, 12C, 13A, and 13B)] with ceiling extensions in alternate gatewells (11A, 11C, 12B, 13A, 13C, and 14B). Each of these configurations was tested under two powerhouse operating modes (four units and six or seven units). The second series was conducted to determine if lights influence fish passage into and within the turbine intake. The 250-watt, mercury vapor lights were placed in Unit 12B on the intake ceiling, the ceiling extension, and in the trashrack. The following is a brief description of the placement of these lights (40 in total) (Fig.1):

1) Intake ceiling - four lights, two rows 30 cm and 1.8 m from the gatewell opening and approximately 2.2 m from each intake wall.

2) Ceiling extension - four lights, two rows 1.5 and 3 m from the trashrack and on the same line as the intake ceiling lights.

3) Trashrack - 16 lights on each of the top two trashrack sections. The lights were mounted to the four horizontal streamlined members of each trashrack.

The third test series was conducted to determine the effect of a short external deflector on FGE. Three deflectors were used (Units 12A, 12B, and 12C); each was a solid steel plate that extended from the trashrack upstream approximately 1.8 m along the estimated flow line and was positioned at Elevation 20.0 (msl) when tested (Fig. 1).

Tests with subyearlings (late phase) were conducted to determine what effect the alternate intake ceiling extension pattern had on FGE for these fish and also to test the different light conditions. In addition, a special test was conducted to determine if removal of the trashracks directly upstream from

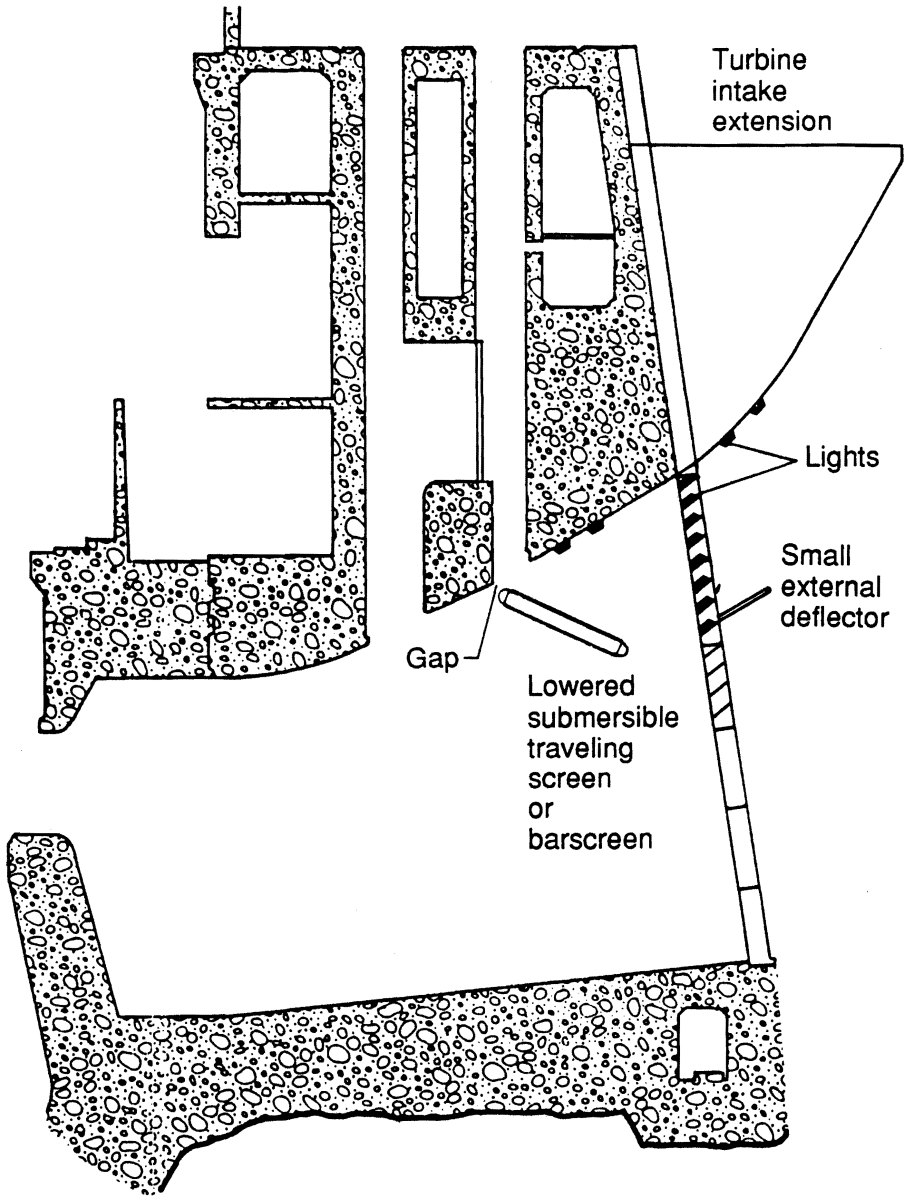

Figure 1.--Cross-sectional view of a turbine intake with intake ceiling extension, mercury vapor lights, and small external deflector (Bonneville Dam Second Powerhouse, 1987.

the STS would improve FGE and STS effectiveness (Fig. 2). With the trash rack sections removed, an internal deflector was added to close the gap and prevent trash from entering the turbine. The hypothesis behind this test was that the proximity of the STS and trashracks (<3 m at the Second Powerhouse compared to 6 m at others) may be causing avoidance.

Results

Fish guiding efficiencies ranged from 25 to 75% during early phase testing and from 2 to 34% during late phase testing (Table 1; Appendix Fig. B1).

Yearling Chinook Salmon

Tests comparing the two intake ceiling extension configurations under the different powerhouse operating modes indicated that the alternate-gatewell pattern with seven units operating (Test 3) gave the highest FGE (72 and 60%) and STS effectiveness (86 and 72%) for Units 12A and 12B, respectively. Test 2 (same configuration, with four units operating) had FGEs of 52 and 42% and STS effectivenesses of 78 and 63% (12A and 12B, respectively). Using the alternate-gatewell ceiling extension configuration, Unit 12A (without the intake ceiling extension) not only had higher FGE but also collected more fish than Unit 12B (ratio A/B = 1.67:1). A possible cause for the higher FGE and larger numbers of fish in Unit 12A was a vortex that developed between the intake ceiling extensions during all tests with the ceiling extensions in the alternate configuration. The ratio for fish numbers in the two slots with the ceiling extensions adjacent was nearly equal (ratio A/B = 0.96:1). Based on the higher FGEs obtained with the ceiling extensions in the alternate configuration, FGE testing was conducted with this pattern during the remainder of the 1987 field season.

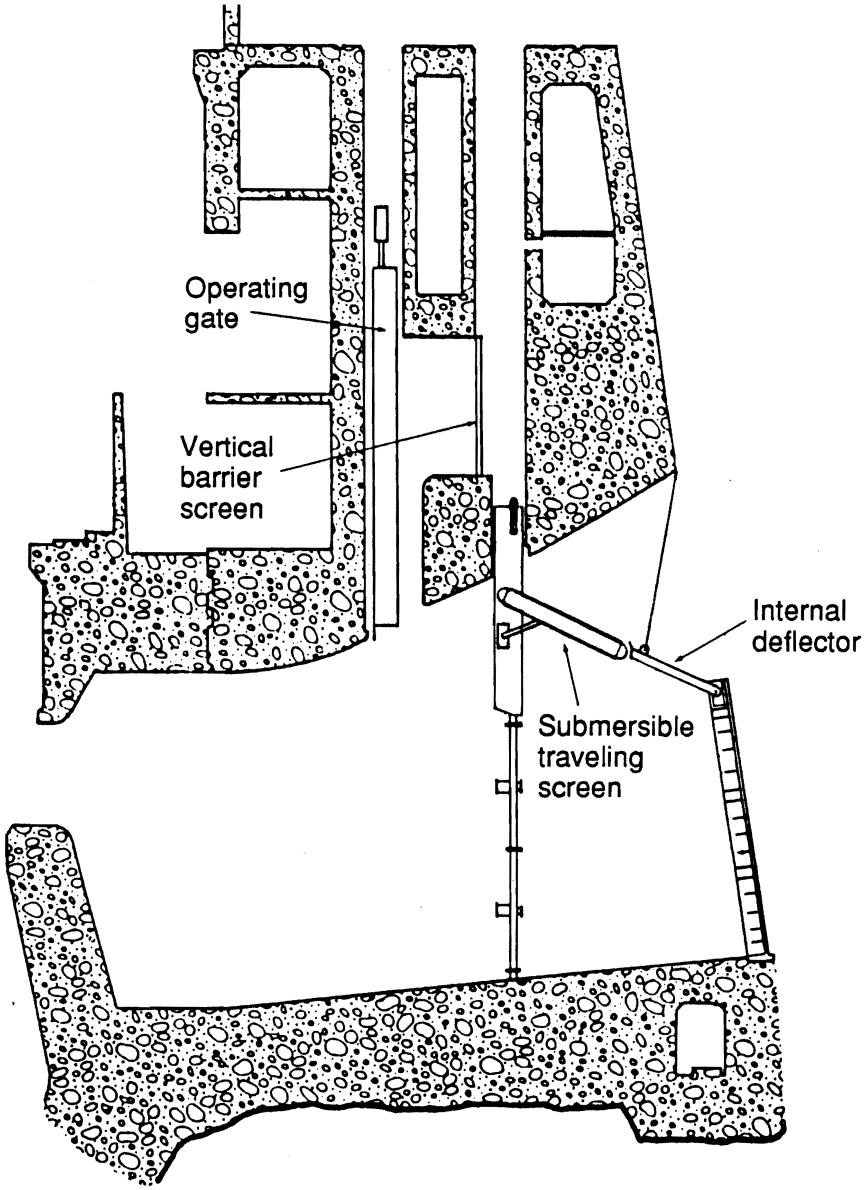

Figure 2.--Cross-sectional of a turbine entrance showing a 55° STS at the 48-in lowered position, the internal deflector, with the top three trashrack sections removed (Bonneville Dam Second Powerhouse, 1987).

Table 1.--Traveling screen fish guiding efficiency (FGE) tests on yearling and subyearling chinook salmon conducted at Bonneville Dam Second Powerhouse during the 1987 field season.

Test no.	Date(s) of tests	Test unit	Turbine units	Flow load Kcfs	STS lowered position	Lights in Unit 12B	Small external deflector	Internal deflector	Intake ceiling extensions	Percentages FGE	Descaling	TFGE	STS Effectiveness
1	21,24,25,26 April	12A	11,12 13,18	18	30-inch	None	None	None	Adjacent	35.0	3.6	65	54
		12B								32.1	4.2	65	50
2	28,29,30 April	12A	11,12 13,18	18	30-inch	None	None	None	Alternate	52.5	11.6	67	78
		12B								42.1	10.9	67	63
3	1,2,3 May	12A	11,12 13,14	18	30-inch	None	None	None	Alternate	72.1	8.5	84	86
		12B	16,17,18							60.0	11.0	84	72
4	5,6 May	12A	11,12 13,14	18	30-inch	None	None	None	Adjacent	47.1	8.6	73	63
		12B	16,17,18							50.5	8.2	73	69
5	7 May	12A	11,12 13,14	18	30-inch	Intake Ceiling (4), Ceiling Extension (4) Top Trashrack (2)	None	None	Adjacent	36.6	8.7	78	47
		12B	16,17,18							45.4	13.6	78	58
6	11,12,13 May	12A	11,12 13,18	18	30-inch	None	None	None	Adjacent	43.4	12.8	64	68
		12B								43.4	14.4	64	68
7	15 May	12A	11,12 13,18	18	30-inch	All lights were on (38 total)	None	None	Alternate	48.0	18.3	76	64
		12B								56.2	12.9	76	74
8	16 May	12A	11,12 13,18	18	30-inch	None	None	None	Alternate	74.9	9.0	83	91
		12B								59.9	15.4	83	73
9	17 May	12A	11,12 13,18	18	30-inch	Intake Ceiling (3)	None	None	Alternate	54.5	18.5	64	86
		12B								55.1		64	86
10	18 May	12A	11,12 13,18	18	30-inch	Ceiling Extension (4)	None	None	Alternate	39.4		71	55
		12B								25.7	14.0	71	37
11	19 May	12A	11,12 13,18	18	30-inch	Top Trashrack Section (15)	None	None	Alternate	54.6	16.8	70	78
		12B								47.7		70	68
12	20 May	12A	11,12 13,18	18	30-inch	Second Trashrack Section (16)	None	None	Alternate	33.8	7.8	64	53
		12B								24.5	15.6	64	39
13	26 May	12A	11,12 13,18	18	30-inch	Intake Ceiling (3)	None	None	Alternate	63.3	3.7	65	97
		12B								46.5	5.4	65	72
14[a]/	27 May	12A	11,12 13,18	18	30-inch	Intake Ceiling (3)	None	None	Alternate	67.2	7.1	78	86
		12B								64.6	5.1	78	83

Table 1.--continued.

Test no.	Date(s) of tests	Test unit	Turbine units	Flow load Kcfs	STS lowered position	Lights in Unit 12B	Small external deflector	Internal deflector	Intake ceiling extensions	Percentages FGE	Descaling	TFGE	STS Effectiveness
15	28 May	12A	11,12 13,18	18	30-inch	None	None	None	Alternate	60.7	4.3	64	95
		12B								42.0		64	65
16	29 May	12A	11,12 13,18	18	30-inch	None	Yes	None	Alternate	63.0		79	80
		12B								54.0		79	68
17	30 May	12A	11,12 13,18	18	30-inch	Intake Ceiling (2)	Yes	None	Alternate	61.2		63	98
		12B								64.0		63	102
18	31 May	12A	11,12 13,18	18	30-inch	Intake Ceiling (2) Top Trashrack Section (15)	Yes	None	Alternate	44.1		66	66
		12B								70.3		66	105
19	1 June	12A	11,12 13,18	18	30-inch	Intake Ceiling (2) Top Trashrack, 1st Row, Middle 2 (2)	Yes	None	Alternate	41.9		76	55
		12B								74.8		76	99
20[b]	2 June	12A	11,12 13,18	18	30-inch	Intake Ceiling (2) Both Trashracks (31)	Yes	None	Alternate	29.5		66	45
		12B								66.7		66	101
21	3 June	12A	11,12 13,18	18	30-inch	Intake Ceiling (2)	Yes	None	Alternate	54.4		63	86
		12B								67.3		63	106
22	14 July	12A	11,12 13,18	16.5	30-inch	None	Yes	None	Alternate	30.0	5.3	47	64
		12B								34.0	4.3	47	72
23	15 July	12A	11,12 13,18	14	30-inch	None	Yes	None	Alternate	22.4		44	50
		12B								16.7		44	39
24	16 July	12A	11,12 13,18	14	30-inch	Intake Ceiling (2) Top Trashrack 1st Row, Middle 2 (2)	Yes	None	Alternate	12.1	6.7	37	32
		12B					No			17.3	4.2	37	46
25	17 July	12A	11,12 13,18	14	30-inch	None	Yes	None	Alternate	9.7		26	39
		12B					No			16.1		26	62
26	18 July	12A	11,12 13,18	14	30-inch	Intake Ceiling (3) Top Trashrack (15)	Yes	None	Alternate	2.1		38	5
		12B					No			15.3		38	40
27	19 July	12A	11,12 13,18	14	30-inch	Intake Ceiling (3)	Yes	None	Alternate	10.6		34	32
		12B					No			16.6	8.3	34	50
28	20 July	12A	11,12 13,18	14	30-inch	Second Trashrack Section (16)	Yes	None	Alternate	1.3		33	3
		12B					No			8.6		33	28

Table 1.--continued.

Test no.	Date(s) of tests	Test unit	Turbine units	Flow load Kcfs	STS lowered position	Lights in Unit 12B	Small external deflector	Internal deflector	Intake ceiling extensions	Percentages FGE	Descaling	TFGE	STS Effectiveness
29	21 July	12A[c]/	11,12 13,18	14	30-inch	Intake Ceiling (1)	Yes	None	Alternate	19.1	6.1	30	64
		12B					No			13.4		37	35
30	22 July	12A[c]/	11,12 13,18	14	30-inch	Intake Ceiling	Yes	None	Alternate	15.8		33	48
		12B[c]/					No			15.7		33	48
31	23 July	12A[c]/	11,12 13,18	14	30-inch	None	No	None	Alternate	14.1		29	48
		12B[c]/					No			13.6		29	48
32	24 July	12A	11,12 13,18	14	30-inch	None	No	None	Alternate	16.5		38	45
		12B					No			15.4		38	40
33	28 July	12A	11,12 13,18	14	30-inch	Intake Ceiling (2)	No	None	Alternate	9.9		38	26
		12B					No			19.3		38	50
34	29 July	12A	11,12 13,18	14	30-inch	Intake Ceiling (2) Battery Strobe on STS 12B	No	None	Alternate	20.3		41	49
		12B					No			16.0		41	39
35[d]/	30 July 1 Aug	12A[c]/	11,12 13,18	14	48-inch	None	No	Yes	Alternate	15.5		53	38[f]/
		12B[c]/			30-inch		No	None		19.6		45	44
36[e]/	31 July	12A[c]/	11,12 13,18	14	48-inch	110 amp strobe Light on STS 12B	No	Yes	Alternate	37.0		56	77[f]/
		12B[c]/			30-inch		No	None		15.7		40	40

a/ Ice and trash sluiceway was closed for remaining FGE tests.
b/ Streamlined trashrack sections (3) installed in Unit 12C.
c/ Angle of STS was 65°.
d/ Top two trashrack sections were removed from Unit 12A for this test.
e/ Small numbers of fish <125 for this test.
f/ STS effectiveness for these tests includes gap net percentage, since these fish are also intercepted by the STS.

Tests with the intake ceiling extensions adjacent to each other (combined data from Tests 1, 4, and 6) indicated that FGE (45 and 46%) and STS effectiveness (66 and 68%) were similar in Units 12A and 12B using either powerhouse operating mode. These results were lower than those from 1986 and may be related to two factors:

1) The 1987 tests were conducted early in the field season (April) whereas the comparable 1986 tests were conducted near the end of May. Tests in April were predominantly with fish from Carson National Fish Hatchery whereas those in May were with upriver migrants. Fish guidance efficiency measurements at other projects were also lower earlier in the migration than those obtained later in the migration (Swan et al. 1985, 1986; Monk et al. 1986). Fish in the early part of the migration are found deeper in the water column, and it has been hypothesized that this is related to a lower level of smoltification in fish recently released from hatcheries (Swan et al. 1987). As the season progresses, a larger portion of the migrants are smolted with corresponding increases in vertical distribution and FGE.

2) During the 1987 tests, the ice and trash sluiceway was open from 21 April through 26 May. In 1986, the sluiceway was open only during July. The open sluiceway was monitored by sonar equipment (COE personnel) to estimate fish passage through this area. The sluiceway is adjacent to Unit 11 and operates by skimming water from the surface. This operation could possibly affect FGEs, especially if those fish passing through the sluiceway would normally be guided by an STS if the sluiceway was closed.

Tests with mercury vapor lights in Slot 12B indicated that the lights had some effect on yearling chinook salmon. In some instances, a combination of lights on the trashrack and intake ceiling appeared to enhance FGE as well as alter the ratio of fish entering Units 12A and 12B (Table 2). In other cases, FGE and STS effectiveness were lower than average when lights on the lower trashrack were used (Table 1). Very little replication occurred with these tests, and lights were only available in Slot 12B; therefore, we are not sure if these results would occur with a full complement of lights in the entire test unit. We feel this is a research area that needs to be pursued.

Tests with the small external deflector (Fig. 1) indicated little, if any, increase in FGE was provided by this device.

Subyearling Chinook Salmon

Tests with subyearling chinook salmon during the late phase indicated that FGE averaged only 16% and STS effectiveness was generally less than 50%. None of the conditions tested, when valid numbers of fish were present, showed a marked improvement when compared to other test results.

The tests with the trashrack sections removed (Test 35) gave no indication that this configuration improved FGE or STS effectiveness.

The lower tailwater in July 1987 compared to 1986 may have been partially responsible for the lack of effectiveness of the devices tested. Unit discharge during July was only 14,000 cfs compared to the usual July discharge of 16,500 cfs and spring discharges of 18,000 cfs. The one test on 14 July 1987 when discharge was 16,500 cfs tends to support this hypothesis (FGE was 34%, nearly double that of tests run at 14,000 cfs). Results from light tests indicated that dramatic changes could be produced. In some tests, the lights were so

Table 2.--Comparison of the FGE and STS effectiveness and ratio of the number of fish in Units 12A and 12B under various light conditions tested at Bonneville Dam Second Powerhouse, 1987.

Date	Unit	Light pattern	% FGE	% STS effect.	Ratio of fish (12A/12B)
1-3 May	12A	None	72	86	
	12B	"	60	72	1.67:1
15 May	12A	None	48	64	
	12B	All lights on	56	74	0.61:1
16 May	12A	None	75	91	
	12B	"	60	73	1.93:1
17 May	12A	None	55	86	
	12B	Intake ceiling (3)	55	86	1.44:1
18 May	12A	None	61	98	
	12B	Intake ceiling (2)	64	102	1.12:1
19 May	12A	None	44	66	
	12B	Intake ceiling (2) + top trashrack (15)	70	105	0.54:1
1 June	12A	None	42	55	
	12B	Intake ceiling (2) + top trashrack (2)	75	99	1.02:1

effective at attracting fish to Unit 12B, that the STS in Unit 12A guided almost none (Tests 26 and 28--FGEs in Unit 12A of 2.1 and 1.3% respectively). Although, these results did not show an increase in FGE, they indicated that subyearlings could be influenced by these lights.

As previously indicated, some tests during the early phase also captured subyearling chinook salmon in sufficient numbers for valid tests. The highest FGE (62%), TFGE (70%), and STS effectiveness (87%) occurred on 1 June (Test #19) in Unit 12B (four lights on intake ceiling and two lights on the top trashrack section)(Appendix Table 1). In comparison, results for yearling chinook salmon in this test (Unit 12B) were 75, 76, and 99%, respectively.

EVALUATION OF THE FIRST AND SECOND POWERHOUSE DSM AND INDEXING FACILITIES

The final evaluations of both sampling facilities, as part of our research agreement with the COE, was completed during 1987. The following is our final summary of the samplers at both powerhouses.

Second Powerhouse

Smolt Collection

The random sampler in the Second Powerhouse downstream migrant system (DSM) provides a means to examine the condition of salmonids guided into the juvenile bypass system. Since 1983 we have used this sampler to enumerate fish collected in the system by species, measure descaling and mortality, and record marks daily throughout the sampling season. A standard operating procedure for the indexing facilities is detailed in Appendix D.

During most weeks in 1987, the random sampler was operated from 1200 on Monday through 1200 on Friday, 24 hours/day. From 13 March to 20 November, the

random sampler operated 3,398 hours or an average of about 92 hours/week. A total of 17,371 juvenile salmonids were captured, of which 12,774 were examined for descaling, injury, and brands (Appendix Table 3). These numbers represent a passage rate for a reduced powerhouse operating level similar to 1985 and 1986 when usually only three or four of the existing eight turbines were operating and generally only during the hours of STS testing. Criteria to determine descaling were the same as in previous years (Gessel et al. 1986,1987). Brand information was collected daily and forwarded to the Fish Passage Center.

Sockeye salmon had the highest descaling (21.1%) and subyearling chinook salmon the lowest (2.6%). Yearling chinook salmon, coho salmon, and steelhead had descaling of 5.7, 4.8, and 3.8%, respectively. These rates were comparable to previous years' outmigrations (Table 3). Mortality during 1987 was highest for sockeye salmon (15.6 %) and less than 2% for the other species (Table 3). Fish were examined from the sample raceways once daily. Therefore, mortalities were representative of fish held between 0 and 24 hours.

DSM Improvements

The only major improvement made to the DSM at the Second Powerhouse since the 1986 outmigration was in the dry separator (El. 65). A section of perforated plate was added to restrict the holding area and subsequently reduce fish delay in the dry separator. This addition decreased passage time between the dry separator and the wet separator in the fish handling facility (El. 45), but some delay still existed. Therefore, it was necessary to drain the wet separator on a daily basis to accurately estimate daily passage.

Table 3.--Average descaling and mortality percentages by species for juvenile salmonids examined daily from the Second Powerhouse sampling facility at Bonneville Dam, 1983-87.

Year	Yearling chinook	Subyearling chinook	Steelhead	Coho	Sockeye
		Descaling (%)			
1983	8.3	1.0	7.2	2.3	16.9
1984	9.6	3.2	5.9	1.9	28.3
1985	4.1	1.1	3.0	1.8	20.7
1986	6.8	1.7	7.2	1.8	31.0
1987	5.7	2.6	3.8	4.8	21.1
		Mortality (%)			
1983	3.4	1.2	1.9	0.6	18.7
1984	2.4	4.5	0.9	0.7	23.7
1985	4.1	1.1	3.0	1.8	20.7
1986	1.3	2.5	2.1	0.7	22.7
1987	1.5	1.8	1.5	0.7	15.6

Recommendations for Sampler Operation

The facility evaluations occurred mostly under conditions with four of the eight turbines in operation and these usually only during a portion of each day. When power generation reaches full capacity considerably more fish will be collected and thus, any malfunction in the system could create problems that are much more serious than those we observed. Although the system is operable "as is" in the automatic mode, it does require periodic oversight, and at times can be labor intensive. The following are suggested operations:

1) Drain the system at least daily since fish continue to hold up in the pipe between the wet and dry separators and in the dry separator. During full powerhouse operation or times of anticipated high passage (e.g., nearby hatchery releases), this may have to be done several times each day.
2) Remove the underwater separator bars from the first compartment of the wet separator if the system is to be left unattended (e.g., overnight), as fluctuating water levels will leave larger fish stranded on the grader bars.
3) Remove the underwater separator bars (see 2. above) when separation is not required.
4) Remove random sampler whenever major releases are made at nearby hatcheries (e.g., Spring Creek National Fish Hatchery).

Problems With the System

Several changes/additions have been made to the facilities since 1983 and operation during 1986-87 was accomplished with a minimum of lost time through equipment failure. However, the following problems occurred in previous years and will potentially re-occur in the system as it now exists:

1) Water levels in the forebay fluctuated which caused the DSM water level to fluctuate. The electric motor regulating system was not able to compensate for the resulting changes in water volume. This in turn caused fluctuating water levels in the wet separator and fish stranding when the separator bars were in place.

2) A buildup of debris, as a result of full powerhouse operation, plugged both the fish transport pipe between the dry and wet separator and the outlets from the raceways in the observation room. The raceways consequently overflowed.

3) The downwell back-surged, sometimes flooding the observation room. An alarm system was installed to alert the operators, but no problems have occurred in the past two seasons.

4) The emergency relief gate (ERG) was opened and this shut off the main water supply to the wet separator. An auxiliary water supply should be installed to prevent fish stranding or mortality in the pipe if the ERG is inadvertently opened. In non-emergency situations, the system should be drained prior to the opening the ERG.

Recommendations for Changes to the System

The following modifications to the system were identified to improve areas where problems (or potential problems) exist:

1) Remove the five 90° bends in the 8-inch diameter fish transport pipe between the wet and dry separators to prevent debris from plugging the pipe.

2) Modify the random sampler so it can be inserted or removed from the flow automatically, and also modify the sampler so that the percentage of downstream migrants can be decreased to 5% or less whenever appropriate. These changes will prevent handling of excessive numbers of fish.

3) An auxiliary water supply to the wet separator that is independent of the DSM channel would stabilize the water supply to the wet separator. This would dampen the effect of fluctuating water levels in the channel, and supply a sufficient amount of water to the system to keep fish alive in the wet separator during an emergency opening of the ERG.

First Powerhouse

Smolt Collection

From 13 March to 20 November, the sampler was operated 494.6 hours. (A standard operating procedure for the indexing facilities is detailed in Appendix C). During this time, 56,664 yearling chinook salmon, 85,000 subyearling chinook salmon, 40,007 coho salmon, 8,255 sockeye salmon, and 16,596 steelhead were captured and of these, 18,241 were examined for descaling and brands. Weekly catches, mortality, and descaling for the First Powerhouse are compiled in Appendix Table 4. Descaling and length data were taken on 100 fish per species per day whenever possible. Identification of chinook salmon as yearlings or subyearlings was based primarily on length frequency data, but other considerations such as hatchery releases, mark recoveries, and physical characteristics were also considered.

Overall mortality was minimal for all species, and descaling was high for sockeye salmon (21.2%) only (Table 4). For this species, the descaling rates were approximately the same at both powerhouses, yet there was a large difference in the mortality rates (First PH = 0.2%, Second PH = 15.6%). This is possibly related to fish handling differences between the powerhouses. Fish at the First Powerhouse were immediately examined and released whereas at the Second Powerhouse collection facility, they were held for as much as 24 hours before examination.

Table 4.--Rates of descaling and mortality at Bonneville Dam DSM samplers--First and Second Powerhouses, through 11 November 1987.

PH.	Yearling chinook salmon		Subyearling chinook salmon		Coho salmon		Sockeye salmon		Steelhead	
	Desc.	Mort.	Desc.	Mort.	Desc.	Mort.	Desc.	Mort.	Desc.	Mort.
1st	3.7	0.1	4.1	3.5	3.2	0.0	25.5	0.2	4.1	0.0
2nd	5.7	1.5	1.7	1.8	4.8	0.7	21.2	15.6	3.8	1.5

The mortality rate for subyearling chinook salmon was very high at the First Powerhouse on 30 June and 1 July (24.4 and 18.6%, respectively). In most cases, these fish were still alive when sampled, but died during handling. The descaling rate during this period was less than 1.0%, and there were no external signs of damage. Live and moribund fish were taken to the Lower Columbia River Fish Health Center and examined for various diseases, but no positive results were obtained. Coded wire tag recoveries from these fish, however, were almost exclusively from a group of 500,000 upriver bright fall chinook salmon from Little White NFH released in Drano Lake between 20-22 May. On 2 July this mortality began to decline and by 3 July was down to 0.1%. During this time, the apparent mortality rates for all other subyearling chinook salmon remained consistently low (0.5 to 1.5%).

DSM Facility and Equipment

To operate the sampler at the First Powerhouse, the flow in the DSM must move in a northerly direction (since the sampler is at the north end of the bypass). When breakdowns in the trash sweep system, the inclined screen, or the water control valves occur, the flow is reversed and the sampler is dewatered (Fig. 3). In 1986, the sampler was unavailable for use for 78 days from 24 April to 29 August (Gessel et al. 1987). The problems were subsequently solved, and the sampler operated continuously from 29 August until the DSM was shut down in early December. Based on this moderate success, it was decided to operate the facility on a daily basis throughout the 1987 fingerling migration to test the reliability of the various systems needed to keep the sampler in operation.

During 1987, we attempted to operate the DSM and the sampler 5 days/week throughout the field season. However, because of various mechanical breakdowns

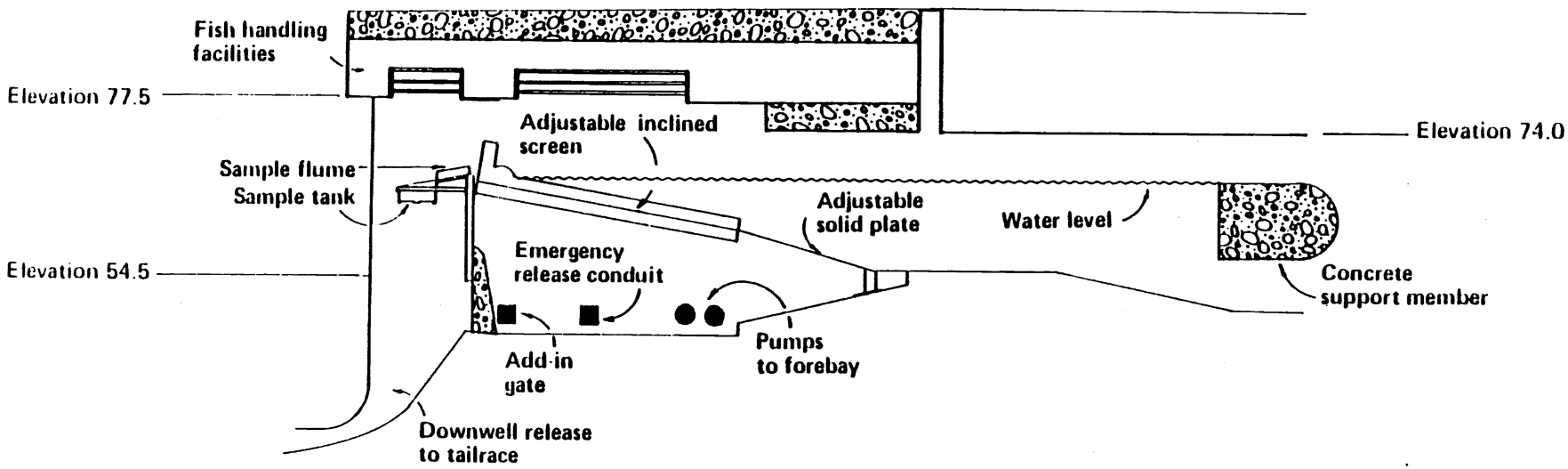

Figure 3.--Cross-section of the juvenile bypass (downstream end) system at Bonneville Dam First Powerhouse, 1987. The inclined screen, emergency-relief conduit, add-in gate, and pumps are designed to operate under automatic control.

(Table 5), the flow in the channel had to be reversed for a total of 80 days. The two major shutdowns (68 of the 80 days) were caused by failure of the screwjacks that raise and lower the inclined screen. In both cases, this happened while the screwjacks were operating in the automatic mode and during a non-sampling period. From 30 August to 20 November, the inclined screen controls were operated only in the manual mode and no further malfunctions occurred.

It should be stressed that, except for the failure of the trash sweep system, the major problems encountered with the sampling facility during 1987 occurred with the system operating in the automatic mode (during non-sampling periods). During sampling periods, the control valves and the inclined screen were manually operated and no breakdowns occurred. However, the manual controls require constant attention and adjustment by the sampling personnel to prevent breakdowns or other mishaps such as stranding of the migrants on the inclined screen.

Some amount of sample time (12 out of 80 days) was lost in 1987 through failure of the sample gear (sample tank, hoist, flume, etc.). In addition, other smaller problems occurred. For example, on 22 April one of the air rams which operate the sample flume failed, and we were able to sample with only a portion of the sample flume for several days.

Recommendations for Sampler Operation

The sampling gear itself was operated for nearly 500 hours with a minimal amount of lost time due to failure of the gear (sample tank, hoist, flume, etc.). A crew of one or two trained personnel was easily able to handle the equipment involved. For optimum sampling, the following are suggested operations for the system:

Table 5.--Availability of the Bonneville Dam First Powerhouse DSM sampling facility during the 1987 outmigration (through August 30).

Date	Bypass Direction North	Bypass Direction South	Comments
13 Mar		X	Initial sampling started
14 Mar		X	Emergency relief valve stuck closed (while on automatic operation). DSM channel flooded and trashrack motor immersed.
16 Mar	X		Emergency relief valve fixed. Sampler in operation.
18 Mar		X	Motor on trash sweep had to be replaced.
19 Mar	X		Sampler in operation
22 Mar		X	Add-in gate valve failed.
25 Mar	X		Sampler in operation.
18 May		X	Couplers to screw jacks failed (while in automatic operation). Inclined screen could not be operated.
1 Jun	X		Sampler in operation.
11 Jun		X	Trash sweep gear box failed. Shaft had to be replaced.
19 Jun	X		Sampler in operation.
6 Jul		X	Couplers to screw jacks failed (while in automatic operation) Inclined screen could not be operated.
30 Aug	X		Sampler in operation.

1) All sampling at the collection facility should be done with all controls in the manual mode so that water levels over the weir crest are maintained at the most efficient level. This requires constant supervision of the controls by the individuals operating the sampling gear.

2) During sampling, the water level at the inclined screen crest should be about 15 cm. Greater depth increases water volume which will flood the sample tank, and lower depth decreases water volume which can strand fish on the sample flume.

3) Hourly sampling periods should not exceed 20 minutes. The duration of the individual hourly samples may need to be decreased, dependent on debris levels and numbers of fish.

Recommendations for Changes to the System

Although the system is operable "as is", a variety of mechanical operations are required for each sample, and thus a potential for problems continues to exist. The problems will probably be directly related to the amount of use and may affect the ability to sample fish or impact fish in the system. Suggested modifications to the system are as follows:

1) The standard operating level of the inclined screen during non-sampling periods should be lowered so that water over the crest is increased to about 60 cm (2 feet) [current operating standards are between 15 and 30 cm (6-12 inches)]. A lower standard operating level would allow more time for the powerhouse operators to readjust water levels in the DSM and help prevent stranding. This will also require relocating the trash sweep motor to prevent it from being submerged if the water level rises.

2) Enlarge the sample tank and install a one-pick system for the hoist that lifts it.

3) Carefully monitor alignment of the air rams that operate the sample flume sections. Realign the rams as necessary as that they do not bend.

4) Replace or redesign the automatic flow control sensors and timers so that the system can reliably be operated in the automatic mode.

DETERMINATION OF TEMPORAL DISTRIBUTION WITH THE EXISTING FACILITIES AT FIRST AND SECOND POWERHOUSES

Second Powerhouse

Approach

Monitoring the juvenile salmonid migration at the Second Powerhouse began in 1982, (McConnell et al. 1982) and has continued each field season since. The sampler is placed at the inclined screen crest, and a chain drive system moves it across the DSM so that migrant collection is continuous. The work in 1982, plus studies in 1983 (Krcma et al. 1984), indicated the random sampler collects 10% of the yearling and subyearling chinook salmon using the DSM. Estimates of total weekly passage (by species) of fish through the DSM were calculated by multiplying the daily catch by 10 and expanding this number to a 7-day week.

Results

Periods of peak migration and passage estimates for each species were 1) yearling chinook salmon--12 April, 109,055; 2) subyearling chinook salmon--1 June, 104,253; 3) steelhead (*Salmo gairdneri*)-- 19 May, 14,405; 4) coho salmon (*O. kisutch*)--5 May, 72,474; and 5) sockeye salmon (*O. nerka*)--1 June, 11,624 (Table 6). It must be stressed, however, that this does not represent overall passage of outmigrants past the Bonneville project, as the powerhouse was not

Table 6.--Total salmonid passage estimates at Bonneville Dam Second Powerhouse DSM, 1987.

Week	Yearling chinook	Subyearling chinook	Coho	Sockeye	Steelhead	Total
09- Mar	140	158	87	17	0	402
16- Mar	175	437	52	70	52	786
23- Mar	507	4,235	1,140	52	17	5,951
30- Mar	0	385	0	0	0	385
06- Apr	56	154	14	0	14	238
12- Apr	21,140	4,186	70	84	882	26,362
20- Apr	13,440	7,630	157	0	192	21,419
27- Apr	18,497	2,275	3,080	35	1,505	25,392
05- May	19,040	3,010	23,887	52	2,800	48,789
11- May	12,180	5,792	22,417	997	2,940	44,326
19- May	19,985	6,247	9,607	3,885	4,165	43,889
26- May	1,794	11,440	5,498	1,561	746	21,039
01- Jun	1,365	12,127	4,497	4,602	892	23,483
08- Jun	70	2,275	805	210	18	3,378
15- Jun	18	717	192	0	0	927
22- Jun	18	2,555	52	0	18	2,643
30- Jun	0	8,900	344	0	0	9,244
07- Jul	51	5,080	76	0	0	5,207
13- Jul	140	5,530	53	0	18	5,741
20- Jul	228	4,182	53	0	18	4,481
27- Jul	175	717	18	0	35	945
04- Aug	0	560	0	0	0	560
10- Aug	0	53	0	0	0	53
17- Aug	0	35	0	0	0	35
24- Aug	0	315	0	0	0	315
31- Aug	0	595	0	0	0	595
09- Sep	0	489	23	23	0	535
14- Sep	0	473	0	18	0	491
21- Sep	0	893	18	0	0	911
27- Sep	0	193	18	0	0	211
05- Oct	0	1,295	70	0	0	1,365
13- Oct	0	3,076	0	0	23	3,099
19- Oct	0	1,628	105	18	35	1,786
26- Oct	0	1,663	0	0	0	1,663
02- Nov	18	1,260	53	0	35	1,366
09- Nov	0	1,663	0	0	0	1,663
16- Nov	18	2,030	88	0	0	2,136
Totals	109,055	104,253	72,474	11,624	14,405	311,811

operated consistently. Generally, it was not operated at night when juveniles normally pass the project, with the exception of the hours when FGE research was conducted. During the spring under spill conditions, there were periods with daylight operation. During the summer, there were periods with no operation at all.

First Powerhouse Subsampler Collection Efficiency

The First Powerhouse sampling facilities (Fig. 3) were designed to collect smolts in one of two modes: 1) using the entire sample flume, which intercepts the full width of the channel or 2) using only a portion of the flume, the subsample flume located in the center of the channel intercepts 16.7% of the channel width. Either of these modes requires the physical installation of the sample tank into the channel.

The subsampler was the preferred sampling device because it intercepted less flow and subsequently less debris. The duration of each sample was dependent on the following: 1) the number of fish collected, 2) fluctuations in the water level of the channel, and 3) the amount of debris in the channel. However, 1986 studies determined that the sampling efficiency of the subsampling flume differed among species and was not proportional to the percentage of flow intercepted (Gessel et al. 1987).

Studies in 1987 were conducted to determine the percentage of yearling and subyearling chinook salmon and steelhead intercepted by the subsampler for both modes of operation (the entire flume across the width of the channel and the subsampler in the center of the channel).

Approach

During early March (prior to the main smolt migration), marked groups of fish were released into the channel at Unit 7 (approximately 200 ft upstream from the inclined screen crest) and either the entire flume or the subsampler section was used to recapture these fish. The tests with the entire flume enabled us to determine the time required for 100% of the release groups to pass through the channel. The alternate tests (with the subsampler only) were then conducted for the same length of time. During tests in which the entire flume was used, the fish collected by the subsampler were held separate. Therefore, it was possible to calculate and compare the catch proportions intercepted by the subsampler when used alone and when used with the remaining sections. The G-test for goodness of fit (Sokal and Rohlf 1981), 95% confidence level, was used to compare the actual subsampler catch with the theoretical 16.7%.

Results

Yearling and subyearling chinook salmon catch by the subsampler was significantly higher than the theoretical 16.7% (Table 7). This occurred both with the entire flume and subsampler-only operation. It indicated that yearling and subyearling chinook salmon were not randomly distributed across the channel. We observed a stronger current in the middle portion of the channel at the approach to the inclined screen crest and surmised that it concentrated the fish toward the subsampler.

The percentage of subyearling chinook salmon collected in the subsampler with either the entire flume or the subsampler only did not significantly vary, 22.4 versus 24.7%, respectively (Table 7) (G value = 1.99, df = 1). Yearling chinook salmon catches between the two collection methods (33.4 and 37.5%) were, however, significantly different (G value = 5.03, df = 1). Although there was a

Table 7.--Percentages of marked yearling and subyearling chinook salmon and steelhead recaptured in entire sample flume and in subsample flume and comparisons to theoretical rate at First Powerhouse juvenile collection facility, Bonneville Dam, 1987.

Entire flume (100% of channel)				Subsampler (16% of channel)		
Time min.	No. rel.	(%) recov.	Center catch (%)	Time min.	No. rel.	Center catch (%)
			Yearling chinook salmon			
50	250	98.4	30.9	50	250	41.6
30	250	100.0	32.0	30	250	43.2
30	250	99.6	38.0	30	250	42.8
30	250	99.6	32.5	30	250	33.2
			$\bar{X}$ = 33.4	30	250	29.6
			SE = 1.6	30	250	29.2
			G = 75.1 ***	30	250	37.2
				30	360	41.9
						$\bar{X}$ = 37.5
						SE = 2.1
						G =236.9***
			Subyearling chinook salmon			
45	250	100.0	16.8	45	250	19.2
30	250	93.6	28.6	30	250	26.4
30	250	98.0	22.4	30	250	27.6
30	250	100.0	22.0	30	250	21.2
			$\bar{X}$ = 22.4	30	250	25.2
			SE = 2.4	30	250	21.2
			G = 10.2**	30	250	29.6
				30	229	27.5
						$\bar{X}$ = 24.7
						SE = 1.3
						G = 39.1***
			Steelhead			
120	250	35.2	17.0			
20	518	23.7	18.7			
60	250	27.6	20.3	No data collected		
20	250	24.0	15.0			
			$\bar{X}$ = 17.9			
			SE = 1.1			
			G = 0.2			

*** P< 0.001
** P< 0.05
a/ G-value for goodness of fit [comparing flume catch percentages vs. theoretical (16.7%)]

difference detected with yearling chinook salmon, the difference between the subsampler and the entire flume was not much more than the one found for subyearling chinook salmon (4.1 versus 2.3%), therefore, sampling for all fish should be considered on the same basis. A conservative sampling approach would use the entire flume to decrease the variability associated with the samples, however, the precision gained with the use of the entire flume is offset by handling of additional fish. The sub-sample flume will not, however, provide adequate estimates for steelhead.

We were unable to evaluate the subsampler-only mode for groups of marked steelhead. With the entire-flume operation, only 35.2% were recovered 2 hours after the first release of 250 fish. Thus with the subsampler operation, we had no measure of how many marked fish had passed through the system. The recapture rate for steelhead in the subsampler when the entire flume was used was 17.9%.

These tests provided additional information about the length of time steelhead can remain in the channel since some fish were captured 160 hours after release. This information underlines the benefit of having a continuous sampling device (similar to that at Bonneville Dam Second Powerhouse) to provide reliable estimates of fish passage at collection facilities.

First Powerhouse Temporal Passage

Approach

We attempted to fish the full width sampler throughout the field season (keeping the subsample separate) 20 minutes on the hour, 8 hours/day (0800-1600 hours), 3 days/week. However, during hours of peak passage, fish numbers and the size of the sample tank limited the duration of each sample to 10 minutes or less. Additionally, diel (24-hour samples) were collected twice each week

(generally Tuesday and Thursday). Diel samples were collected in the same manner as those during the standard shift (20 min/hour, except during peak passage) and were used to calculate the mean percentage catch for three collection periods (0800-1600, 1600-2400, and 2400-0800 hours) for each species.

No studies were done to determine the variability between the partial hourly samples and a sample for an entire hour, therefore, passage estimates for each hour were simply derived by expanding each sampling period by a direct ratio to its duration. The hourly samples were then summarized into 8-hour blocks. On days with diel sampling, the three 8-hour blocks were compared to each other as a percentage of the total 24-hour catch. A ratio estimate of the catch in the 0800-1600 and 1600-2400 periods to the total 24-hour catch was then derived for the spring outmigration (Cochran 1963). The sampler was inoperable for the most of the summer outmigration, and a second ratio estimate was made for subyearling chinook salmon for the fall.

Results

Hourly passage estimates for the First Powerhouse sampling facility ranged from 0 to 30,600 juvenile salmonids. This was derived from expansion of the hourly collection data (Appendix Table 5).

The diel passage for each species, presented as a percent collection for each of the three periods (0800-1600, 1600-2400, and 2400-0800 hours), varied considerably throughout the field season and even between days within the same week (Table 8). To provide a means to estimate the total fish passage (by species) through the sampling system for the year, the total fish observed (by species) during the 8-hour samples was expanded by the ratio estimate (Tables 9 and 10). We were unable to make an estimate of the temporal passage of fish at the First Powerhouse DSM from our 5-day/week, 8-hour samples, however, because

Table 8.--Percentages of fish taken from each of three 8-hour shifts during diel samples at the Bonneville Dam First Powerhouse juvenile collection system in 1987.

Date	Shift (hours) 0800 1600	1600 2400	2400 0800	Date	Shift (hours) 0800 1600	1600 2400	2400 0800
			Subyearling chinook salmon				
31 Mar	27.3	25.4	47.3	1 Sep	21.7	49.3	29.1
2 Apr	22.0	33.0	45.0	3 Sep	16.5	49.6	33.9
7 Apr	30.7	27.0	42.3	8 Sep	24.3	28.3	47.4
9 Apr	26.2	27.2	46.6	10 Sep	21.1	40.6	38.3
14 Apr	16.5	45.9	37.6	15 Sep	28.5	40.3	31.2
16 Apr	8.8	23.3	67.9	17 Sep	41.9	30.0	28.1
23 Apr	39.9	26.8	33.3	22 Sep	20.0	36.6	43.3
28 Apr	24.4	26.2	49.4	24 Sep	28.0	26.8	45.5
30 Apr	40.2	29.5	30.3	29 Sep	33.1	43.0	23.8
5 May	38.4	22.3	39.3	1 Oct	48.8	22.2	29.0
7 May	36.2	20.2	43.7	6 Oct	36.6	38.3	25.1
12 May	30.7	25.0	44.3	8 Oct	40.2	35.7	24.1
14 May	48.3	31.4	20.2	13 Oct	33.3	48.6	18.0
2 Jun	28.4	27.2	44.3	15 Oct	17.0	63.1	19.9
4 Jun	25.3	31.3	43.3	20 Oct	28.1	41.3	30.5
7 Jun	42.4	24.8	32.8	22 Oct	23.0	47.6	29.4
23 Jun	49.3	26.9	23.7	27 Oct	29.6	47.9	22.5
25 Jun	51.5	21.1	27.4	29 Oct	60.6	22.5	16.9
30 Jun	43.8	24.4	31.8	3 Nov	20.4	33.3	46.3
				5 Nov	23.6	43.6	32.7
				10 Nov	41.8	29.1	29.1
				12 Nov	23.2	53.6	23.2
				17 Nov	9.0	45.4	45.4
				19 Nov	50.0	41.7	8.3
			Steelhead				
31 Mar	32.1	42.9	25.0	5 May	27.9	29.0	43.1
2 Apr	5.9	50.0	44.1	7 May	23.4	46.2	30.4
7 Apr	17.5	47.5	35.0	12 May	32.4	40.4	27.2
9 Apr	14.3	67.0	18.7	14 May	50.1	25.6	24.3
14 Apr	8.2	58.5	33.0	2 Jun	27.0	38.3	34.7
16 Apr	6.6	62.5	30.9	4 Jun	18.4	42.2	39.4
23 Apr	20.0	54.4	25.7	7 Jun	21.2	33.2	45.6
28 Apr	15.9	46.2	37.9	23 Jun	50.0	23.1	26.9
30 Apr	31.3	34.6	34.1	25 Jun	27.6	41.4	31.0
				30 Jun	11.1	44.4	44.4

Table 8.--continued.

Date	Shift (hours) 0800 1600	Shift (hours) 1600 2400	Shift (hours) 2400 0800	Shift (hours) 0800 1600	Shift (hours) 1600 2400	Shift (hours) 2400 0800	Shift (hours) 0800 1600	Shift (hours) 1600 2400	Shift (hours) 2400 0800
	Yearling chinook			Coho			Sockeye		
31 Mar	17.4	39.1	43.5	16.7	50.0	33.3	0.0	77.8	22.2
2 Apr	18.4	44.7	36.8	19.2	73.1	7.7	16.7	66.6	16.7
7 Apr	25.3	48.4	26.3	20.0	20.0	60.0	41.7	41.7	16.6
9 Apr	14.9	65.4	19.7	13.8	58.6	27.6	17.9	80.6	1.5
14 Apr	18.0	56.0	26.0	8.1	62.9	29.0	7.1	84.3	8.6
16 Apr	8.1	37.9	54.1	3.9	52.4	43.7	5.7	55.2	39.1
23 Apr	21.8	33.7	44.5	17.4	28.8	53.8	7.8	31.1	61.2
28 Apr	18.9	25.3	55.8	34.5	29.8	35.6	20.0	80.0	0.0
30 Apr	30.2	28.5	41.3	22.9	31.9	45.3	40.0	0.0	60.0
5 May	19.8	19.5	60.7	27.0	24.4	48.7	19.6	41.2	39.2
7 May	28.6	34.6	36.8	32.7	33.1	34.2	9.8	73.3	16.8
12 May	31.2	32.9	35.9	32.7	37.7	29.5	27.2	47.0	25.7
14 May	43.6	25.6	30.9	35.7	32.4	31.8	34.0	48.5	17.5
2 Jun	24.7	35.9	39.4	31.6	30.7	37.7	27.2	33.3	39.4
4 Jun	28.3	30.8	40.8	16.0	34.1	49.9	16.4	47.7	35.9
7 Jun	33.7	23.0	43.3	39.5	24.8	37.5	32.2	43.8	24.0
23 Jun	28.4	28.4	43.1	53.8	24.8	21.3	33.3	33.3	33.3
25 Jun	11.5	44.0	44.5	31.6	27.3	41.0	40.0	60.0	0.0
30 Jun	11.7	28.7	59.6	32.6	65.2	2.2			

Table 9.--Weighted ratio estimate of percentage of fish captured during 8-hour sampling compared with total diel samples at the Bonneville First Powerhouse juvenile sampler for 18 diel samples taken during the period 31 March - 25 June, 1987.

	Subyearling chinook salmon	Yearling chinook salmon	Coho salmon	Sockeye salmon	Steelhead
1. Total fish captured	100,168	247,900	160,333	24,168	70,819
2. Total 0800-1600 catch	38,924	64,675	49,911	6,093	21,943
Ratio estimate (2 ÷ 1)	0.3886	0.2609	0.3113	0.2521	0.3098
S.E.	0.0395	0.0344	0.0158	0.0339	0.0509
S.D.	0.1675	0.1460	0.0668	0.1438	0.2157
3. Total 1600-2400 catch	26,835	76,626	51,604	10,782	26,968
Ratio estimate (3 ÷ 1)	0.3091	0.2664	0.3219	0.4461	0.3808
S.E.	0.0206	0.0149	0.0193	0.0356	0.0379
S.D.	0.0874	0.0634	0.0818	0.1509	0.1609

Table 10.--Weighted ratio estimate of percentage of subyearling chinook salmon captured during 8-hour sampling compared with total diel samples at the Bonneville First Powerhouse juvenile sampler for 24 diel samples taken during the period 1 September - 19 November, 1987.

	0800-1600	1600-2400
1. Total fish captured	9,468	9,468
2. Total sample catch	2,906	3,812
Ratio estimate (2 ÷ 1)	0.3069	0.4026
S.E.	0.0240	0.0239
S.D.	0.1178	0.01172

the sampler was out of commission during crucial times of the fish migration (18-31 May and 6 July-31 August). If the sampler was in operation over the outmigration, the total fish observed during the outmigration (by species) would be expanded by the ratio estimate. The numbers would have the associated S.E. attached (Table 9) and the confidence intervals around the estimates would range from 3.5 to 10%. The ratio estimate could be used to expand daily counts, however, the error associated with daily counts would require use of the S.D. and not the S.E. Thus daily estimates would have ranges of 12 to 42%, depending upon the species.

Total project passage

Estimates of total project passage could not be made from the data we collected. We did not know what percentage of fish passed through the spill when it was operating, nor did we know the variability of the collection by the STSs. We also did not make an estimate of total project temporal passage, as again, we did not know the percentage of fish passing through the spill and the First Powerhouse sampling system was not operating during some periods of peak fish movement. Additionally, the Second Powerhouse was only operated on nights when FGE research was conducted.

Although temporal fish passage estimates can be made at Bonneville Dam, they will, in general, only reflect the huge hatchery releases into the Bonneville pool. Due to the large number of hatchery releases, substantial increases in numbers of fish handled will be necessary in order to recover sufficient numbers of marked upriver fish to make any estimates.

A comparison of the limited data available when diel samples were taken simultaneously at both powerhouses indicated that the proportions of fish were the approximately the same at each powerhouse, with the exception of steelhead

(Table 11). Thus, the Second Powerhouse sampling system may provide better estimates of temporal fish passage because it operates 24-hours per day--and does not have the large errors associated with expanding partial sampling information as does the First Powerhouse system. This requires, however, operation of the Second Powerhouse at least daily. It probably would not require full operation, but would require operation during evening hours when fish enter the gatewells.

CONCLUSIONS AND RECOMMENDATIONS

Second Powerhouse FGE Studies

1) Fish guidance efficiencies greater than 70% in Unit 12A (w/o ceiling extension) and 60% in Unit 12B (w/ceiling extension) for a combined FGE of 68% are attainable for yearling chinook salmon with full powerhouse operation.
2) Mercury vapor lights located on the turbine intake ceiling have some potential to improve FGE.
3) The small external deflector does not appear to increase FGE.
4) Removal of the upper three trashrack sections does not appear to increase FGE or STS effectiveness.
5) Studies to improve FGE through the use of lights, a more porous guiding device, or other modifications/additions should be continued.

First Powerhouse DSM

1) The percentages of yearling and subyearling chinook salmon and steelhead collected by the subsampler are 1) disproportionate to the actual amount of flow intercepted by the subsampler, 2) different for each species or race, and 3) will probably vary for each species or race throughout the

Table 11.--Comparison of the proportion of fish passing the Bonneville First and Second Powerhouses during periods with equal sampling intensity.

		Subyearling chinook salmon	Yearling chinook salmon	Coho salmon	Sockeye salmon	Steelhead
			First Powerhouse sampler			
1986						
	21 May	24%	37%	24%	7%	9%
	3 Jun	7%	38%	35%	10%	10%
1987	5 May	38%	3%	47%	<1%	12%
	7 May	23%	2%	52%	1%	22%
	12 May	28%	7%	49%	3%	14%
	14 May	34%	10%	35%	5%	16%
			Second Powerhouse sampler			
1986						
	21 May	29%	43%	8%	13%	8%
	3 Jun	9%	11%	43%	29%	7%
1987						
	5 May	54%	6%	34%	<1%	6%
	7 May	25%	7%	62%	<1%	6%
	12 May	37%	8%	49%	1%	5%
	14 May	24%	16%	50%	3%	7%

field season. Thus, daily estimates will have large errors associated with them, but a yearly estimate could be made with fairly good precision.

2) During marked fish releases, steelhead were able to hold up in the bypass channel for several days whereas other salmonids moved through in less than 40 minutes.

3) Due to breakdowns in the sampling system, an estimate of temporal passage for 1987 was not made.

4) Design of the sample facilities (non-continuous sampler) and variability in collection data dictate that extensive sampling efforts (24 h/day and 7 days/week) are necessary to reliably estimate daily smolt passage.

Second Powerhouse DSM

The second powerhouse DSM sampler samples 10% of the fish using the DSM. It could be used to make estimates of temporal fish passage by the powerhouse during the periods in which the powerhouse was operating. To date, estimates of temporal fish passage have been a function of second powerhouse operation, not overall passage of fish at the Bonneville project.

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APPENDIX A

Data Tables

Appendix Table I.--Numbers of fish collected in the individual replicates of STS FGE tests at Bonneville Dam Second Powerhouse, 1986 (tests conducted in July and August captured only subyearling chinook salmon).

	Date (Test Unit) and (test number)[a]											
	21 April (12A) (1)				21 April (12B) (1)				24 April (12A) (1)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	73	911	8	--	42	764	12	--	5	282	14	--
Gap Net	10	23	1	--	14	27	--	--	3	5	--	--
Closure Net	30	353	5	--	40	327	3	--	3	122	1	--
1st Level	18	153	--	--	12	195	3	--	3	48	--	--
2nd Level	42	639	21	--	48	666	--	--	6	216	--	--
3rd Level	21	306	3	--	18	303	12	--	3	102	--	--
4th Level	21	141	6	--	21	159	3	--	--	102	3	--
5th Level	--	21	--	--	3	30	--	--	3	3	--	--
Totals	215	2547	44	--	198	2471	33	--	26	880	18	--
	34	36	18		21	31	36		19	32	78	

	24 April (12B) (1)				25 April (12A) (1)				25 April (12B) (1)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	7	305	17	--	5	192	14	1	4	285	16	1
Gap Net	3	8	--	--	1	7	--	--	--	7	--	--
Closure Net	6	104	1	--	1	90	4	--	2	113	1	--
1st Level	3	63	--	--	3	36	--	--	--	78	--	--
2nd Level	9	270	12	--	3	150	--	--	--	183	9	--
3rd Level	6	153	--	--	9	69	--	--	3	99	--	--
4th Level	3	123	--	--	3	30	--	--	--	72	--	--
5th Level	--	3	--	--	--	3	--	--	--	9	--	--
Totals	37	1029	30	--	25	577	18	1	9	846	16	1
	19	27	57		20	34	78	100	45	34	100	100

	26 April (12A) (1)				26 April (12B) (1)				28 April (12A) (2)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	9	142	9	2	7	215	10	--	2	286	62	2
Gap Net	2	2	--	--	1	4	1	--	--	4	1	--
Closure Net	4	54	3	--	2	53	2	--	1	63	13	1
1st Level	--	12	3	--	9	51	3	--	--	39	9	--
2nd Level	3	72	3	--	9	114	6	--	--	105	9	--
3rd Level	--	48	3	--	6	57	--	--	3	54	3	--
4th Level	--	30	--	--	--	36	3	--	3	30	3	--
5th Level	--	--	--	--	--	6	--	--	--	6	--	--
Totals	18	360	21	2	34	536	25	--	9	587	100	3
	50	39	43	100	21	40	40		22	49	62	67

Appendix Table 1.--Continued.

Location	28 April (12B) (2) SC	YC	ST	SO	29 April (12A) (2) SC	YC	ST	SO	29 April (12B) (2) SC	YC	ST	SO
Gatewell	3	133	24	--	--	297	27	--	6	182	30	--
Gap Net	2	3	--	--	--	7	--	--	1	6	--	--
Closure Net	2	61	7	--	--	92	5	--	1	29	2	--
1st Level	--	27	6	--	--	39	--	--	--	42	3	--
2nd Level	--	78	21	--	3	154	6	--	--	150	9	--
3rd Level	--	66	3	--	1	61	6	--	3	75	--	--
4th Level	3	27	3	--	--	45	--	--	3	51	--	--
5th Level	--	--	--	--	--	3	--	--	3	12	--	--
Totals	10	395	64	--	4	698	39	--	17	547	44	--
	30	34	38		0	43	70	0	35	33	68	0

Location	30 April (12A) (2) SC	YC	ST	SO	30 April (12B) (2) SC	YC	ST	SO	1 May (12A) (3) SC	YC	ST	SO
Gatewell	7	658	54	--	2	360	37	--	3	742	43	--
Gap Net	--	9	1	--	1	5	--	--	2	9	--	--
Closure Net	4	136	5	--	1	86	8	--	1	95	7	--
1st Level	3	69	6	--	--	30	--	--	--	36	3	--
2nd Level	3	158	11	--	3	135	21	--	2	115	6	--
3rd Level	2	34	2	--	--	24	--	--	3	62	5	--
4th Level	--	15	3	--	3	15	--	--	--	33	3	--
5th Level	--	--	--	--	--	6	--	--	3	3	--	--
Totals	19	1079	82	--	10	661	66	--	14	1095	67	--
	37	61	66	0	20	51	56	0	21	68	64	0

Location	1 May (12B) (3) SC	YC	ST	SO	2 May (12A) (3) SC	YC	ST	SO	2 May (12A) (3) SC	YC	ST	SO
Gatewell	7	381	39	--	3	580	41	1	3	363	35	1
Gap Net	--	3	--	--	--	8	--	--	--	5	--	--
Closure Net	--	66	2	--	--	61	4	--	1	57	12	--
1st Level	--	60	6	--	--	42	3	--	--	33	3	--
2nd Level	--	114	9	--	--	93	18	--	--	84	12	--
3rd Level	6	51	--	--	6	39	3	--	3	24	3	--
4th Level	--	15	6	--	--	12	--	--	--	9	--	--
5th Level	--	--	3	--	--	--	--	--	--	--	3	--
Totals	13	690	65	--	9	835	69	1	7	575	68	1
	54	55	60	0	33	69	59	100	43	63	51	100

Appendix Table 1.--Continued.

	Date (Test Unit) and (test number)[a]											
	3 May (12A) (3)				3 May (12B) (3)				5 May (12A) (4)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	--	1098	83	--	3	354	53	1	--	194	39	1
Gap Net	--	21	1	--	--	5	1	--	--	10	2	--
Closure Net	--	113	13	--	--	47	11	--	1	41	10	1
1st Level	--	45	--	--	--	33	9	--	--	36	12	--
2nd Level	--	87	3	--	--	72	15	--	--	84	6	3
3rd Level	--	36	12	--	--	42	--	--	--	75	9	--
4th Level	--	24	6	--	--	12	--	--	--	21	3	--
5th Level	--	3	--	--	--	--	--	--	--	3	--	--
Totals	--	1427	118	--	3	565	89	1	1	464	81	5
	0	77	70	0	100	63	60	100	0	41	48	20

	5 May (12B) (4)				6 May (12A) (4)				6 May (12B) (4)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	3	234	32	--	5	232	50	2	3	184	50	--
Gap Net	--	8	--	--	1	7	1	--	2	7	1	--
Closure Net	1	45	10	1	--	40	--	--	2	34	16	--
1st Level	--	30	12	3	3	39	21	--	--	39	3	--
2nd Level	--	66	6	--	--	69	30	--	--	84	15	--
3rd Level	--	36	--	--	--	30	3	--	--	15	9	--
4th Level	--	27	3	--	3	15	--	--	--	12	--	--
5th Level	--	3	3	--	--	9	--	--	--	3	--	--
Totals	4	449	66	4	12	441	105	2	7	378	94	--
	75	52	48	0	42	53	48	100	43	49	53	0

	7 May (12A) (5)				7 May (12B) (5)				11 May (12A) (6)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	6	230	85	1	5	309	43	7	16	194	57	8
Gap Net	1	14	1	--	1	12	1	--	--	2	--	1
Closure Net	2	57	22	--	--	56	15	--	4	57	18	26
1st Level	6	60	27	--	3	57	18	--	--	18	27	6
2nd Level	12	165	60	--	3	156	39	--	12	60	45	24
3rd Level	--	57	24	--	--	39	6	3	--	36	12	6
4th Level	3	39	9	--	6	45	9	--	3	21	9	9
5th Level	3	6	6	--	--	6	--	--	--	15	--	--
Totals	33	628	234	1	18	680	131	10	35	403	168	80
	18	37	36	100	27	45	39	70	46	48	34	10

Appendix Table I.--Continued.

	Date (Test Unit) and (test number)[a]											
	11 May (12B) (6)				12 May (12A) (6)				12 May (12B) (6)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	8	165	45	13	30	226	57	24	19	198	42	19
Gap Net	2	3	--	--	2	2	1	4	3	6	1	6
Closure Net	6	58	17	18	11	85	28	16	11	59	19	15
1st Level	--	57	18	3	3	42	15	9	--	36	6	6
2nd Level	3	45	12	9	9	96	60	33	9	102	27	27
3rd Level	6	12	6	9	6	36	12	18	9	30	27	9
4th Level	3	27	6	6	6	24	18	9	6	15	9	21
5th Level	--	--	3	--	--	3	--	--	--	3	--	--
Totals	28	367	107	58	67	514	191	113	57	449	131	103
	29	45	42	23	45	44	30	21	30	44	32	18

	13 May (12A) (6)				13 May (12B) (6)				15 May (12A) (7)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	23	149	41	15	21	115	56	12	23	208	74	47
Gap Net	--	5	1	2	5	1	--	1	2	13	5	4
Closure Net	2	18	4	4	8	21	9	7	34	104	19	22
1st Level	--	30	18	6	9	9	15	3	6	30	12	3
2nd Level	12	96	48	24	9	51	27	12	18	27	24	24
3rd Level	9	51	27	21	6	45	3	--	3	15	12	15
4th Level	3	36	27	--	3	32	--	3	9	33	6	9
5th Level	--	9	--	--	3	12	--	--	--	3	--	--
Totals	49	394	166	72	64	286	110	38	95	433	152	124
	47	38	25	21	33	40	51	32	24	48	49	38

	15 May (12B) (7)				16 May (12A) (8)				16 May (12B) (8)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	44	399	60	69	75	441	181	61	27	182	104	55
Gap Net	9	21	1	4	11	8	3	5	2	8	3	9
Closure Net	17	65	9	16	15	77	72	36	9	45	27	16
1st Level	15	114	30	30	3	18	30	42	3	27	15	15
2nd Level	9	54	36	33	6	30	60	33	15	24	66	36
3rd Level	3	30	12	15	3	15	21	12	6	6	12	18
4th Level	6	24	6	--	6	--	21	6	6	9	12	9
5th Level	--	3	--	--	--	--	3	--	3	3	--	--
Totals	103	710	154	167	119	589	391	195	61	304	239	158
	43	56	39	41	63	75	46	31	44	60	44	35

Appendix Table I.--Continued.

	Date (Test Unit) and (test number)[a]											
	17 May (12A) (9)				17 May (12B) (9)				18 May (12A) (10)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	59	261	99	45	28	183	66	38	25	142	81	49
Gap Net	5	14	3	8	2	2	1	1	--	18	1	12
Closure Net	4	75	52	19	5	27	16	21	6	56	48	32
1st Level	3	18	36	12	6	39	30	21	9	18	51	42
2nd Level	9	69	30	21	6	72	21	24	6	75	42	54
3rd Level	6	24	21	6	6	3	6	12	--	33	21	42
4th Level	3	15	15	6	6	6	6	9	3	15	24	12
5th Level	--	3	--	--	--	--	3	--	3	3	--	
Totals	89	479	256	117	59	332	149	126	52	360	268	243
	66	55	39	39	47	55	44	30	48	39	30	20

	18 May (12B) (10)				19 May (12A) (11)				19 May (12B) (11)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	21	107	72	36	34	173	76	79	26	134	40	60
Gap Net	3	18	5	7	2	4	3	3	6	18	2	8
Closure Net	10	96	44	44	4	38	31	36	3	21	12	11
1st Level	3	84	24	9	--	30	21	21	6	12	9	30
2nd Level	6	66	45	39	3	45	24	66	9	66	30	33
3rd Level	3	15	9	12	--	15	9	18	3	15	6	27
4th Level	--	30	6	6	--	9	3	9	12	15	6	12
5th Level	3	--	--	3	--	3	--	--	--	--	--	3
Totals	49	416	205	156	43	317	167	232	65	281	105	184
	42	26	35	23	80	55	46	34	40	48	38	37

	20 May (12A) (12)				20 May (12B) (12)				26 May (12A) (13)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	13	51	31	30	17	45	21	27	112	164	33	29
Gap Net	--	4	--	1	1	12	1	5	6	5	1	2
Closure Net	6	12	8	12	8	7	4	8	15	18	4	8
1st Level	--	3	--	12	6	33	12	15	24	21	9	3
2nd Level	3	42	21	24	3	42	21	21	39	30	9	21
3rd Level	--	15	12	15	9	24	9	12	24	15	9	--
4th Level	6	21	15	6	9	21	3	--	12	6	--	3
5th Level	3	3	--	--	--	--	--	--	6	--	--	--
Totals	31	151	87	100	54	184	71	88	238	259	65	69
	42	34	36	30	31	24	30	30	47	63	51	42

Appendix Table 1.--Continued.

	Date (Test Unit) and (test number)[a]											
	26 May (12B) (13)				27 May (12A) (14)				27 May (12B) (14)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	115	92	13	19	162	308	24	58	123	137	20	29
Gap Net	5	3	1	1	5	11	1	7	6	2	--	1
Closure Net	10	7	4	7	21	22	7	11	16	16	1	4
1st Level	15	24	6	6	15	18	12	9	9	24	6	9
2nd Level	39	36	6	6	60	48	3	18	27	27	6	27
3rd Level	42	18	6	3	15	30	6	12	21	6	--	3
4th Level	36	18	3	6	6	21	--	6	18	--	3	3
5th Level	--	--	--	--	--	--	--	3	--	3	--	3
Totals	262	198	39	48	284	458	53	124	220	212	36	79
	49	46	33	40	57	67	45	47	56	65	56	37

	28 May (12A) (15)				28 May (12B) (15)				29 May (12A) (16)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	133	164	21	175	71	58	33	51	188	232	50	94
Gap Net	10	3	1	13	2	1	--	4	9	6	3	11
Closure Net	26	22	13	44	18	13	5	20	42	40	7	40
1st Level	15	15	6	27	15	12	6	18	12	21	6	21
2nd Level	66	27	15	75	21	21	6	39	72	39	9	147
3rd Level	15	15	9	33	21	21	6	36	36	18	6	69
4th Level	21	24	--	30	12	6	3	36	18	9	9	42
5th Level	3	--	--	--	--	6	--	9	3	3	--	3
Totals	289	270	63	397	160	138	59	213	380	368	90	427
	46	61	33	44	44	42	56	24	49	63	56	22

	29 May (12B) (16)				30 May (12A) (17)				30 May (12B) (17)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	110	122	31	74	159	156	37	162	191	146	49	155
Gap Net	9	5	1	6	4	3	1	32	4	2	--	3
Closure Net	46	24	7	57	38	18	5	80	29	11	2	69
1st Level	27	12	3	39	24	18	--	78	33	6	--	42
2nd Level	27	18	6	66	84	33	9	207	96	24	3	165
3rd Level	21	24	3	111	48	15	3	159	21	21	12	189
4th Level	27	15	3	51	27	12	--	54	6	12	--	105
5th Level	3	6	--	6	3	--	--	18	12	6	--	3
Totals	270	226	54	410	387	255	55	790	392	228	66	731
	41	54	57	18	41	61	67	21	49	64	74	21

Appendix Table 1.--Continued.

	Date (Test Unit) and (test number)[a]											
	31 May (12A) (18)				31 May (12B) (18)				1 June (12A) (19)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	58	90	24	46	235	265	51	182	125	95	42	101
Gap Net	--	4	1	3	11	18	1	14	9	4	1	8
Closure Net	40	41	9	89	22	13	8	50	33	35	27	43
1st Level	21	12	3	51	24	21	6	27	18	12	6	48
2nd Level	63	24	6	249	81	24	--	81	72	18	24	144
3rd Level	24	24	6	141	42	9	9	132	48	42	18	93
4th Level	9	6	--	66	9	18	--	63	27	18	--	60
5th Level	3	3	--	9	3	9	--	9	--	3	--	9
Totals	218	204	49	654	427	377	75	558	332	227	118	506
	27	44	49	7	55	70	68	33	38	42	36	20

	1 June (12B) (19)				2 June (12A) (20)				2 June (12B) (20)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	191	166	48	129	83	43	16	36	248	130	32	134
Gap Net	9	6	7	9	6	9	--	7	7	5	1	18
Closure Net	13	11	3	12	45	19	1	27	16	12	1	16
1st Level	15	9	3	24	24	6	6	12	36	12	6	21
2nd Level	39	12	6	90	96	36	--	90	69	12	3	21
3rd Level	33	3	--	84	66	27	6	105	33	18	3	72
4th Level	9	12	3	39	15	6	--	39	21	6	3	57
5th Level	--	3	--	6	3	--	--	--	9	--	3	9
Totals	309	222	70	393	338	146	29	316	439	195	49	348
	62	75	69	39	25	29	55	11	57	67	65	39

	3 June (12A) (21)				3 June (12B) (21)			
Location	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	169	92	18	34	159	74	15	22
Gap Net	14	3	--	3	10	2	--	2
Closure Net	26	20	6	28	12	1	--	2
1st Level	27	15	6	9	27	3	--	21
2nd Level	33	27	12	42	66	12	9	18
3rd Level	33	3	12	21	39	6	--	9
4th Level	36	9	3	3	12	12	--	12
5th Level	3	--	--	3	3	--	--	--
Totals	341	169	57	143	328	110	24	86
	50	54	32	24	48	67	63	26

Appendix Table 1.--Continued.

	Date (Test Unit) and (test number)[a]											
	14 July (12A) (22)				14 July (12B) (22)				15 July (12A) (23)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	57				117				43			
Gap Net	--				10				6			
Closure Net	34				28				29			
1st Level	15				39				3			
2nd Level	42				51				30			
3rd Level	36				48				45			
4th Level	6				45				27			
5th Level	--				6				9			
Totals	190				344				192			
	30				34				22			

	15 July (12B) (23)				16 July (12A) (24)				16 July (12B) (24)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	45				30				72			
Gap Net	6				2				5			
Closure Net	30				21				49			
1st Level	21				30				45			
2nd Level	72				84				117			
3rd Level	63				42				60			
4th Level	24				36				51			
5th Level	9				3				18			
Totals	270				248				417			
	17				12				17			

	17 July (12A) (25)				17 July (12B) (25)				18 July (12A) (26)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	21				41				17			
Gap Net	2				4				3			
Closure Net	40				23				40			
1st Level	24				21				18			
2nd Level	51				51				234			
3rd Level	54				63				312			
4th Level	15				30				132			
5th Level	9				21				39			
Totals	216				254				795			
	10				16				2			

Appendix Table 1.--Continued.

	Date (Test Unit) and (test number)[a]											
	18 July (12B) (26)				19 July (12A) (27)				19 July (12B) (27)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	133				58				133			
Gap Net	4				3				5			
Closure Net	81				43				58			
1st Level	111				24				63			
2nd Level	216				132				264			
3rd Level	153				174				87			
4th Level	111				102				150			
5th Level	60				12				39			
Totals	869				548				799			
	15				11				17			

	20 July (12A) (28)				20 July (12B) (28)				21 July (12A) (29)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	7				40				49			
Gap Net	1				3				1			
Closure Net	13				16				45			
1st Level	24				63				21			
2nd Level	132				159				60			
3rd Level	189				81				45			
4th Level	147				96				30			
5th Level	18				9				6			
Totals	524				467				257			
	1				9				19			

	21 July (12B) (29)				22 July (12A) (30)				22 July (12B) (30)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	39				29				58			
Gap Net	4				--				2			
Closure Net	22				30				52			
1st Level	18				12				24			
2nd Level	69				39				93			
3rd Level	81				39				57			
4th Level	45				27				78			
5th Level	12				6				6			
Totals	290				183				370			
	14				16				16			

Appendix Table 1.--Continued.

	Date (Test Unit) and (test number)[a]											
	23 July (12A) (31)				23 July (12B) (31)				24 July (12A) (32)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	47				53				45			
Gap Net	--				2				2			
Closure Net	46				65				36			
1st Level	15				30				24			
2nd Level	90				105				75			
3rd Level	78				78				48			
4th Level	42				42				33			
5th Level	15				15				9			
Totals	333				390				272			
	14				14				17			

	24 July (12B) (32)				28 July (12A) (33)				28 July (12B) (33)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	57				12				33			
Gap Net	4				2				2			
Closure Net	50				17				7			
1st Level	27				6				18			
2nd Level	75				45				42			
3rd Level	72				27				48			
4th Level	72				9				12			
5th Level	12				3				9			
Totals	369				121				170			
	15				10				19			

	29 July (12A) (34)				29 July (12B) (34)				30 July (12A) (35)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	26				27				20			
Gap Net	--				--				8			
Closure Net	18				19				18			
1st Level	3				21				12			
2nd Level	30				42				39			
3rd Level	36				18				24			
4th Level	15				36				9			
5th Level	--				6				--			
Totals	128				169				130			
	20				16				15			

Appendix Table 1.--Continued.

	Date (Test Unit) and (test number)[a]											
	30 July (12B) (35)				31 July (12A) (36)				31 July (12B) (36)			
Location	SC	YC	ST	SO	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	28				37				17			
Gap Net	--				6				1			
Closure Net	50				18				24			
1st Level	12				3				9			
2nd Level	33				24				18			
3rd Level	18				6				9			
4th Level	21				6				30			
5th Level	12				--				--			
Totals	174 16				100 37				108 16			

	1 August (12A) (35)				1 August (12B) (35)			
Location	SC	YC	ST	SO	SC	YC	ST	SO
Gatewell	22				52			
Gap Net	9				--			
Closure Net	25				56			
1st Level	21				3			
2nd Level	42				48			
3rd Level	30				27			
4th Level	15				45			
5th Level	3				3			
Totals	167 13				234 22			

[a]/Test numbers correspond to those in Table 1, this report.

SC = Subyearling chinook salmon

YC = Yearling chinook salmon (includes data for coho salmon)

ST = Steelhead

SO = Sockeye salmon

Appendix Table 2.--Collection data of yearling and subyearling chinook salmon for the individual replicates of vertical distribution tests at Bonneville Dam Second Powerhouse, 1987.

	YEARLING CHINOOK SALMON									
Test Date	**21 April**	**24 April**	**25 April**	**26 April**	**28 April**	**29 April**	**30 April**	**1 May**	**2 May**	**3 May**
Gatewell	620	176	146	132	75	147	228	419	294	388
1st Level	1272	432	321	195	108	204	357	561	291	309
2nd Level	975	303	192	153	129	165	282	336	231	204
3rd Level	810	210	186	141	75	153	153	159	102	84
4th Level	630	240	135	69	78	126	75	132	39	48
5th Level	447	180	105	99	60	114	60	96	39	12
6th Level	186	99	54	45	45	81	24	39	6	12
7th Level	63	27	18	12	15	30	30	30	--	3
Totals	**5003**	**1667**	**1157**	**846**	**585**	**1020**	**1209**	**1772**	**1002**	**1060**

Test Date	**5 May**	**6 May**	**7 May**	**11 May**	**12 May**	**13 May**	**15 May**	**16 May**	**17 May**	**18 May**
Gatewell	221	141	162	90	74	82	184	85	78	139
1st Level	252	183	222	99	108	189	309	195	174	267
2nd Level	159	153	129	138	129	147	237	141	189	198
3rd Level	147	51	75	60	87	96	138	99	105	93
4th Level	123	39	63	72	51	78	96	18	120	99
5th Level	90	24	24	57	66	39	63	27	66	66
6th Level	48	12	18	18	60	42	18	3	24	30
7th Level	9	6	9	18	18	30	12	--	15	24
Totals	**1049**	**609**	**702**	**552**	**593**	**703**	**1057**	**568**	**771**	**916**

Appendix Table 2.--Continued.

YEARLING CHINOOK SALMON

Test Date	19 May	20 May	26 May	27 May	28 May	29 May	30 May	31 May	1 June	2 June
Gatewell	96	75	30	35	24	31	47	55	54	28
1st Level	150	99	66	81	36	48	54	63	51	48
2nd Level	123	57	60	42	27	48	48	57	27	27
3rd Level	69	69	36	33	30	45	27	42	27	18
4th Level	42	45	18	18	15	12	36	15	15	27
5th Level	33	39	30	6	18	21	24	36	6	18
6th Level	36	18	24	3	3	9	24	15	6	--
7th Level	24	15	3	6	6	3	--	12	6	3
Totals	**573**	**417**	**267**	**224**	**159**	**217**	**260**	**295**	**192**	**169**

YEARLING CHINOOK SALMON		SUBYEARLING CHINOOK SALMON					
Test Date	**3 June**	**14 July**	**15 July**	**16 July**	**17 July**	**18 July**	**19 July**
Gatewell	22	35	23	17	14	29	55
1st Level	21	45	39	54	15	87	75
2nd Level	27	81	72	48	36	120	111
3rd Level	30	69	84	93	48	126	135
4th Level	21	63	57	66	63	117	183
5th Level	6	57	60	90	69	126	168
6th Level	3	51	42	57	51	108	141
7th Level	6	15	21	21	48	75	42
Totals	**136**	**416**	**398**	**446**	**344**	**788**	**910**

Appendix Table 2.--Continued.

	SUBYEARLING CHINOOK SALMON									
Test Date	**20 July**	**21 July**	**22 July**	**23 July**	**24 July**	**28 July**	**29 July**	**30 July**	**31 July**	**1 Aug**
Gatewell	23	27	23	27	17	16	18	14	9	22
1st Level	33	54	66	75	30	9	33	24	27	24
2nd Level	96	60	48	63	69	18	30	39	21	54
3rd Level	93	69	90	120	72	30	30	21	24	54
4th Level	105	69	81	96	78	21	45	42	27	39
5th Level	135	93	39	123	51	30	51	36	12	54
6th Level	81	81	42	45	66	21	18	27	18	15
7th Level	45	24	21	21	18	6	9	3	6	12
Totals	**611**	**477**	**410**	**570**	**401**	**151**	**234**	**206**	**144**	**274**

Appendix Table 3.--Weekly summaries of juvenile salmonid catch data for the Second Powerhouse collection facility, Bonneville Dam, 1987. "1" = yearling chinook, "0" = subyearling chinook.

WEEK NO 1	STARTED 03/09/87		ENDED 03/13/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	8	9	5	1	0
Mortality:					
No. dead	0	0	1	0	
%	0.0	0.0	20.0	0.0	
Descaling:					
no. exam	8	9	5	1	
%	0.0	0.0	0.0	0.0	

WEEK NO 2	STARTED 03/16/87		ENDED 03/20/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	10	25	3	4	3
Mortality:					
No. dead	0	0	0	0	0
%	0.0	0.0	0.0	0.0	0.0
Descaling:					
no. exam	10	25	3	4	3
%	0.0	0.0	0.0	0.0	0.0

WEEK NO 3	STARTED 03/23/87		ENDED 03/27/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	29	242	8	3	1
Mortality:					
No. dead	0	0	0	0	0
%	0.0	0.0	0.0	0.0	0.0
Descaling:					
no. exam	29	242	8	3	1
%	0.0	0.0	0.0	0.0	0.0

WEEK NO 4	STARTED 03/30/87		ENDED 04/03/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	22	0	0	0
Mortality:					
No. dead		0			
%		0.0			
Descaling:					
no. exam		22			
%		0.0			

Appendix Table 3.--cont.

WEEK NO 5	STARTED 04/06/87		ENDED 04/11/87	HOURS 120.	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	4	11	1	0	1
Mortality:					
No. dead	1	0	0		0
%	25.0	0.0	0.0		0.0
Descaling:					
no. exam	3	11	1		1
%	0.0	0.0	0.0		0.0

WEEK NO 6	STARTED 04/12/87		ENDED 04/17/87	HOURS 120.	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	1510	299	5	6	63
Mortality:					
No. dead	18	9	0	0	0
%	1.2	3.0	0.0	0.0	0.0
Descaling:					
no. exam	1496	297	5	6	63
%	1.7	0.3	0.0	0.0	0.0

WEEK NO 7	STARTED 04/20/87		ENDED 04/24/87	HOURS 96.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	768	436	9	0	11
Mortality:					
No. dead	4	4	0		0
%	0.5	0.9	0.0		0.0
Descaling:					
no. exam	711	435	9		11
%	1.3	0.0	0.0		0.0

WEEK NO 8	STARTED 04/27/87		ENDED 05/01/87	HOURS 96.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	1057	130	176	2	86
Mortality:					
No. dead	25	0	1	0	0
%	2.4	0.0	0.6	0.0	0.0
Descaling:					
no. exam	798	130	175	2	86
%	7.1	0.8	8.0	50.0	3.5

Appendix Table 3.--cont.

WEEK NO 9	STARTED 05/04/87		ENDED 05/08/87	HOURS	96.0
	"1"	"0"			
	CHIN	CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	1088	172	1365	3	160
Mortality:					
No. dead	13	3	5	1	2
%	1.2	1.7	0.4	33.3	1.2
Descaling:					
no. exam	460	170	545	2	158
%	7.4	4.7	2.9	50.0	1.3

WEEK NO 10	STARTED 05/11/87		ENDED 05/15/87	HOURS	96.0
	"1"	"0"			
	CHIN	CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	696	331	1281	57	168
Mortality:					
No. dead	10	5	11	13	4
%	1.4	1.5	0.9	22.8	2.4
Descaling:					
no. exam	361	317	425	44	164
%	14.1	1.6	6.1	13.6	7.3

WEEK NO 11	STARTED 05/19/87		ENDED 05/22/87	HOURS	96.0
	"1"	"0"			
	CHIN	CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	1142	357	549	222	238
Mortality:					
No. dead	19	5	5	37	4
%	1.7	1.4	0.9	16.7	1.7
Descaling:					
no. exam	361	331	348	206	234
%	13.0	1.2	2.9	14.1	2.6

WEEK NO 12	STARTED 05/26/87		ENDED 05/29/87	HOURS	72.0
	"1"	"0"			
	CHIN	CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	77	491	236	67	32
Mortality:					
No. dead	1	12	2	8	0
%	1.3	2.4	0.8	11.9	0.0
Descaling:					
no. exam	76	281	234	60	32
%	21.1	1.4	1.7	15.0	3.1

Appendix Table 3.--cont.

WEEK NO 13	STARTED 06/01/87		ENDED 06/05/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	78	693	257	263	51
Mortality:					
No. dead	1	21	1	41	0
%	1.3	3.0	0.4	15.6	0.0
Descaling:					
no. exam	77	458	256	222	51
%	18.2	4.8	7.8	30.2	13.7

WEEK NO 14	STARTED 06/08/87		ENDED 06/12/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	4	130	46	12	1
Mortality:					
No. dead	2	1	0	0	1
%	50.0	0.8	0.0	0.0	100.0
Descaling:					
no. exam	2	129	46	12	0
%	50.0	3.9	17.4	50.0	

WEEK NO 15	STARTED 06/15/87		ENDED 06/19/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	1	41	11	0	0
Mortality:					
No. dead	0	1	0		
%	0.0	2.4	0.0		
Descaling:					
no. exam	1	41	11		
%	0.0	2.4	9.1		

WEEK NO 16	STARTED 06/22/87		ENDED 06/26/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	1	146	3	0	1
Mortality:					
No. dead	1	7	1		0
%	100.0	4.8	33.3		0.0
Descaling:					
no. exam	0	139	2		1
%		1.4	0.0		0.0

Appendix Table 3.--cont.

WEEK NO 17	STARTED 06/30/87		ENDED 07/02/87	HOURS 44.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	233	9	0	0
Mortality:					
No. dead		5	0		
%		2.1	0.0		
Descaling:					
no. exam		228	9		
%		0.9	0.0		

WEEK NO 18	STARTED 07/07/87		ENDED 07/10/87	HOURS 66.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	2	200	3	0	0
Mortality:					
No. dead	0	2	0		
%	0.0	1.0	0.0		
Descaling:					
no. exam	2	196	3		
%	0.0	0.5	0.0		

WEEK NO 19	STARTED 07/13/87		ENDED 07/17/87	HOURS 96.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	8	316	3	0	1
Mortality:					
No. dead	1	5	0		1
%	12.5	1.6	0.0		100.0
Descaling:					
no. exam	8	314	3		0
%	0.0	2.5	33.3		

WEEK NO 20	STARTED 07/20/87		ENDED 07/24/87	HOURS 96.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	13	239	3	0	1
Mortality:					
No. dead	0	1	1		0
%	0.0	0.4	33.3		0.0
Descaling:					
no. exam	13	238	2		1
%	0.0	0.8	0.0		0.0

Appendix Table 3.--cont.

WEEK NO 21	STARTED 07/27/87		ENDED 07/31/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	10	41	1	0	2
Mortality:					
No. dead	0	1	0		0
%	0.0	2.4	0.0		0.0
Descaling:					
no. exam	10	40	1		2
%	0.0	0.0	0.0		0.0

WEEK NO 22	STARTED 08/04/87		ENDED 08/07/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	32	0	0	0
Mortality:					
No. dead		1			
%		3.1			
Descaling:					
no. exam		31			
%		12.9			

WEEK NO 23	STARTED 08/10/87		ENDED 08/14/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	3	0	0	0
Mortality:					
No. dead		0			
%		0.0			
Descaling:					
no. exam		3			
%		0.0			

WEEK NO 24	STARTED 08/17/87		ENDED 08/21/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	2	0	0	0
Mortality:					
No. dead		0			
%		0.0			
Descaling:					
no. exam		2			
%		0.0			

Appendix Table 3.--cont.

WEEK NO 25	STARTED 08/24/87		ENDED 08/28/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	18	0	0	0
Mortality:					
No. dead		1			
%		5.6			
Descaling:					
no. exam		17			
%		5.9			

WEEK NO 26	STARTED 08/31/87		ENDED 09/04/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	34	0	0	0
Mortality:					
No. dead		0			
%		0.0			
Descaling:					
no. exam		34			
%		5.9			

WEEK NO 27	STARTED 09/09/87		ENDED 09/11/87		HOURS 72.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	21	1	1	0
Mortality:					
No. dead		1	0	0	
%		4.8	0.0	0.0	
Descaling:					
no. exam		20	1	1	
%		15.0	0.0	0.0	

WEEK NO 28	STARTED 09/14/87		ENDED 09/18/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	27	0	1	0
Mortality:					
No. dead		1		0	
%		3.7		0.0	
Descaling:					
no. exam		26		1	
%					

Appendix Table 3.--cont.

WEEK NO 29	STARTED 09/21/87		ENDED 09/25/87	HOURS 96.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	51	1	0	0
Mortality:					
No. dead		0	0		
%		0.0	0.0		
Descaling:					
no. exam		51	1		
%		9.8	0.0		

WEEK NO 30	STARTED 09/27/87		ENDED 10/02/87	HOURS 96.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	11	1	0	0
Mortality:					
No. dead		0	0		
%		0.0	0.0		
Descaling:					
no. exam		11	1		
%		36.4	0.0		

WEEK NO 31	STARTED 10/05/87		ENDED 10/07/87	HOURS 48.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	37	2	0	0
Mortality:					
No. dead		0	0		
%		0.0	0.0		
Descaling:					
no. exam		37	2		
%		13.5	0.0		

WEEK NO 32	STARTED 10/13/87		ENDED 10/16/87	HOURS 72.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	132	0	0	1
Mortality:					
No. dead		1			0
%		0.8			0.0
Descaling:					
no. exam		113			1
%		10.6			0.0

Appendix Table 3.--cont.

WEEK NO 33	STARTED 10/19/87		ENDED 10/23/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	93	6	1	2
Mortality:					
No. dead		1	0	0	0
%		1.1	0.0	0.0	0.0
Descaling:					
no. exam		92	6	1	2
%		9.8	0.0	0.0	0.0

WEEK NO 34	STARTED 10/26/87		ENDED 10/30/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	95	0	0	0
Mortality:					
No. dead		2			
%		2.1			
Descaling:					
no. exam		93			
%		0.0			

WEEK NO 35	STARTED 11/02/87		ENDED 11/06/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	1	72	3	0	2
Mortality:					
No. dead	0	4	0		0
%	0.0	5.6	0.0		0.0
Descaling:					
no. exam	1	68	3		2
%	0.0	4.4	0.0		0.0

WEEK NO 36	STARTED 11/09/87		ENDED 11/13/87		HOURS 96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	95	0	0	0
Mortality:					
No. dead		2			
%		2.1			
Descaling:					
no. exam		93			
%		6.5			

Appendix Table 3.--cont

WEEK NO 37	STARTED 11/16/88		ENDED 11/20/87	HOURS	96.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	1	116	5	0	0
Mortality:					
No. dead	0	2	0		
%	0.0	1.7	0.0		
Descaling:					
no. exam	1	114	5		
%	0.0	7.0	0.0		

Appendix Table 4.--Weekly summaries of juvenile salmonid catch data for the First Powerhouse collection facility, Bonneville Dam, 1987. "1" = yearling chinook, "0" = subyearling chinook.

WEEK NO. 1	STARTED 03/13/87		ENDED 03/13/87	HOURS 2.7	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	4	2	0	1
Mortality:					
No. dead		0	0		1
%		0.0	0.0		100.0
Descaling:					
no. exam		4	2		0
%		0.0	0.0		

WEEK NO. 2	STARTED 03/16/87		ENDED 03/20/87	HOURS 5.5	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	32	14156	22	11	5
Mortality:					
No. dead	0	20	0	0	0
%	0.0	0.1	0.0	0.0	0.0
Descaling:					
no. exam	32	112	22	11	5
%	0.0	0.9	0.0	0.0	0.0

WEEK NO. 3	STARTED 03/25/87		ENDED 03/27/87	HOURS 9.8	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	34	269	3	1	13
Mortality:					
No. dead	0	8	1	0	0
%	0.0	3.0	33.3	0.0	0.0
Descaling:					
no. exam	34	269	2	1	13
%	2.9	0.0	0.0	0.0	0.0

WEEK NO. 4	STARTED 03/30/87		ENDED 04/03/87	HOURS 24.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	102	285	38	16	64
Mortality:					
No. dead	0	0	0	0	0
%	0.0	0.0	0.0	0.0	0.0
Descaling:					
no. exam	38	134	13	3	22
%	2.6	0.0	0.0	0.0	0.0

Appendix Table 4.--cont.

WEEK NO. 5	STARTED 04/06/87		ENDED 04/11/87	HOURS 26.7	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	259	140	74	51	186
Mortality:					
No. dead	0	1	0	0	0
%	0.0	0.7	0.0	0.0	0.0
Descaling:					
no. exam	143	75	54	34	96
%	2.8	1.3	3.7	17.6	4.2

WEEK NO. 6	STARTED 04/12/87		ENDED 04/17/87	HOURS 27.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	11189	1602	256	150	965
Mortality:					
No. dead	1	29	0	0	0
%	0.0	1.8	0.0	0.0	0.0
Descaling:					
no. exam	691	278	48	39	290
%	2.5	0.4	2.1	5.1	2.1

WEEK NO. 7	STARTED 04/20/87		ENDED 04/24/87	HOURS 17.9	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	10922	2311	612	21	865
Mortality:					
No. dead	36	27	1	0	0
%	0.3	1.2	0.2	0.0	0.0
Descaling:					
no. exam	500	489	297	9	397
%	3.0	0.2	3.7	22.2	2.3

WEEK NO. 8	STARTED 04/27/87		ENDED 05/01/87	HOURS 23.9	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	10659	629	1647	12	1641
Mortality:					
No. dead	4	1	0	0	0
%	0.0	0.2	0.0	0.0	0.0
Descaling:					
no. exam	500	354	446	4	463
%	3.0	0.3	0.4	0.0	1.1

Appendix Table 4.--cont.

WEEK NO. 9	STARTED 05/04/87		ENDED 05/08/87	HOURS	15.7
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	9119	792	15233	137	4750
Mortality:					
No. dead	1	2	3	0	0
%	0.0	0.3	0.0	0.0	0.0
Descaling:					
no. exam	1500	341	400	39	400
%	0.9	0.3	2.2	10.3	2.2

WEEK NO. 10	STARTED 05/11/87		ENDED 05/15/87	HOURS	11.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	11231	3003	15144	1546	4763
Mortality:					
No. dead	11	15	5	0	0
%	0.1	0.5	0.0	0.0	0.0
Descaling:					
no. exam	500	500	500	482	500
%	4.8	0.8	2.8	16.2	6.0

WEEK NO. 11	STARTED 06/01/87		ENDED 06/05/87	HOURS	20.7
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	2163	13249	4811	5505	2550
Mortality:					
No. dead	3	15	1	18	0
%	0.1	0.1	0.0	0.3	0.0
Descaling:					
no. exam	500	520	500	500	500
%	7.2	3.8	4.6	38.4	7.0

WEEK NO. 12	STARTED 06/08/87		ENDED 06/11/87	HOURS	14.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	496	8979	1657	781	668
Mortality:					
No. dead	0	5	0	2	0
%	0.0	0.1	0.0	0.3	0.0
Descaling:					
no. exam	250	400	316	275	283
%	8.8	2.7	3.8	26.2	5.3

Appendix Table 4.--cont.

WEEK NO. 13	STARTED 06/19/87		ENDED 06/19/87	HOURS	2.7
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	76	474	84	8	29
Mortality:					
No. dead	0	8	0	0	1
%	0.0	1.7	0.0	0.0	3.4
Descaling:					
no. exam	76	100	84	8	28
%	31.6	5.0	9.5	50.0	10.7

WEEK NO. 14	STARTED 06/22/87		ENDED 06/26/87	HOURS	26.1
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	302	12905	306	15	67
Mortality:					
No. dead	7	164	0	0	2
%	2.3	1.3	0.0	0.0	3.0
Descaling:					
no. exam	91	500	179	12	40
%	9.9	3.4	5.6	8.3	20.0

WEEK NO. 15	STARTED 06/29/87		ENDED 07/03/87	HOURS	10.4
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	78	21774	85	1	18
Mortality:					
No. dead	2	2708	0	0	0
%	2.6	12.4	0.0	0.0	0.0
Descaling:					
no. exam	35	500	67	1	12
%	2.9	1.4	3.0	0.0	8.3

WEEK NO. 16	STARTED 08/31/87		ENDED 09/04/87	HOURS	22.8
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	383	5	0	0
Mortality:					
No. dead		1	0		
%		0.3	0.0		
Descaling:					
no. exam		129	3		
%		3.1	0.0		

Appendix Table 4.--cont.

WEEK NO. 17	STARTED 09/08/87		ENDED 09/11/87	HOURS	20.8
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	370	0	0	0
Mortality:					
No. dead		0			
%		0.0			
Descaling:					
no. exam		272			
%		5.1			

WEEK NO. 18	STARTED 09/14/87		ENDED 09/18/87	HOURS	24.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	671	5	0	2
Mortality:					
No. dead		1	0		0
%		0.1	0.0		0.0
Descaling:					
no. exam		341	4		0
%		9.1	0.0		

WEEK NO. 19	STARTED 09/21/87		ENDED 09/25/87	HOURS	24.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	216	2	0	0
Mortality:					
No. dead		0	0		
%		0.0	0.0		
Descaling:					
no. exam		131	1		
%		6.9	0.0		

WEEK NO. 20	STARTED 09/28/87		ENDED 10/02/87	HOURS	23.4
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	1	451	5	0	2
Mortality:					
No. dead		1	0		0
%	0.0	0.2	0.0		0.0
Descaling:					
no. exam	1	293	5		2
%	0.0	11.3	0.0		0.0

Appendix Table 4.--cont.

WEEK NO. 21	STARTED 10/05/87		ENDED 10/09/87	HOURS 24.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	716	1	0	0
Mortality:					
No. dead		2	0		
%		0.3	0.0		
Descaling:					
no. exam		380	1		
%		7.9	0.0		

WEEK NO. 22	STARTED 10/13/87		ENDED 10/16/87	HOURS 21.4	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	618	4	0	3
Mortality:					
No. dead		3	0		0
%		0.5	0.0		0.0
Descaling:					
no. exam		272	2		1
%		8.1	0.0		0.0

WEEK NO. 23	STARTED 10/19/87		ENDED 10/23/87	HOURS 24.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	451	9	0	3
Mortality:					
No. dead		1	0		0
%		0.2	0.0		0.0
Descaling:					
no. exam		230	5		2
%		8.3	0.0		0.0

WEEK NO. 24	STARTED 10/26/87		ENDED 10/30/87	HOURS 24.0	
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	1	218	1	0	0
Mortality:					
No. dead	0	0	0		
%	0.0	0.0	0.0		
Descaling:					
no. exam	1	140	1		
%	0.0	5.0	0.0		

Appendix Table 4.--cont.

WEEK NO. 25	STARTED 11/02/87		ENDED 11/06/87	HOURS	24.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	173	0	0	0
Mortality:					
No. dead		0			
%		0.0			
Descaling:					
no. exam		88			
%		4.5			

WEEK NO. 26	STARTED 11/09/87		ENDED 11/13/87	HOURS	24.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	133	0	0	1
Mortality:					
No. dead		0			0
%		0.0			0.0
Descaling:					
no. exam		58			1
%		5.2			0.0

WEEK NO. 27	STARTED 11/16/87		ENDED 11/20/87	HOURS	24.0
	"1" CHIN	"0" CHIN	COHO	SOCKEYE	STEELHEAD
No.Captured	0	28	1	0	0
Mortality:					
No. dead		0	0		
%		0.0	0.0		
Descaling:					
no. exam		13	1		
%		7.7	0.0		

Appendix Table 5.--Collection data for juvenile salmonids at Bonneville Dam First Powerhouse, 1987.

			Chinook Subyearlings		Chinook Yearlings		Coho		Sockeye		Steelhead	
Date	Start Sample	Length of Sample (Minutes)	# Cap.	Expnd Total	# Cap.	Expnd Total	#Cap.	Expnd Total	# Cap.	Expnd Total	# Cap.	Expnd Total
03-13	0820	20									1	3
	0920	20										
	1020	20										
	1120	20					1	3				
	1220	20	1	3								
	1320	20	1	3								
	1420	20	1	3			1	3				
	1520	20	1	3								
Expanded Totals				12				6				3
03-16	1225	20			1	3						
	1400	30	2	4	1	2						
Expanded Totals				4		5						
03-17	1420	20					2	6				
	1520	20	1	3								
Expanded Totals				3				6				
03-18	1400	20							1	3		
	1500	20							2	6		
Expanded Totals		20								9		
03-19	0820	20			3	9			3	9		
	0920	20	1	3	2	6	4	12				
	1020	20	3	9			4	12				
	1120	20	2	6	1	3	1	3	1	3		
	1220	20	2	6	1	3	1	3			1	3
	1320	20	1	3	1	3	1	3			2	6
	1420	20			1	3	2	6				
	1520	20			3	9	1	3				
Expanded Totals				27		36		42		12		9
03-20	0820	10	4839	29034	6	36	2	12	1	6	1	6
	0920	3.5	1247	21377	1	17	2	34	1	17		
	1030	3	1261	25220	1	20	1	20				
	1130	3	952	19040	1	20						
	1230	3	749	14980	1	20			1	20	1	20
	1300	3	740	14800	2	40						
	1330 1/	3.5	247	17280								
	1400	3	1530	30600	2	40	1	20				
	1430	3	655	13100	2	40			1	20		
	1500	3	641	12820								
	1530	3	522	10440	2	40						
Expanded Totals		3		208691		273		86		63		26

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
03-25	0920	20	11	33								
	1020	20	16	48								
	1120	20	12	36	2	6						
	1220	20	8	24							1	3
	1320	20	17	51	1	3					1	3
	1425	20	7	21								
Expanded Totals				213		9						6
03-26	0805	10	4	24								
	0837	60	37	37	4	4	1	1				
	0944 1/	60	9	27	1	3					1	3
	1050	120	59	30	13	6					5	3
	1340	20	17	51	2	6			1	3	3	9
	1500	20	6	18								
	1540	20	1	3	3	9					2	6
Expanded Totals				190		28		1		3		21
03-27	0820	20	5	15	1	3						
	0920	20	4	12	1	3						
	1020	20	6	18								
	1120	20	6	18	2	6						
	1220	20	3	9			1	3				
	1320	20	7	21	2	6	1	3				
	1420	20	5	15	2	6						
	1520	20	2	6								
Expanded Totals				114		24		6				
03-30	0830	20	2	6	1	3	1	3			4	12
	0920	20	4	12	1	3					1	3
	1020	20	11	33	1	3						
	1120	20	10	30	4	12					1	3
	1220	20	4	12	1	3					1	3
	1320	20	6	18			1	3				
	1420	20	4	12								
	1520	20	2	6	2	6					2	6
Expanded Totals				129		30		6				27
03-31	0820	20	5	15								
	0923	20	5	15							1	3
	1020	20	3	9								
	1120	20	3	9	1	3						
	1220	20	3	9							2	6
	1320	20	1	3	2	6						
	1420	20	5	15								
	1520	20	5	15	1	3	1	3				

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
03-31	1620	20	4	12	1	3						
	1720	20	1	3								
	1820	20	1	3					1	3		
	1920	20	6	18	6	18	3	9	5	15	2	6
	2020	20	2	6	1	3					2	6
	2120	20	7	21	1	3			1	3		
	2220	20	2	6								
	2320	20	5	15							3	9
	0020	20	7	21	1	3			1	3	1	3
	0120	20	3	9					1	3		
	0220	20	5	15	3	9					1	3
	0320	20	6	18	3	9	1	3				
	0420	20	5	15	2	6						
	0520	20	15	45	1	3						
	0620	20	6	18			1	3				
	0720	20	5	15							1	3
Expanded Totals				330		69		18		27		39
04-01	0820	20	3	9								
	0920	20	3	9	1	3					1	3
	1020	20	1	3	1	3						
	1120	20	3	9								
	1220	20	1	3								
	1320	20	6	18			1	3				
	1420	20	3	9			1	3				
	1520	20	1	3	3	9			1	3		
Expanded Totals				63		15		6		3		3
04-02	0820	20	3	9	1	3						
	0920	20	1	3	2	6	1	3				
	1020	20	2	6			1	3				
	1120	20	1	3								
	1220	20	3	9	2	6	1	3	1	3	1	3
	1320	20	3	9	2	6	1	3			1	3
	1420	20	2	6			1	3				
	1520	20	5	15								
	1620	20	2	6								
	1720	20	1	3			3	9				
	1820	20	3	9	1	3	1	3	1	3		
	1920	20	7	21	7	21	12	36	3	9	6	18
	2020	20	4	12	4	12					1	3
	2100	20	4	12							2	6
	2200	20	4	12	3	9	1	3			5	15
	2300	20	5	15	2	6	2	6			3	9

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
04-02	0020	20	6	18	6	18			1	3	3	9
	0140	20	1	3	2	6					3	9
	0220	20	2	6	1	3	1	3			2	6
	0320	20	4	12	2	6	1	3			3	9
	0420	20	10	30	1	3						
	0520	20	4	12	1	3						
	0620	20	7	21	1	3					3	9
	0720	20	7	21							1	3
Expanded Totals				273		114		78		18		102
04-03	0820	20	1	3			1	3				
	0920	20	4	12	4	12					1	3
	1020	20	1	3	1	3	1	3			1	3
	1120	20	5	15	2	6						
	1220	20	4	12	2	6					2	6
	1320	20	2	6	3	9					1	3
	1415	20	1	3								
	1515	20	2	6							1	3
Expanded Totals				60		36		6				18
04-06	0820	20	1	3	1	3						
	0920	20									1	3
	1020	20	3	9	2	6	1	3				
	1120	20	1	3								
	1220	20	4	12								
	1320	20	1	3	2	6					1	3
	1420	20	2	6	1	3					2	6
	1520	20	3	9			1	3	1	3	5	15
Expanded Totals				45		18		6		3		27
04-07	0820	20	4	12	1	3			1	3		
	0920	20	1	3			3	9				
	1020	20	3	9								
	1120	20	3	9	3	9	1	3	1	3	3	9
	1220	20	1	3	5	15					1	3
	1320	20	1	3	3	9					2	6
	1420	20	3	9	4	12	1	3				
	1520	20			8	24	1	3	3	9	1	3
	1620	20			2	6						
	1720	20	1	3	1	3	2	6				
	1820	20	1	3	1	3						
	1920	20	2	6	5	15	2	6	2	6	1	3
	2020	20	5	15	18	54			1	3	11	33
	2120	20	4	12	5	15			2	6	5	15
	2220	20	1	3	3	9	1	3			1	3
	2320	20			11	33	1	3			1	3

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
04-07	0020	20			5	15	2	6				
	0120	20	5	15	4	12					3	9
	0220	20			3	9	2	6	1	3	1	3
	0320	20	4	12	5	15	3	9			2	6
	0420	20	2	6	5	15	1	3	2	6	2	6
	0520	20	2	6	1	3	3	9			2	6
	0620	20	6	18	2	6	7	21			2	6
	0720	20	3	9							2	6
Expanded Totals				156		285		90		39		120
04-08	0820	20	2	6	1	3	1	3			1	3
	0920	20	3	9			1	3				
	1020	20			1	3	2	6				
	1120	20	2	6	2	6						
	1220	20			1	3	1	3			2	6
	1320	20	2	6	4	12	1	3			2	6
	1420	20	2	6	1	3					1	3
	1520	20	2	6	2	6					1	3
Expanded Totals				39		36		18				21
04-09	0820	20			1	3						
	0920	20	1	3	3	9	2	6			2	6
	1020	20			2	6			1	3	1	3
	1120	20	1	3							1	3
	1220	20			2	6			1	3	1	3
	1320	20	1	3							2	6
	1420	20	3	9	2	6	1	3	2	6	2	6
	1520	20	3	9	4	12	1	3			4	12
	1620	20			4	12					2	6
	1720	20	1	3	5	15	1	3			2	6
	1820	20			1	3					2	6
	1920	20	2	6	17	51	9	27	10	30	15	45
	2020	20	10	30	25	75	3	9	4	12	26	78
	2120	20	1	3	4	12	3	9	2	6	4	12
	2220	20			2	6			1	3	7	21
	2320	20	2	6	5	15	1	3	1	3	3	9
	0020	20	1	3	2	6					3	9
	0120	20	1	3	3	9					3	9
	0220	20	1	3	2	6	2	6	1	3	3	9
	0320	20	3	9	2	6	1	3				
	0420	20	1	3	2	6	3	9			1	3
	0520	20	3	9	3	9	1	3			3	9
	0620	20	4	12	1	3	1	3			2	6
	0720	20	2	6	4	12					2	6
Expanded Totals				123		288		87		69		273

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
04-10	0820	20			2	6			2	6	1	3
	0920	20			1	3			1	3		
	1020	20	2	6	2	6			2	6	4	12
	1120	20	2	6	2	6			1	3	1	3
	1220	20	4	12	1	3	1	3	1	3	2	6
	1320	20	1	3	4	12	1	3			3	9
	1420	20	2	6	2	6	1	3			2	6
	1520	20	3	9	4	12	1	3	1	3	1	3
Expanded Totals				42		54		12		24		42
04-11	0840	20			2	6					1	3
	0920	20			5	15					3	9
	1020	20	2	6	2	6			2	6		
	1120	20			5	15					4	12
	1220	20			5	15			2	6	3	9
	1320	20	1	3	8	24					7	21
	1420	20	1	3	5	15	1	3			5	15
	1520	20	1	3	10	30	1	3			1	3
Expanded Totals				15		126		6		12		72
04-12	0820	20	4	12	16	48					2	6
	0920	20	1	3	13	39					1	3
	1020	20	2	6	16	48					4	12
	1120	20	5	15	12	36			1	3	3	9
	1220	20	2	6	13	39					10	30
	1320	20			22	66	1	3	1	3	8	24
	1420	20	3	9	15	45					6	18
	1520	20			24	72					4	12
	1620	20	2	6	23	69	1	3			8	24
	1720	20	1	3	10	30	1	3			4	12
	1820	20			14	42					5	15
	1920	20			13	39			1	3		
Expanded Totals				60		573		9		9		165
04-13	0820	20	5	15	18	54	1	3			4	12
	0920	20	4	12	25	75					4	12
	1020	20	4	12	13	39			2	6	4	12
	1120	20	5	15	25	75			1	3		
	1220	20	8	24	18	54					3	9
	1320	20	6	18	21	63			1	3	3	9
	1420	20	6	18	33	99					5	15
	1520	20	4	12	37	111			1	3	5	15
Expanded Totals				126		570		3		15		84

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
04-14	0820	20	14	42	25	75					5	15
	0920	20	12	36	24	72	2	6			2	6
	1020	20	6	18	21	63			1	3	5	15
	1120	20	8	24	22	66					2	6
	1220	20	4	12	32	96	1	3			6	18
	1320	20	6	18	45	135			1	3	2	6
	1420	20	3	9	39	117			2	6	5	15
	1520	20	9	27	43	129	2	6	1	3	2	6
	1620	20	5	15	27	81			1	3		
	1720	20	3	9	38	114	1	3			3	9
	1820	20	15	45	10	30			1	3	6	18
	1920	20	8	24	132	396	1	3	1	3	13	39
	2020	20	104	312	1203	3609	29	87	44	132	126	378
	2120	20	12	36	408	1224	4	12	8	24	35	105
	2220	20	7	21	251	753	1	3	3	9	20	60
	2320	20	18	54	268	804	3	9	1	3	26	78
	0020	20	14	42	143	429			1	3	15	45
	0120	20	20	60	172	516	1	3			15	45
	0220	20	13	39	145	435	3	9			14	42
	0320	20	22	66	156	468	5	15			27	81
	0420	20	21	63	160	480	1	3	3	9	12	36
	0520	20	26	78	161	483	4	12	1	3	15	45
	0620	20	20	60	88	264	2	6	1	3	17	51
	0720	20	5	15	57	171	2	6			3	9
Expanded Totals				1125		11010		186		210		1128
04-15	0820	20	10	30	44	132					1	3
	0920	20	6	18	237	711	3	9			10	30
	1020	20	2	6	61	183	1	3	1	3	3	9
	1120	20	2	6	86	258	2	6	4	12	1	3
	1220	20	5	15	61	183	3	9	1	3	4	12
	1320	20	1	3	38	114	1	3			7	21
	1420	20	4	12	49	147			1	3	3	9
	1520	20	2	6	36	108	1	3			7	21
Expanded Totals				96		1836		33		21		108
04-16	0820	20	1	3	102	309					1	3
	0920	20	2	6	51	153					4	12
	1020	20	3	9	57	171	1	3	1	3	2	6
	1120	20			44	132	3	9			2	6
	1220	20	2	6	63	189					5	15
	1320	20	7	21	87	261					6	18
	1420	20	1	3	111	333	2	6	2	6	10	30
	1520	20	6	18	87	261	2	6	1	3	3	9

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
04-16	1620	20	2	6	74	222	1	3	2	6	7	21
	1720	20	2	6	57	171	1	3	1	3	10	30
	1820	20	12	36	176	528	1	3	3	9	24	72
	1920	15	4	16	280	1120	3	12	4	16	7	28
	2020	10	23	138	510	3060	21	126	10	60	68	408
	2120	10	6	36	266	1596	12	72	3	18	40	240
	2220	10	8	48	150	900	6	36	1	6	10	60
	2320	20	7	21	297	891	23	69	2	6	28	84
	0020	20	18	54	191	573	7	21	3	9	23	138
	0120	20	22	66	239	717	10	30	3	9	25	75
	0220	20	26	78	283	849	6	18	2	6	11	33
	0320	20	25	75	344	1032	4	12	1	3	25	75
	0420	20	39	117	638	1914	31	93	2	6	26	78
	0520	10	16	96	505	3030	13	78	6	36	14	84
	0620	10	13	78	305	1830	9	35	1	6	6	36
	0720	15	10	40	181	724	3	12	2	8	4	16
Expanded Totals				977		20966		647		219		1577
04-17	0820	20	11	33	133	399	3	9	3	9	11	33
	0920	20	8	24	80	240	3	9	3	9	10	30
	1020	20	25	75	90	270			1	3	11	33
	1120	20	40	120	175	525	4	12	1	3	9	27
	1220	20	91	273	183	549	2	6	1	3	14	42
	1320	20	203	609	222	666	3	9	1	3	23	69
	1420	20	210	630	235	705	2	6	1	3	19	57
	1520	20	290	870	310	930	3	9	4	12	12	36
Expanded Totals				2634		4284		60		45		327
04-20	0820	5	296	3552	717	8604	7	84			9	108
	0920	10	119	714	145	870	5	30	1	6	4	24
	1020	20	178	534	288	864	15	45	2	6	21	64
	1120	20	224	672	545	1632	11	33	1	3	44	132
	1440 1/	20	57	479	38	361	1	15			1	16
	1520 1/	20	69	580	208	1995	7	105	1	28	6	96
Expanded Totals				6531		14326		312		43		440
04-21	0820 1/	20	100	840	169	1605	1	15			3	47
	0920 1/	20	55	462	185	1757	1	15				
	1020 1/	20	74	622	106	1007					6	94
	1120 1/	20	46	386	85	807					6	78
	1220 1/	20	62	521	69	655	5	74	1	29	3	47
	1320 1/	20	67	563	104	988	4	59			2	31
	1420 1/	20	42	353	112	1064	2	30	1	29	9	141
	1520 1/	20	46	386	121	1150	4	59			5	78
Expanded Totals				4133		9033		252		58		516

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
04-22	0820	No Sample										
	0920	No Sample										
	1020 2/	20	44	416	343	3014	18	135			14	102
	1120	20	33	312	302	2654	11	83	1	7	11	80
	1220	20	24	227	113	993	3	22			10	73
	1320	20	39	369	142	1248	8	60			19	139
	1420	20	35	331	155	1362	12	90	1	7	18	132
	1520	20	31	293	200	1758	9	68			14	102
Expanded Totals				1948		11029		458		14		628
04-23	0820 2/	20	22	208	87	764	12	90			8	58
	0920	20	24	226	278	2443	8	60			25	187
	1020	20	14	132	104	914					7	51
	1120	20	18	170	76	668	4	30			6	44
	1220	20	21	198	97	852	6	45	1	7	11	81
	1320	20	19	179	137	1204	17	128			15	110
	1420	20	23	217	135	1187	10	75			11	80
	1520	20	17	161	290	2549	6	45			21	154
	1620	20	17	161	24	210	11	83			8	59
	1720	20	3	28	123	1081	8	60			9	66
	1820	20	8	76	49	431	7	53			8	59
	1920	20	3	28	114	1002	18	135			14	102
	2020	20	33	312	487	4281	12	90	2	13	117	856
	2120	10	12	227	236	4149	4	60			38	556
	2220	15	7	88	227	2660	13	131	1	9	24	234
	2320	20	9	85	290	2549	23	173	1	7	19	139
	0020	20	19	179	563	4949	54	407	3	20	20	35
	0120	15	8	101	279	3270	27	271			14	137
	0220	20	22	208	359	3155	27	203			15	110
	0320	20	24	227	343	3015	21	158	2	13	23	168
	0420	20	17	161	312	2742	19	143	1	7	16	117
	0520	20	17	161	350	3076	23	173			16	117
	0620	20	11	104	104	914	10	15			3	22
	0720	20	14	132	148	1301	14	105	2	13	12	88
Expanded Totals				3769		49366		2733		89		3630
04-24	0820 2/	20	11	104	80	703	10	75			9	66
	0920	20	8	76	81	712	8	60			14	102
	1020	20	11	104	135	1187	8	60			19	139
	1120	20	16	151	130	1142	11	83			13	95
	1220	20	12	113	309	2716	36	271			33	241
	1320	20	11	104	114	1002	6	45			23	168
	1420	20	8	76	137	1204	12	90			14	102
	1520	20	12	113	85	747	10	75			14	102
Expanded Totals				841		9413		759				1015

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
04-27	0820 2/	20	8	76	69	606	3	23	1	7	5	37
	0920	20	7	66	536	10	75				6	44
	1020	20	1	9	46	404	8	60			7	51
	1120	20	10	94	35	307	11	87			3	22
	1220	20	9	85	56	492	10	75			13	95
	1320	20	4	38	55	483	9	68			6	44
	1420	20	15	142	114	1002	16	120			7	51
	1520	20	5	47	78	685	13	98			8	59
Expanded Totals				557		3989		531		7		403
04-28	0820 2/	20	4	38	65	571	3	23			5	37
	0920	20	7	66	37	325	4	30			4	29
	1020	20	4	38	46	404	9	68			9	66
	1120	20	1	9	39	343	10	75			4	29
	1220	20	2	19	53	466	13	98			5	37
	1320	20	2	19	47	413	7	53	1	7	13	95
	1420	20	14	132	52	457	9	68			11	80
	1520	20	7	66	71	625	11	83			5	37
	1620	20	2	19	28	246	3	23	1	7	7	51
	1720	20	2	38	36	316	2	15			4	29
	1820	20	4	38	32	281	5	38	1	7	1	7
	1920	20	2	19	13	114	4	30				
	2020	20	10	94	58	510	8	60	1	7	38	278
	2120	20	12	113	152	1336	12	90			54	395
	2220	20	5	47	95	835	8	60	1	7	42	307
	2320	20	5	47	135	1186	15	113			17	124
	0020	20	9	85	139	1222	14	105			17	124
	0120	20	10	94	165	1450	15	113			20	146
	0220	20	11	104	187	1644	9	68			24	176
	0320	20	8	76	202	1776	6	45			13	95
	0420	20	11	104	155	1362	6	45			20	146
	0520	20	24	227	191	1697	6	45			23	168
	0620	20	4	38	74	650	8	60			8	59
	0720	20	6	57	99	870	4	30			4	29
Expanded Totals				1587		19099		1438		35		2544
04-29	0820 2/	20	8	76	98	861	16	120			23	168
	0920	20	3	28	81	712	11	87			8	58
	1020	20	2	19	69	606	13	98			19	139
	1120	20	7	66	81	712	14	105			23	168
	1220	20	4	38	63	554	11	87			32	234
	1320	20	8	76	92	809	14	105			15	110
	1420	20	9	85	97	853	9	68			16	117
	1520	20	15	142	138	1213	13	98			16	117
Expanded Totals				530		6320		768				1111

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
04-30	0820 2/	20	10	94	222	1951	21	158			27	198
	0920	20	7	66	152	1336	11	82	1	7	21	154
	1020	20	15	142	200	1758	27	203			22	161
	1102	20	11	104	184	1617	33	248			42	307
	1220	20	11	104	125	1099	17	128			32	234
	1320	20	21	198	224	1969	22	166	1	7	42	307
	1420	20	10	94	209	1837	23	173			36	263
	1520	20	13	123	253	2224	27	203			21	154
	1645	05	2	76	64	2250	3	90			8	234
	1720	20	5	47	89	782	26	196			8	58
	1820	20	6	57	80	703	22	166			12	88
	1920	20	3	28	59	519	9	68			7	51
	2020	20	18	170	218	1916	65	489			81	593
	2120	20	14	132	373	3279	52	391			67	490
	2220	20	12	113	200	1758	39	294			29	212
	2320	20	6	57	202	1776	45	339			32	234
	0020	20	8	76	226	1987	38	286	1	7	46	337
	0120	20	8	76	278	2444	54	407			35	256
	0220	20	10	95	234	2057	36	271			33	242
	0320	20	14	132	211	1855	29	218			32	234
	0420	20	11	104	296	2602	45	338			44	322
	0520	20	9	85	246	2162	57	429			26	190
	0620	20	5	47	248	2180	52	391	2	13	20	146
	0720	15	7	88	302	3539	55	552			22	215
Expanded Totals				2308		45600		6286		34		5680
05-01	0820 2/	20	10	95	142	1248	72	542			24	176
	0920	20	11	104	379	3331	75	565			67	490
	1020	20	6	57	280	2461	66	497			44	322
	1120	20	18	170	198	1740	46	346			30	220
	1220	20	13	123	268	2356	49	369			31	227
	1320	20	21	198	322	2830	60	452			35	256
	1420	20	13	123	263	2312	38	286			56	410
	1520	20	10	95	216	1899	34	256			18	132
Expanded Totals				965		18177		3313				2233
05-04	0820 2/	20	2	19	66	580	205	1544			25	183
	0920	20	4	38	108	949	184	1386			26	190
	1020	20	4	38	109	958	206	1551	1	7	25	183
	1120	20	4	38	83	730	165	1242	1	7	28	205
	1220	20	14	132	106	931	179	1348			32	234
	1320	20	14	132	122	1072	163	1227			35	256
	1420	20	12	113	129	1134	137	1032			38	278
	1520	20	10	95	95	835	125	941			31	227
Expanded Totals				605		7189		10271		14		1756

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
05-05	1620 3/	10	11	66	96	576	115	690	1	6	24	144
	1720	20	9	27	85	255	54	162	1	3	15	45
	1820	20	2	6	26	78	52	156	2	6	14	42
	1920	20	3	9	18	54	73	219	1	3	17	51
	2020	20	7	21	51	153	56	168	1	3	35	105
	2120	10	11	66	239	1434	396	2376	3	18	123	738
	2220	5	6	72	74	888	132	1584			40	480
	2320	10	14	84	177	1062	266	1596	4	24	76	456
	0020	10	17	102	155	930	254	1524	1	6	78	468
	0120	10	15	90	759	4554	818	4908	4	36	86	516
	0235	05	7	84	123	1476	141	1692	2	24	49	588
	0320	10	12	72	187	1122	233	1398			68	408
	0420	10	12	72	248	1488	208	1248			54	324
	0520	10	15	90	303	1818	201	1206	1	6	44	264
	0620	10	8	48	265	1590	97	582			20	120
	0720	10	10	60	172	1032	221	1326			63	378
	0820	20	27	81	170	510	328	984	1	3	55	165
	0930 4/	20	14	63	396	1552	217	812	1	4	52	178
	1020	20	27	81	170	510	344	1032	1	3	69	207
	1120	20	37	111	150	450	337	1011	2	6	77	231
	1220	20	27	81	138	414	379	1137	1	3	107	321
	1320	20	31	93	94	117	354	1062	2	6	103	309
	1420	20	16	48	144	432	296	888			106	318
	1520	20	26	78	148	444	268	804	2	6	85	255
Expanded Tables				1605		22939		28565		166		7111
05-07	0820	15	14	56	123	492	322	1288			95	308
	0920	20	15	45	193	579	517	1551			113	339
	1020	10	11	66	75	450	184	1104			60	360
	1120	15	13	52	143	572	494	1976	2	8	104	416
	1220	15	20	80	212	848	416	1664	1	4	123	492
	1320	15	12	48	108	432	238	952	6	24	101	404
	1420	15	10	60	64	384	171	1026	3	18	74	444
	1520	15	8	32	98	392	241	964	1	4	90	360
	1620	15	10	40	90	369	133	532	3	12	70	280
	1720	15	8	32	104	416	185	740	3	12	87	348
	1820	15	5	20	38	152	133	532	1	4	44	176
	1920	20	4	12	28	84	123	369	8	24	34	102
	2020	20	3	9	32	96	70	210	6	18	49	147
	2120	5	8	96	136	1632	336	4032	22	264	279	3348
	2220	5	2	24	119	1428	224	2688	5	60	94	1128
	2320	5	1	12	70	840	130	1560	5	60	65	780

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
05-07	0020	10	8	48	74	444	244	1464	2	12	74	444
	0120	10	17	102	77	462	203	1218	3	18	78	468
	0220	15	14	56	130	520	370	1480	5	20	125	500
	0320	10	7	42	109	654	341	2046	2	12	100	600
	0420	10	16	96	95	570	272	1632	2	12	78	468
	0520	10	13	78	86	516	157	942	2	12	56	336
	0620	10	4	24	131	786	131	786	3	18	50	300
	0720	5	8	96	115	1380	121	1452			86	1032
Expanded Totals				1226		14498		32208		616		13580
05-08	0820	20	22	66	250	750	343	1029			166	498
	0920	15	19	76	200	800	472	1888			202	808
	1020	10	14	84	80	480	228	1368	5	30	64	384
	1120	20	23	69	152	456	231	693	2	6	109	327
	1220	20	23	69	125	375	264	792	3	9	85	255
	1320	20	7	21	151	453	207	621			84	252
	1420	20	18	54	221	663	273	819	5	15	99	297
	1520	15	12	48	170	680	206	824	3	12	105	420
Expanded Totals				487		4657		8034		72		3241
05-11	0800	No Sample										
	0920	20	27	81	293	879	449	1347	16	48	173	519
	1020	10	15	90	157	942	236	1416	10	60	81	486
	1120	10	16	96	140	840	288	1728	8	48	106	636
	1220	10	8	48	85	510	189	1134	8	48	46	276
	1320	15	28	112	153	612	431	1724	19	76	130	520
	1420	15	37	148	271	1084	446	1784	22	88	100	400
	1520	10	22	132	139	834	200	1200	12	72	82	222
Expanded Totals				707		5701		10333		440		3059
05-12	0820	10	34	204	197	1182	277	1662	9	54	80	480
	0920	10	27	162	123	738	229	1374	7	42	89	534
	1020	10	22	132	131	786	306	1836	16	96	57	342
	1120	10	23	138	87	522	220	1320	14	84	92	552
	1220	10	29	174	109	654	199	1194	14	84	72	432
	1320	15	38	152	247	988	470	1880	12	48	76	304
	1420	10	30	180	103	618	148	888	6	36	42	252
	1520	10	43	258	130	780	146	876	9	54	32	192
	1620	10	27	162	160	960	176	1056	4	24	35	210
	1720	10	27	162	163	978	211	1266	8	48	22	132
	1820	10	8	48	91	546	126	756	2	12	17	102
	1920	10	8	48	34	204	145	870	4	24	5	30
	2020	10	4	24	22	132	75	450	13	78	13	78
	2120	5	43	516	195	2340	513	6156	46	552	209	2508
	2220	5	7	84	63	756	168	2016	10	120	49	588
	2320	10	26	156	116	696	207	1242	7	42	65	390

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
05-12	0020	10	39	234	116	696	218	1308	25	150	72	432
	0120	10	27	162	118	708	145	870	11	66	44	264
	0220	10	41	246	120	720	241	1446	9	54	66	396
	0320	10	38	228	138	828	189	1134	4	24	52	312
	0420	10	46	276	112	672	188	1128	4	24	61	366
	0520	10	76	456	151	906	258	1548	6	36	49	294
	0620	10	53	318	308	1848	329	1974	11	66	47	282
	0720	5	17	204	71	852	117	1404	6	72	31	372
Expanded Totals				4724		20110		35654		1890		9844
05-13	0820	10	54	324	214	1284	483	2898	10	60	44	264
	0920	10	49	294	107	642	296	1776	18	108	65	390
	1020	10	67	402	178	1068	296	1776	29	174	78	468
	1120	10	67	402	145	870	218	1308	37	222	59	354
	1220	10	57	342	126	756	149	894	31	186	33	198
	1320	15	107	428	238	952	216	864	26	104	78	312
	1420	10	75	450	200	1200	137	822	18	108	47	282
	1520	10	78	468	228	1368	145	870	22	198	41	246
Expanded Totals				3110		8140		11208		1160		2514
05-14	0820	5	67	804	200	2400	187	2244	12	144	214	2568
	0920	10	58	348	158	948	189	1134	14	84	103	618
	1020	5	50	600	170	2040	189	2268	18	216	167	2004
	1120	10	76	456	212	1272	187	1122	35	210	123	738
	1220	10	82	492	239	1434	223	1338	68	408	116	696
	1320	5	41	492	112	1344	118	1416	16	192	43	516
	1420	5	107	1284	381	4572	220	2640	38	456	88	1056
	1520	10	91	546	307	1842	164	984	30	180	44	264
	1620	5	46	552	153	1836	100	1200	14	168	35	420
	1720	5	25	300	153	1836	87	1044	8	96	20	240
	1820	10	19	114	71	426	69	414	21	126	25	150
	1920	10	12	72	90	540	69	414	19	144	31	186
	2020	10	9	54	59	354	194	1164	95	570	51	306
	2120	5	154	1848	200	2400	430	5160	102	1224	165	1980
	2230	2	5	150	39	1170	51	1530	8	240	20	600
	2320	10	29	174	123	738	167	1002	26	156	75	450

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
05-14	0020	5	16	192	68	816	195	1260	4	48	56	672
	0120	10	32	192	114	684	133	798	17	102	51	306
	0220	10	34	204	174	1044	204	1224	12	72	74	444
	0320	5	17	204	66	792	139	1668	17	204	67	804
	0420	10	54	324	100	600	138	828	16	96	73	438
	0520	10	57	342	174	1044	172	1032	17	102	60	360
	0620	5	20	240	261	3132	204	2448	9	108	35	420
	0720	5	33	396	260	3120	203	2436	20	240	55	660
Expanded Totals				10380		36384		36768		5586		16896
05-15	0835 1/	20	79	237	377	1131	490	1470	63	189	96	288
	0930	10	55	330	221	1326	300	1800	74	444	126	756
	1030	5	29	348	113	1356	150	1800	47	564	37	444
	1120	5	23	276	147	1764	158	1896	43	516	72	864
	1220	10	37	222	201	1206	227	1362	67	402	67	402
	1320	10	47	282	186	1116	255	1530	37	222	60	360
	1420	10	52	312	252	1512	232	1392	46	276	53	318
	1520	10	60	360	333	1998	255	1530	32	192	44	264
Expanded Totals				2367		11409		12780		2805		3696
06-01	0800	No Sample										
	0900	No Sample										
	1020	5	76	912	28	336	55	660	72	864	18	216
	1120	5	61	732	20	240	73	876	79	948	27	324
	1220	10	198	1188	31	186	137	822	171	1026	28	168
	1320	10	189	1134	24	144	139	834	161	966	21	126
	1420	10	145	870	24	144	107	642	156	936	29	174
	1520	10	164	984	33	198	67	402	218	1308	34	204
Expanded Totals				5820		1248		4236		6048		1212
06-02	0820	20	118	354	28	84	100	300	43	129	49	147
	0920	20	140	420	49	147	84	252	58	174	72	216
	1025	20	176	528	39	117	89	267	79	237	71	213
	1120	20	148	444	32	96	82	246	70	210	32	96
	1220	20	170	510	31	93	66	198	67	201	44	132
	1320	20	147	441	29	87	76	228	85	255	35	105
	1420	20	286	858	37	111	74	222	109	327	30	90
	1520	20	177	531	39	117	62	186	93	279	28	84
	1620	20	150	450	27	81	36	108	31	93	46	138
	1720	20	94	282	27	81	52	156	43	129	26	78
	1820	20	52	156	15	45	37	111	42	126	29	87
	1920	20	38	114	7	21	22	66	19	57	18	54
	2020	20	33	99	24	72	28	54	22	66	20	60
	2120	15	333	1332	88	352	139	556	270	1080	148	592
	2220	10	154	924	64	384	85	510	82	492	48	288

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
06-02	2320	10	93	558	34	204	42	252	29	174	40	240
	0020	20	192	576	51	153	70	210	69	207	59	177
	0120	20	265	795	63	189	85	255	127	381	76	228
	0220	20	231	693	34	102	68	204	160	480	61	183
	0320	20	236	708	35	105	66	198	163	489	79	237
	0420	20	270	810	49	147	65	195	116	348	65	195
	0520	20	243	729	63	189	118	354	48	144	26	78
	0620	15	320	1280	82	328	147	588	95	380	56	224
	0720	10	131	786	25	150	44	264	32	192	12	72
Expanded Totals				14378		3455		5980		6650		4014
06-03	0820	20	124	372	12	36	75	225	62	186	31	93
	0920	20	150	450	33	99	60	180	54	162	32	96
	1020	20	174	522	18	54	54	162	71	213	30	90
	1120	20	228	684	21	63	74	222	72	216	40	120
	1220	20	202	606	27	81	59	177	81	243	41	123
	1320	20	161	483	21	63	40	120	65	195	27	81
	1420	20	250	750	29	87	47	141	64	192	43	129
	1520	20	186	558	26	78	39	117	38	114	30	90
Expanded Totals				4425		561		1344		1521		822
06-04	0820	20	130	390	24	72	40	120	42	126	17	51
	0920	20	108	324	12	36	39	117	48	144	29	87
	1020	20	132	396	21	63	40	120	44	132	25	75
	1120	20	113	339	25	75	51	153	51	153	27	81
	1220	20	239	717	29	87	52	156	60	180	30	90
	1320	20	113	339	19	57	19	57	25	75	19	57
	1420	20	254	762	22	66	37	111	50	150	7	21
	1520	20	239	717	19	57	27	81	45	135	16	48
	1620	20	178	534	7	21	16	48	24	72	24	72
	1720	20	114	342	10	30	19	57	15	45	19	57
	1820	20	50	150	8	24	9	27	5	15	12	36
	1920	20	35	105	4	12	12	36	3	9	15	45
	2020	20	60	180	17	51	31	93	10	30	20	60
	2120	20	381	1143	54	162	173	519	565	1695	141	423
	2225	10	255	1530	27	162	129	774	149	894	55	330
	2320	10	157	942	16	96	65	390	69	414	25	150
	0020	15	182	728	16	64	59	236	93	372	30	120

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
06-04	0120	20	278	834	10	30	90	270	90	270	36	108
	0220	20	264	792	22	66	101	303	155	465	53	159
	0320	20	289	867	20	60	112	336	170	510	45	135
	0420	20	274	822	17	51	103	309	147	441	43	129
	0520	15	111	444	31	124	49	196	20	80	29	116
	0620	15	281	1124	29	116	147	588	15	60	50	200
	0720	15	303	1212	57	228	151	604	48	192	32	128
Expanded Totals				15733		1810		5601		6659		2778
06-05	0820	15	237	948	40	160	52	208	32	128	25	100
	0920	20	195	585	11	33	44	132	36	108	18	54
	1020	20	170	510	21	63	50	150	30	90	13	39
	1120	20	278	834	32	96	45	135	42	126	19	57
	1220	20	273	819	47	141	51	153	53	159	16	48
	1320	20	370	1110	56	168	41	123	51	153	25	75
	1420	20	274	822	49	147	53	159	47	147	19	57
	1520	20	407	1221	72	216	41	123	55	165	15	45
Expanded Totals				6849		1024		1183		1076		475
06-08	0820	20	168	504	12	36	35	105	7	21	17	51
	0920	20	295	885	11	33	66	198	6	18	30	90
	1020	20	264	792	6	18	58	174	10	30	20	60
	1120	20	230	690	12	36	36	108	9	27	20	60
	1220	20	296	888	15	45	41	123	11	33	18	54
	1320	20	331	993	12	36	36	108	28	84	19	57
	1420	20	400	1200	15	45	26	78	26	78	11	33
	1520	20	234	702	11	33	32	96	16	48	10	30
Expanded Totals				6654		282		990		339		435
06-07	0820	20	210	630	13	39	60	180	15	45	7	21
	0920	20	224	672	16	48	67	201	20	60	12	36
	1020	20	245	735	22	66	99	297	15	45	24	72
	1120	20	196	588	10	30	44	132	18	54	8	24
	1220	20	244	732	14	42	49	147	23	69	13	39
	1320	20	216	648	17	51	24	72	27	81	5	15
	1420	20	407	1221	23	69	39	117	48	144	17	51
	1520	20	364	1092	8	24	48	144	32	96	10	30

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
06-07	1620	20	227	681	11	33	20	60	9	27	5	15
	1720	20	128	384	7	21	13	39	5	15	5	15
	1820	20	59	177	8	24	11	33	2	6	8	24
	1920	20	40	120	4	12	21	63	3	9	1	3
	2020	20	27	81	9	27	8	24	6	18	2	6
	2120	20	211	633	6	18	48	144	94	282	60	180
	2220	20	371	1113	19	57	109	327	108	324	55	165
	2320	15	124	496	15	60	30	120	32	128	11	44
	0020	20	82	246	17	51	20	60	15	45	28	84
	0120	20	272	816	27	81	59	177	36	108	34	102
	0220	20	144	432	14	42	40	120	21	63	31	93
	0320	20	189	567	8	24	34	102	14	42	35	105
	0420	20	218	654	12	36	39	117	19	57	17	51
	0520	20	183	549	31	93	52	156	3	9	10	30
	0620	15	286	1144	22	88	69	276	12	48	24	96
	0720	10	78	468	10	60	26	156	12	72	10	60
Expanded Totals				14879		1096		3264		1847		1361
06-10	0820	No Sample										
	0920	20	146	438	3	9	34	102	11	33	13	39
	1020	20	207	621	11	33	50	150	16	48	29	87
	1120	20	186	558	7	21	32	96	11	33	7	21
	1220	20	295	885	9	27	40	120	13	39	8	24
	1320 1/	20	57	687	1	27	8	105	1	18	1	12
	1420	20	290	870	5	15	32	96	13	39	5	15
	1520	20	304	912	2	6	40	120	4	12	5	15
Expanded Totals				4971		138		789		222		213
06-11	0820	20	98	294	6	18	16	48	1	3	4	12
	0920	20	276	828	8	24	30	90	3	9	13	39
	1020	20	157	471	7	21	16	48	6	18	6	18
Expanded Totals				1593		63		186		30		69
06-19	0820	20	44	132	8	24	18	54			6	18
	0920	20	50	150	11	33	11	33	2	6	5	15
	1020	20	46	138	14	42	14	42	1	3	3	9
	1120	20	54	162	15	45	9	27			3	9
	1220	20	58	174	4	12	10	30	1	3		
	1320	20	57	171	5	15	1	3	2	6	3	9
	1420	20	99	297	9	27	16	48	1	3	2	6
	1520	20	66	198	10	30	5	15	1	3	7	21
Expanded Totals				1422		228		252		24		87

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
06-22	0820	20	19	57	1	3					2	6
	0920	20	23	69	1	3	3	9				
	1020	20	55	165	1	3	1	3				
	1120	20	66	198	3	9	5	15	2	6	2	6
	1220	20	45	135								
	1320	20	52	156	2	6	5	15	1	3	2	6
	1420	20	73	219			3	9	2	6	3	9
	1520	20	67	201	1	3	4	12	1	3	2	6
Expanded Totals				1200		27		63		18		33
06-23	0820	20	43	129	4	12	5	15			2	6
	0920	20	124	372	8	24	13	39	1	3		
	1020	20	123	369	1	3	9	27				
	1120	20	180	540	5	15	7	21			2	6
	1220	20	333	999	6	18	14	42			7	21
	1320	35	303	515	5	9	10	17			2	3
	1420	20	188	564	2	6	3	9			2	6
	1520	20	185	555			4	12			1	3
	1620	20	153	459	8	24	4	12				
	1720	20	186	558	2	6	3	9			2	6
	1820	20	58	174	2	6						
	1920	20	90	270	2	6						
	2020	20	8	24	1	3	1	3			2	6
	2120	20	19	57								
	2220	20	168	504	10	30	13	39	1	3	1	3
	2320	20	54	162	4	12	7	21			1	3
	0020	20	66	198	6	18	3	9	1	3	1	3
	0120	20	44	132	4	12	2	6			1	3
	0220	20	89	267	4	12	3	9			2	6
	0320	20	44	132	4	12	2	6				
	0420	20	42	126	6	18	6	18				
	0520	20	139	417	10	30	5	15			2	6
	0620	20	171	513	8	24	2	6				
	0720	20	53	159	2	6	1	3			1	3
Expanded Totals				8195		306		338		9		84
06-24	0835 1/	40	8	12	57	86	8	12				
	0925 1/	40	73	110			3	5				
	1040	20	117	351	2	6	7	21			2	6
	1120	20	73	219			3	9	1	3	1	3
	1220	20	136	408	3	9	11	33			1	3
	1320	40	97	146	3	5	7	11			1	2
	1420	20	143	429	5	15	1	3			1	3
	1520	20	131	393	4	12	6	18				
Expanded Totals				2068		133		112		3		17

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
06-25	0820	20	248	744	4	12	12	36				
	0920	20	475	1425	2	6	9	27				
	1020	20	451	1353	4	12	5	15			3	9
	1120	20	459	1377	3	9	5	15				
	1220	20	510	1530	1	3	3	9			1	3
	1320	40	551	827	1	2	7	11	1	2		
	1420	20	425	1275	2	6	3	9				
	1520	15	282	1128	2	8	1	4			1	4
	1620	20	173	519								
	1720	20	87	261								
	1820	20	27	81								
	1920	20	22	66								
	2020	20	8	24	2	6	2	6				
	2120	20	130	390	8	24					1	3
	2220	20	709	2127	54	162	26	78			6	18
	2320	20	164	492	10	30	8	24	1	3	1	3
	0020	20	219	657	11	33	5	15				
	0120	20	164	492	7	21	2	6			2	6
	0220	20	104	312	4	12						
	0320	20	83	249	3	9	1	3			1	3
	0420	20	103	309	2	6	9	27			1	3
	0520	20	178	534	10	30	3	9				
	0620	10	325	1950	15	90	13	78			1	6
	0720	20	216	648	8	24	8	24				
Expanded Totals				18770		505		396		5		58
06-26	0830 1/	40	460	690	13	19	2	4			2	4
	0940 1/	40	701	1052			5	8				
	1020											
	1120	20	505	1515	3	9	1	3				
	1220	20	580	1740	2	6	1	3				
	1320	40	554	831	3	5	3	5	1	2	1	2
	1420	20	346	1038	3	9	1	3	1	3	1	3
	1520	20	378	1134	2	6	1	3	1	3		
Expanded Totals				8000		54		29		8		9
06-29	0820	20	27	81	2	6					1	3
	0920	20	32	96							1	3
	1020	20	20	60	1	3						
	1120	20	32	96					1	3	1	3
	1220	20	72	216								
	1320	20	174	522			1	3				
	1420	20	656	1968	2	6	1	3				
	1520	20	630	1890	1	3	2	6				
Expanded Totals				4929		18		12		3		9

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
06-30	0820	20	199	597	4	12	1	3				
	0920	5	109	654	2	12	1	6				
	0930	15	239	956	2	8	1	4				
	1020	20	827	2481	3	9	6	18	1	3		
	1120	20	1077	3231	1	3	2	6			2	6
	1220	10	489	2934	1	6	3	18				
	1320	10	529	3174			4	24				
	1420	10	708	4248	2	12	2	12				
	1520	5	185	1110								
	1620	5	204	1224								
	1720	5	284	1704	1	6	1	6				
	1820	3	172	3440								
Expanded Totals				25753		68		97		3		6
07-01	0820	20	383	1149			3	9			1	3
	0920	10	290	1740	1	6	2	12				
	1020	10	499	2994			5	30			1	6
	1120	10	311	1866	1	6	1	6				
	1220	10	550	3300	1	6	1	6			1	6
	1320	10	598	3588			3	18				
	1420	10	531	3186			3	18				
	1520	10	697	4182	1	6	4	24				
Expanded Totals				22005		24		123				15
07-02	0800	10	257	1542	1	6						
	0837	8	150	1125	1	8	1	8				
	0920	10	340	2040	1	6						
	1020	10	710	4260	1	6	1	6				
	1120	10	619	3714	1	6	1	6				
	1220	10	956	5736			2	12				
	1320	10	688	4128	2	12	3	18				
	1420	10	892	5352			3	18				
	1520	10	1243	7458			4	24			1	6
	1620	5	441	5292	1	12	2	24				
	1720	5	206	2472	1	12						
	1820	5	226	2712	1	12						
	1920	5	65	780								
	2020	10	72	432								
	2120	10	182	1092			3	18				
	2220	5	400	4800	3	36	11	132			2	24
	2320	10	221	1326	6	36	16	96			2	12
	0020	10	254	1524			1	6			4	24
	0120	12	412	2060	11	55						

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
07-02	0220	13	384	1766	1	5						
	0320	5	125	1500								
	0420	5	133	1596	1	12						
	0520	10	825	4950	14	84						
	0620	5	585	7020	4	48						
	0720	3	212	4240	1	20						
Expanded Totals				78917		376		368				60
07-03	0820	5	216	2592			3	36			1	12
	0920	5	63	756			1	12				
	1020	5	121	1452	2	24						
	1120	5	109	1308			1	12			1	12
	1220											
	1320	5	72	864								
	1420	5	31	372			1	12				
	1520	5	50	600			1	12			1	12
Expanded Totals				7944		24		72				36
08-31	1024	20	3	9								
	1122	20	2	6								
	1223	20										
	1325	20	6	18								
	1420	20										
	1518	20	8	24								
Expanded Totals				57								
09-01	0820	20	3	9								
	0920	20	7	21								
	1020	20	5	15								
	1120	20	1	3								
	1220	20	8	24								
	1320	20	9	27								
	1420	20	4	12								
	1520	20	7	21								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
09-01	1620	20										
	1720	20	1	3								
	1820	20	5	15							1	3
	1920	20	2	6								
	2020	20	83	249								
	2120	20	4	12								
	2220	20	3	9								
	2320	20	2	6								
	0020	20	4	12								
	0120	20	3	9								
	0220	20	2	6								
	0320	20	5	15			1	3				
	0420	20	10	30								
	0520	20	8	24								
	0620	20	15	45								
	0720	20	12	36								
Expanded Totals				609				3				3
09-02	0820	20	8	24								
	0920	20	1	3								
	1020	20	2	6								
	1120	20	5	15								
	1220	20	1	3								
	1320	20	3	9								
	1420	20	3	9								
	1520	20	4	12			1	3				
Expanded Totals				81				3				
09-03	0820	20	2	6								
	0920	20	7	21								
	1020	20	5	15								
	1120	20	2	6								
	1220	20	1	3								
	1320	20										
	1420	20	1	3								
	1520	20	1	3								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
09-03	1620	20										
	1720	20										
	1820	20	2	6								
	1920	20	1	3								
	2020	20	44	132			2	6				
	2120	20	1	3								
	2220	20	5	15								
	2320	20	4	12								
	0020	20	5	15								
	0120	20	4	12								
	0220	20	3	9								
	0320	20	4	12								
	0420	20	5	15								
	0520	20	9	27								
	0620	20										
	0720	20	7	21								
Expanded Totals				339				6				
09-04	0820	20	1	3								
	0920	20	5	15								
	1020	20	4	12								
	1120	20	2	6								
	1220	20	2	6								
	1320	20										
	1420	20	2	6								
	1520	20	5	15								
Expanded Totals				63								
09-08	0820	20	5	15								
	0920	20	2	6								
	1020	20	2	6								
	1120	20	2	6								
	1220	20	3	9								
	1320	20	2	6								
	1420	20										
	1520	20	2	6								
	1620	20	5	15								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
09-08	1720	20										
	1820	20	1	3								
	1920	20										
	2020	20	16	48								
	2120	20	3	9								
	2220	20	1	3								
	2320	20	5	15								
	0020	20	6	18								
	0120	20	9	27								
	0220	20	4	12								
	0320	20	6	18								
	0420	20	6	18								
	0520	20	13	39								
	0620	20	2	6								
	0720	20	6	18								
Expanded Totals				303								
09-09	0820	20	6	18								
	0920	20	3	9								
	1020	20	6	18								
	1120	20	2	6								
	1220	20	4	12								
	1320	20	6	18								
	1420	20	5	15								
	1520	20	13	39								
Expanded Totals				135								
09-10	0820	20	4	12								
	0920	20	9	27								
	1020	20										
	1120	20	2	6								
	1220	20	9	27								
	1320	20	3	9								
	1420	20	5	15								
	1520	20	5	15								
	1620	20	6	18								
	1720	20	1	3								
	1820	20	1	3								
	1920	20	3	9			1	3				
	2020	20	41	123								
	2120	20	4	12								
	2220	20	8	24								
	2320	20	7	21								
	0020	20	9	27								
	0120	20	5	15								
	0220	20	7	21								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
09-10	0320	20	11	33								
	0420	20	11	33			1	3				
	0520	20	5	15								
	0620	20	2	6								
	0720	20	17	51								
Expanded Totals				525				6				
09-11	0820	20	15	45			1	3				
	0920	20	6	18								
	1020	20	8	24								
	1120	20										
	1220	20	9	27			1	3				
	1320	20	10	30								
	1420	20	3	9								
	1520	20	8	24								
Expanded Totals				177				6				
09-14	0820	20	13	39								
	0920	20	2	6								
	1020	20	3	9								
	1120	20	9	27								
	1220	20	17	51								
	1320	20	2	6								
	1420	20	1	3								
	1520	20	7	21							1	3
Expanded Totals				162								3
09-15	0820	20	12	36								
	0920	20	6	18								
	1020	20	5	15								
	1120	20	3	9			1	3				
	1220	20	2	6								
	1320	20	6	18								
	1420	20	4	12								
	1520	20	3	9								
	1620	20	8	24								
	1720	20										
	1820	20	4	12								
	1920	20	5	15								
	2020	20	28	84							1	3
	2120	20	6	18								
	2220	20	2	6								
	2320	20	5	15								
	0020	20	3	9								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
09-15	0120	20	6	18								
	0220	20	4	12								
	0320	20	2	6								
	0420	20	7	21								
	0520	20	11	33								
	0620	20	2	6								
	0720	20	10	30								
Expanded Totals				432				3				3
09-16	0820	20	14	42								
	0920	20	10	30								
	1020	20	11	33								
	1120	20	8	24								
	1220	20	5	15								
	1320	20	9	27			1	3				
	1420	20	11	33								
	1520	20	13	39								
Expanded Totals				243				3				
09-17	0820	20	55	165								
	0920	20	35	105								
	1020	20	11	33								
	1120	20	6	18								
	1220	20	8	24								
	1320	20	5	15								
	1420	20	13	39			1	3				
	1520	20	4	12								
	1620	20	3	9								
	1720	20	6	18								
	1820	20	12	36								
	1920	20	20	60								
	2020	20	32	96								
	2120	20	11	33								
	2220	20	6	18								
	2320	20	8	24								
	0020	20	7	21								
	0120	20	5	15								
	0220	20	11	33								
	0320	20	5	15								
	0420	20	16	48								
	0520	20	11	33								
	0620	20	5	15							1	3
	0720	20	32	96							1	3
Expanded Totals				981				3				6

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
09-18	0820	20	9	27								
	0920	20	11	33								
	1020	20	3	9								
	1120	20	3	9								
	1220	20	12	36								
	1320	20	10	30			1	3				
	1420	20	9	27								
	1520	20	8	24			1	3				
Expanded Totals				195				6				
09-21	0820	20	1	3								
	0920	20	1	3								
	1020	20	1	3								
	1120	20	1	3								
	1220	20										
	1320	20	2	6								
	1420	20	1	3								
	1520	20										
Expanded Totals				21								
09-22	0820	20	2	6								
	0920	20	4	12								
	1020	20	2	6								
	1120	20										
	1220	20										
	1320	20	2	6								
	1420	20										
	1520	20	2	6								
	1620	20										
	1720	20	1	3								
	1820	20										
	1920	20	2	6								
	2020	20	6	18								
	2120	20	6	18								
	2220	20										
	2320	20	7	21								
	0020	20	1	3								
	0120	20	4	12								
	0220	20	4	12								
	0320	20	3	9								
	0420	20	7	21								
	0520	20	6	18			1	3				
	0620	20										
	0720	20	1	3								
Expanded Totals				180				3				

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
09-23	0820	20	2	6								
	0920	20	1	3			1	3				
	1020	20	1	3								
	1120	20	3	9								
	1220	20										
	1320	20	3	9								
	1420	20	2	6								
	1520	20	2	6								
Expanded Totals				42				3				
09-24	0820	20	6	18								
	0920	20	3	9								
	1020	20	4	12								
	1120	20										
	1220	20	2	6								
	1320	20										
	1420	20	3	9								
	1520	20	5	15								
	1620	20	9	27			1	3				
	1720	20	5	15								
	1820	20										
	1920	20	3	9								
	2020	20	1	3								
	2120	20	4	12								
	2220	20										
	2320	20										
	0020	20	1	3								
	0120	20	3	9								
	0220	20	7	21								
	0320	20	5	15								
	0420	20	6	18								
	0520	20	3	9								
	0620	20	5	15								
	0720	20	7	21								
Expanded Totals				246				3				
09-25	0820	20	17	51								
	0920	20	7	21								
	1020	20	2	6								
	1120	20	2	6								
	1220	20	12	36								
	1320	20	3	9								
	1420	20	5	15								
	1520	20	5	15								
Expanded Totals				159								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
09-28	0820	20	7	21								
	0920	20	1	3								
	1020	20	1	3			1	3				
	1120	20	4	12								
	1220	20	8	24								
	1320	20	2	6								
	1420	20										
	1520	20	8	24								
Expanded Totals				93				3				
09-29	0820	20	15	45								
	0920	20	2	6								
	1020	20	3	9								
	1120	20										
	1220	20	26	78								
	1320	20	2	6								
	1420	20	6	18	1	3						
	1520	20	5	15								
	1620	20	3	9								
	1720	20	3	9								
	1820	20	1	3								
	1920	20	48	144			1	3				
	2020	20	12	36								
	2120	20	2	6							1	3
	2220	20	3	9								
	2320	20	2	6								
	0020	20	2	6								
	0120	20	3	9								
	0220	20	5	15								
	0320	20	11	33								
	0420	20	7	21								
	0520	20	5	15								
	0620	No Sample										
	0720	No Sample										
Expanded Totals				498		3		3				3
09-30	0820	20	3	9								
	0920	20	4	12			1	3				
	1020	20	13	39								
	1120	20	3	9								
	1220	20	1	3								
	1320	20	6	18								
	1420	20	16	48								
	1520	20	17	51								
Expanded Totals				189				3				

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
10-01	0820	20	11	33								
	0920	20	13	39								
	1020	20	10	30			1	3				
	1120	20	5	15								
	1220	20	8	24								
	1320	20	17	51								
	1420	20	10	30								
	1520	20	5	15							1	3
	1620	20	3	9								
	1720	20										
	1820	20	1	3								
	1920	20	20	60								
	2020	20	3	9								
	2120	20	3	9								
	2220	20	4	12								
	2320	20	2	6								
	0020	20										
	0120	20	7	21								
	0220	20	8	24								
	0320	20	15	45								
	0420	20	4	12							1	3
	0520	20	5	15								
	0620	20	5	15								
	0720	20	3	9								
Expanded Totals				486				3				6
10-02	0820	20	10	30								
	0920	20	3	9			1	3				
	1020	20	3	9								
	1120	20	4	12								
	1220	20	6	18								
	1320	20			Sample tank flooded, fish may have been lost							
	1420	20	1	3								
	1520	20	2	6								
Expanded Totals				87				3				
10-05	0820	20	7	21								
	0920	20	9	27								
	1020	20	8	24								
	1120	20	6	18								
	1220	20	19	57								
	1320	20	13	39								
	1420	20	22	66								
	1520	20	11	33								
Expanded Totals				285								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
10-06	0820	20	43	129								
	0920	20	19	57								
	1020	20	9	27								
	1120	20	19	57								
	1220	20	24	72								
	1320	20	2	6								
	1420	20	9	27								
	1520	20	13	39								
	1620	20	2	6								
	1720	20	3	9								
	1820	20	13	39								
	1920	20	31	93								
	2020	20	39	117								
	2120	20	26	78								
	2220	20	13	39								
	2320	20	12	36								
	0020	20	13	39								
	0120	20	8	24								
	0220	20	10	30								
	0320	20	13	39								
	0420	20	8	24								
	0520	20	12	36								
	0620	20	16	48								
	0720	20	11	33								
Expanded Totals				1104								
10-07	0820	20	22	66								
	0920	20	14	42								
	1020	20	7	21								
	1120	20										
	1220	20	4	12								
	1320	20	5	15								
	1420	20	2	6								
	1520	20	11	33								
Expanded Totals				195								
10-08	0820	20	9	27			1	3				
	0920	20	8	24								
	1020	20	4	12								
	1120	20	1	3								
	1220	20	6	18								
	1320	20	4	12								
	1420	20	7	21								
	1520	20	6	18								
	1620	20	3	9								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
10-08	1720	20	4	12								
	1820	20	2	6								
	1920	20	18	54								
	2020	20	2	6								
	2120	20	5	15								
	2220	20	4	12								
	2320	20	2	6								
	0020	20	3	9								
	0120	20	4	12								
	0220	20	2	6								
	0320	20	2	6								
	0420	20	3	9								
	0520	20	5	15								
	0620	20	4	12								
	0720	20	4	12								
Expanded Totals				336								
10-09	0820	20	13	39								
	0920	20	8	24								
	1020	20	12	36								
	1120	20	10	30								
	1220	20	4	12								
	1320	20	11	33								
	1420	20	9	27								
	1520	20	9	27								
Expanded Totals				228								
10-13	0820	20	21	63								
	0920	20	2	6								
	1020	20	3	9								
	1120	20	9	27								
	1220	20	10	30								
	1320	20	13	39								
	1420	20	10	30								
	1520	20	17	51								
	1620	20	15	45								
	1720	20	16	48								
	1820	20	14	42								
	1920	20	42	126								
	2020	20	19	57								
	2120	20	6	18								
	2220	20	6	18								
	2320	20	6	18								
	0020	20	3	9								
	0120	20	5	15								
	0220	20	4	12								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
10-13	0320	20	7	21								
	0420	20	7	21								
	0520	20	8	24								
	0620	20	6	18								
	0720	20	6	18								
Expanded Totals				765								
10-14	0820	20	14	42			1	3				
	0920	20	8	24								
	1020	20	12	36								
	1120	20	7	21								
	1220	20	5	15								
	1320	20	14	42								
	1420	20	3	9								
	1520	20	16	48								
Expanded Totals				237				3				
10-15	0820	20	3	9							1	3
	0920	20	5	15								
	1020	20	5	15								
	1120	20	3	9								
	1220	20	4	12			1	3				
	1320	20	7	21								
	1420	20	4	12								
	1520	20	4	12								
	1620	20	18	54								
	1720	20	15	45								
	1820	20	3	9								
	1920	20	60	180			2	6				
	2020	20	17	51								
	2120	20	8	24								
	2220	20	4	12								
	2320	20	5	15								
	0020	20	4	12								
	0120	20	1	3								
	0220	20	9	27							1	3
	0320	20	8	24								
	0420	20	5	15								
	0520	20	4	12							1	3
	0620	20	7	21								
	0720	20	3	9								
Expanded Totals				618				9				9

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
10-16	0820	20	19	57								
	0920	20	10	30								
	1020	20	10	30								
	1120	20	4	12								
	1220	20	16	48								
	1320	20	13	39								
	1420	20	4	12								
	1520	20	2	6								
Expanded Totals				234								
10-19	0820	20	4	12								
	0920	20	2	6								
	1020	20	3	9								
	1120	20	3	9								
	1220	20	4	12								
	1320	20	50	150			3	9				
	1420	20	12	36								
	1520	20	26	78								
Expanded Totals				312				9				
10-20	0820	20	12	36								
	0920	20	2	6								
	1020	20	4	12			1	3			1	3
	1120	20	12	36								
	1220	20	2	6								
	1320	20	2	6								
	1420	20	4	12								
	1520	20	9	27								
	1620	20	11	33								
	1720	20	6	18			1	3				
	1820	20	1	3			1	3				
	1920	20	23	69			1	3				
	2020	20	10	30								
	2120	20	7	21								
	2220	20	6	18								
	2320	20	5	15								
	0020	20	4	12								
	0120	20	6	18								
	0220	20	3	9								
	0320	20	2	6								
	0420	20	10	30								
	0520	20	2	6								
	0620	20	20	60								
	0720	20	4	12								
Expanded Totals				501				12				6

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
10-21	0820	20	1	3								
	0920	20	2	6								
	1020	20	3	9								
	1120	20	6	18								
	1220	20	11	33								
	1320	20	5	15								
	1420	20	9	27								
	1520	20	6	18								
Expanded Totals				129								
10-22	0820	20	8	24								
	0920	20	3	9								
	1020	20										
	1120	20	9	27								
	1220	20	2	6								
	1320	20	1	3								
	1420	20	3	9			1	3				
	1520	20	3	9							1	3
	1620	20	21	63			1	3				
	1720	20	5	15								
	1820	20										
	1920	20	17	51								
	2020	20	4	12								
	2120	20	5	15								
	2220	20	2	6								
	2320	20	6	18								
	0020	20	1	3			1	3				
	0120	20	3	9								
	0220	20	2	6								
	0320	20	2	6								
	0420	20	3	9								
	0520	20	10	30								
	0620	20	12	36							1	3
	0720	20	4	12								
Expanded Totals				378				9				6
10-23	0820	20	2	6								
	0920	20	3	9								
	1020	20										
	1120	20	1	3								
	1220	20	3	9								
	1320	20	1	3								
	1420	20	1	3								
	1520	20										
Expanded Totals				33								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
10-26	0820	20										
	0920	20	4	12								
	1020	20	1	3								
	1120	20	5	15								
	1220	20	4	12								
	1320	20	6	18								
	1420	20	1	3								
	1520	20	2	6								
Expanded Totals				69								
10-27	0820	20	3	9								
	0920	20	4	12								
	1020	20	2	6								
	1120	20	2	6								
	1220	20	3	9								
	1320	20										
	1420	20	3	9								
	1520	20	4	12								
	1620	20	2	6								
	1720	20	2	6								
	1820	20	12	36								
	1920	20	5	15								
	2020	20	5	15								
	2120	20	3	9								
	2220	20	3	9								
	2320	20	2	6								
	0020	20										
	0120	20	1	3								
	0220	20	3	9								
	0320	20	4	12								
	0420	20	5	15								
	0520	20	2	6								
	0620	20										
	0720	20	5	15								
Expanded Totals				225								
10-28	0820	20	7	21								
	0920	20	6	18								
	1020	20	4	12								
	1120	20	8	24								
	1220	20	2	6								
	1320	20	8	24								
	1420	20	6	18								
	1520	20	4	12								
Expanded Totals				135								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
10-29	0820	20										
	0920	20	7	21								
	1020	20	3	9								
	1120	20	6	18								
	1220	20	2	6			1	3				
	1320	20	8	24								
	1420	20	10	30								
	1520	20	7	21								
	1620	20	6	18								
	1720	20										
	1820	20	3	9								
	1920	20	1	3								
	2020	20	1	3								
	2120	20	3	9								
	2220	20	2	6								
	2320	20										
	0020	20	1	3								
	0120	20										
	0220	20	3	9								
	0320	20	2	6								
	0420	20										
	0520	20	3	9								
	0620	20	1	3								
	0720	20	2	6								
Expanded Totals				213				3				
10-30	0820	20	4	12								
	0920	20										
	1020	20										
	1120	20										
	1220	20										
	1320	20										
	1420	20										
	1520	20	4	12								
Expanded Totals				24								
11-02	0820	20	3	9								
	0920	20										
	1020	20	2	6								
	1120	20	3	9								
	1220	20	1	3								
	1320	20	2	6								
	1420	20	2	6								
	1520	20	3	9								
Expanded Totals				48								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
11-03	0820	20										
	0920	20										
	1020	20										
	1120	20	1	3								
	1220	20	1	3								
	1320	20	1	3								
	1420	20	4	12								
	1520	20	4	12								
	1620	20										
	1720	20	6	18								
	1820	20	4	12								
	1920	20	1	3								
	2020	20	2	6								
	2120	20	1	3								
	2220	20	2	6								
	2320	20	2	6								
	0020	20										
	0120	20	2	6								
	0220	20										
	0320	20	3	9								
	0420	20	2	6								
	0520	20	3	9								
	0620	20	5	15								
	0720	20	10	30								
Expanded Totals				162								
11-04	0820	20	6	18								
	0920	20	1	3								
	1020	20	4	12								
	1120	20	6	18								
	1220	20	6	18								
	1320	20	5	15								
	1420	20	2	6								
	1520	20	7	21								
Expanded Totals				111								
11-05	0820	20	2	6								
	0920	20	1	3								
	1020	20	3	9								
	1120	20	1	3								
	1220	20	3	9								
	1320	20	1	3								
	1420	20	1	3								
	1520	20	1	3								
	1620	20										

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
11-05	1720	20	9	27								
	1820	20	3	9								
	1920	20	3	9								
	2020	20	4	12								
	2120	20	2	6								
	2220	20	3	9								
	2320	20										
	0020	20	1	3								
	0120	20	2	6								
	0220	20	2	6								
	0320	20	4	12								
	0420	20	1	3								
	0520	20	2	6								
	0620	20	1	3								
	0720	20	5	15								
Expanded Totals				165								
11-06	0820	20	3	9								
	0920	20	2	6								
	1020	20										
	1120	20	2	6								
	1220	20	3	9								
	1320	20										
	1420	20										
	1520	20	1	3								
Expanded Totals				33								
11-09	0820	20	3	9								
	0920	20	1	3								
	1020	20										
	1120	20										
	1220	20	1	3								
	1320	20										
	1420	20	2	6								
	1520	20	3	9							1	3
Expanded Totals				30								3
11-10	0820	20	3	9								
	0920	20										
	1020	20	1	3								
	1120	20	1	3								
	1220	20	5	15								
	1320	20	4	12								
	1420	20	7	21								
	1520	20	2	6								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
11-10	1620	20	2	6								
	1720	20										
	1820	20	6	18								
	1920	20	4	12					1	3		
	2020	20	1	3								
	2120	20	1	3								
	2220	20	2	6								
	2320	20										
	0020	20	1	3								
	0120	20	4	12								
	0220	20	1	3								
	0320	20	3	9								
	0420	20	1	3								
	0520	20	4	12								
	0620	20	1	3								
	0720	20	1	3								
Expanded Totals				165						3		
11-11	0820	20	5	15								
	0920	20										
	1020	20										
	1120	20										
	1220	20										
	1320	20	2	6								
	1420	20	2	6								
	1520	20										
Expanded Totals				27								
11-12	0820	20	3	9								
	0920	20	2	6								
	1020	20	2	6								
	1120	20	1	3								
	1220	20	1	3								
	1320	20	2	6								
	1420	20										
	1520	20	2	6								
	1620	20										
	1720	20	10	30								
	1820	20	2	6								
	1920	20	8	24								
	2020	20	1	3								
	2120	20	4	12								
	2220	20	2	6								
	2320	20	3	9								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
11-12	0020	20	2	6								
	0120	20	3	9								
	0220	20	3	9								
	0320	20										
	0420	20	1	3								
	0520	20										
	0620	20	1	3								
	0720	20	3	9								
Expanded Totals				168								
11-13	0820	20	1	3								
	0920	20	2	6								
	1020	20										
	1120	20										
	1220	20										
	1320	20										
	1420	20										
	1520	20										
Expanded Totals				9								
11-16	0820	20										
	0920	20	1	3								
	1020	20										
	1120	20										
	1220	20										
	1320	20										
	1420	20										
	1520	20										
Expanded Totals				3								
11-17	0820	20										
	0920	20										
	1020	20										
	1120	20										
	1220	20										
	1320	20	1	3								
	1420	20										
	1520	20										
	1620	20	1	3								
	1720	20										
	1820	20										
	1920	20	1	3								
	2020	20										
	2120	20	2	6								
	2220	20										
	2320	20	1	3								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
11-17	0020	20	1	3								
	0120	20										
	0220	20	1	3								
	0320	20	1	3								
	0420	20										
	0520	20	2	6								
	0620	20										
	0720	20										
Expanded Totals				33								
11-18	0820	20										
	0920	20										
	1020	20	2	6								
	1120	20										
	1220	20										
	1320	20										
	1420	20	1	3								
	1520	20										
Expanded Totals				9								
11-19	0820	20	1	3								
	0920	20	1	3								
	1020	20	2	6								
	1120	20	1	3								
	1220	20	1	3								
	1320	20										
	1420	20										
	1520	20										
	1620	20	1	3								
	1720	20										
	1820	20	3	9								
	1920	20										
	2020	20										
	2120	20										
	2220	20										
	2320	20	1	3								
	0020	20										
	0120	20										
	0220	20	1	3								
	0320	20										
	0420	20										
	0520	20										
	0620	20										
	0720	20										
Expanded Totals				36								

Appendix Table 5.--Continued.

Date	Start Sample	Length of Sample (Minutes)	Chinook Subyearlings # Cap.	Chinook Subyearlings Expnd Total	Chinook Yearlings # Cap.	Chinook Yearlings Expnd Total	Coho #Cap.	Coho Expnd Total	Sockeye # Cap.	Sockeye Expnd Total	Steelhead # Cap.	Steelhead Expnd Total
11-20	0820	20										
	0920	20										
	1020	20										
	1120	20	1	3								
	1220	20										
	1320	20										
	1420	20					1	3				
	1520	20										
Expanded Totals				3				3				

1/ These samples were collected with the center flume section only.

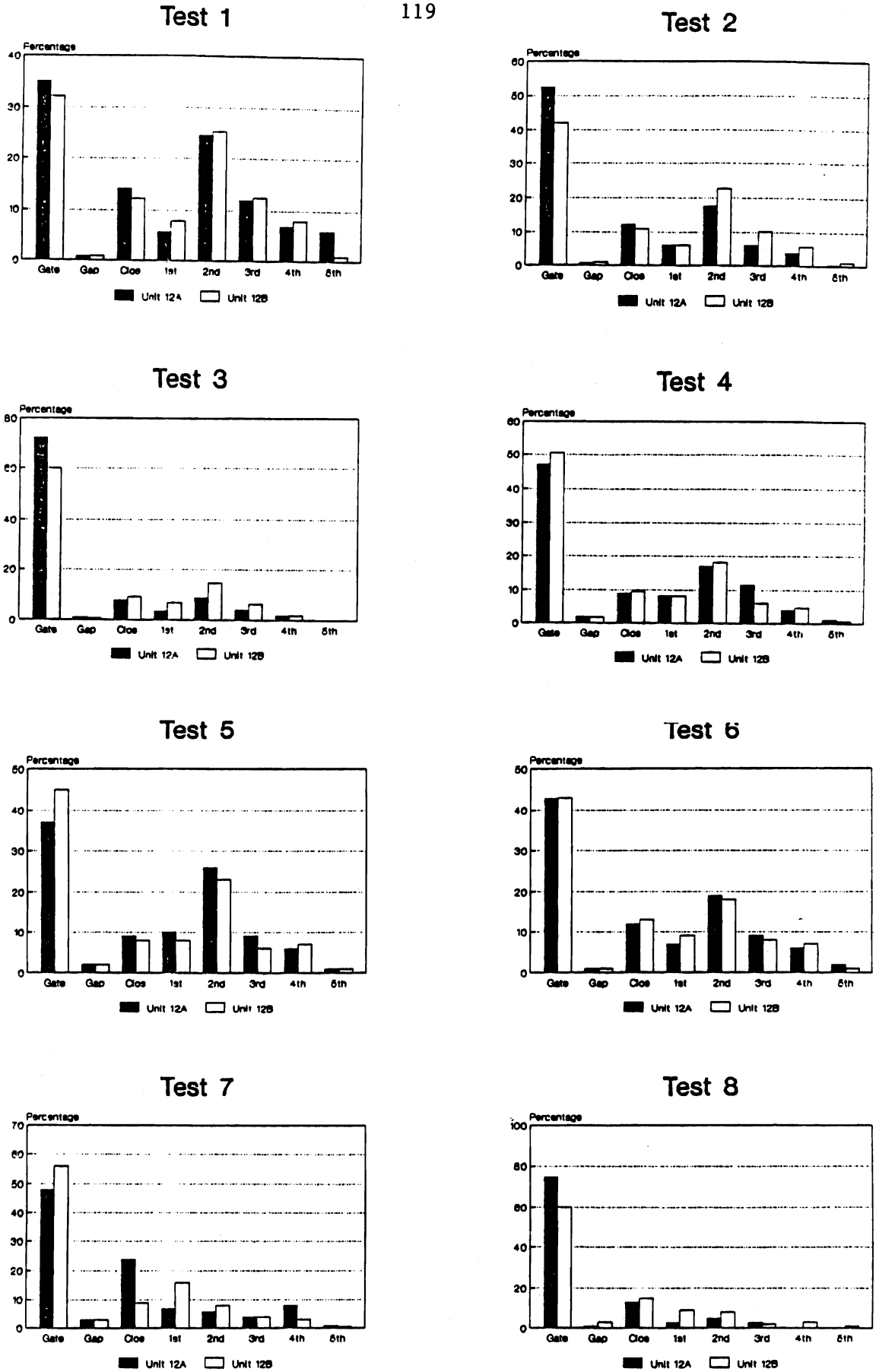
2/ Samples during the period 22 April - 4 May were collected with one outside section of flume (East side of channel).

3/ Diel sample began at 1600 not at 0800.

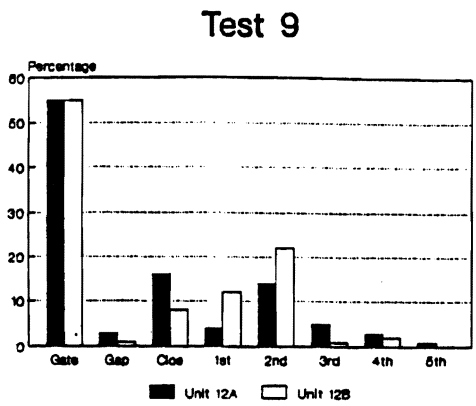
4/ Sample was collected by the two outside flume sections.

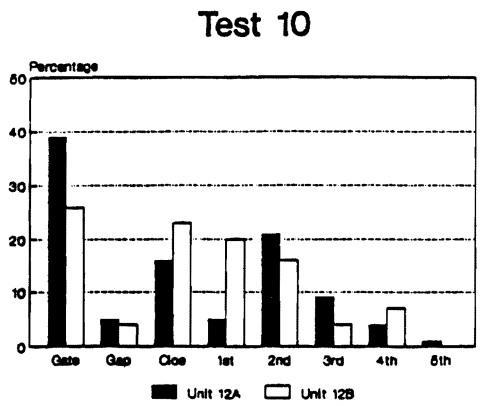
APPENDIX B

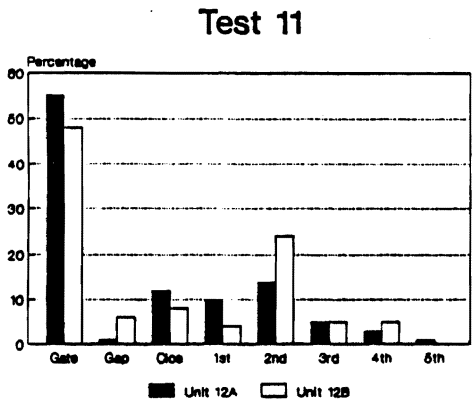
Data Figures

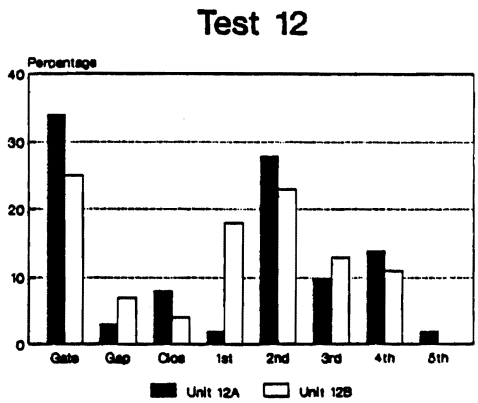


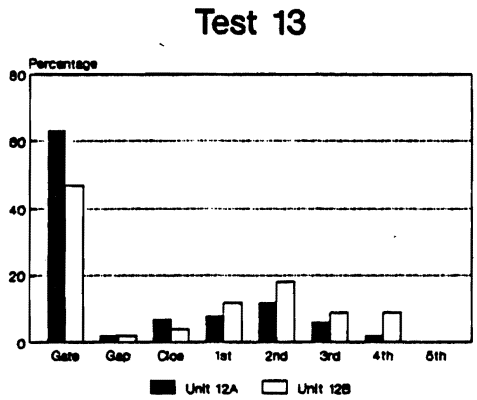
Appendix Figure B1.--Results of STS tests for yearling chinook salmon showing FGE and percentage of fish captured at the various net levels, Bonneville Dam Second Powerhouse, 1987. Test numbers correspond to tests as listed in Table 1 (refer to this table fro complete test details).

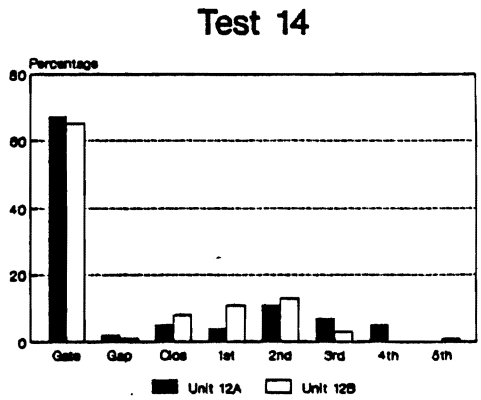


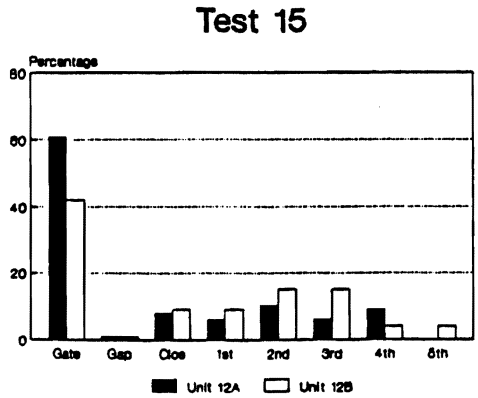


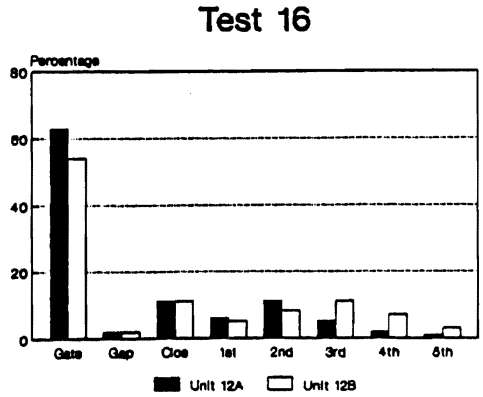




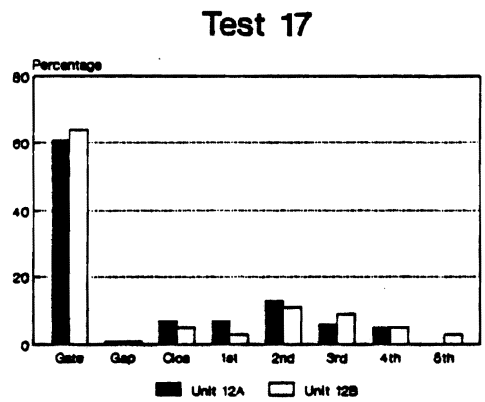


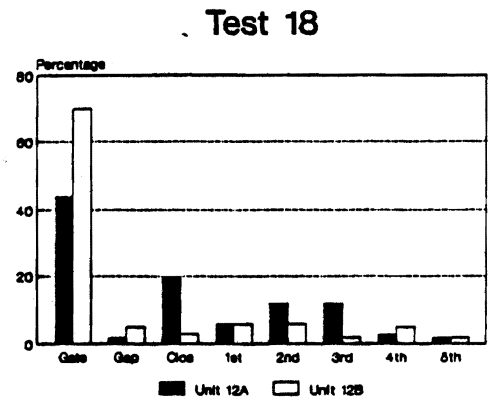


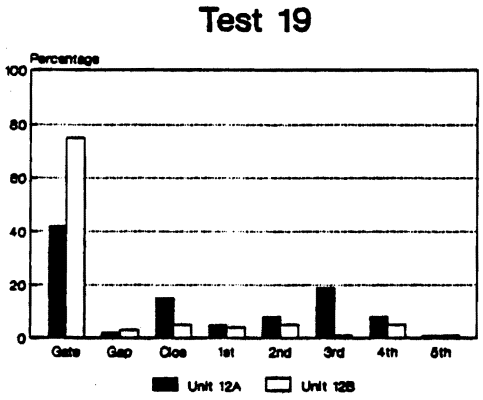


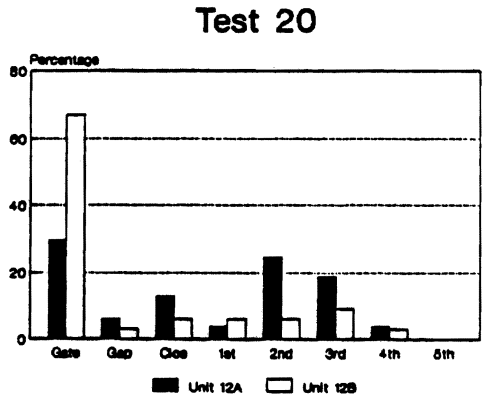


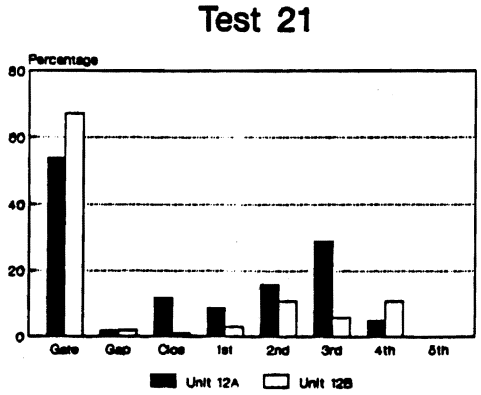
Appendix Figure B1.--Cont.



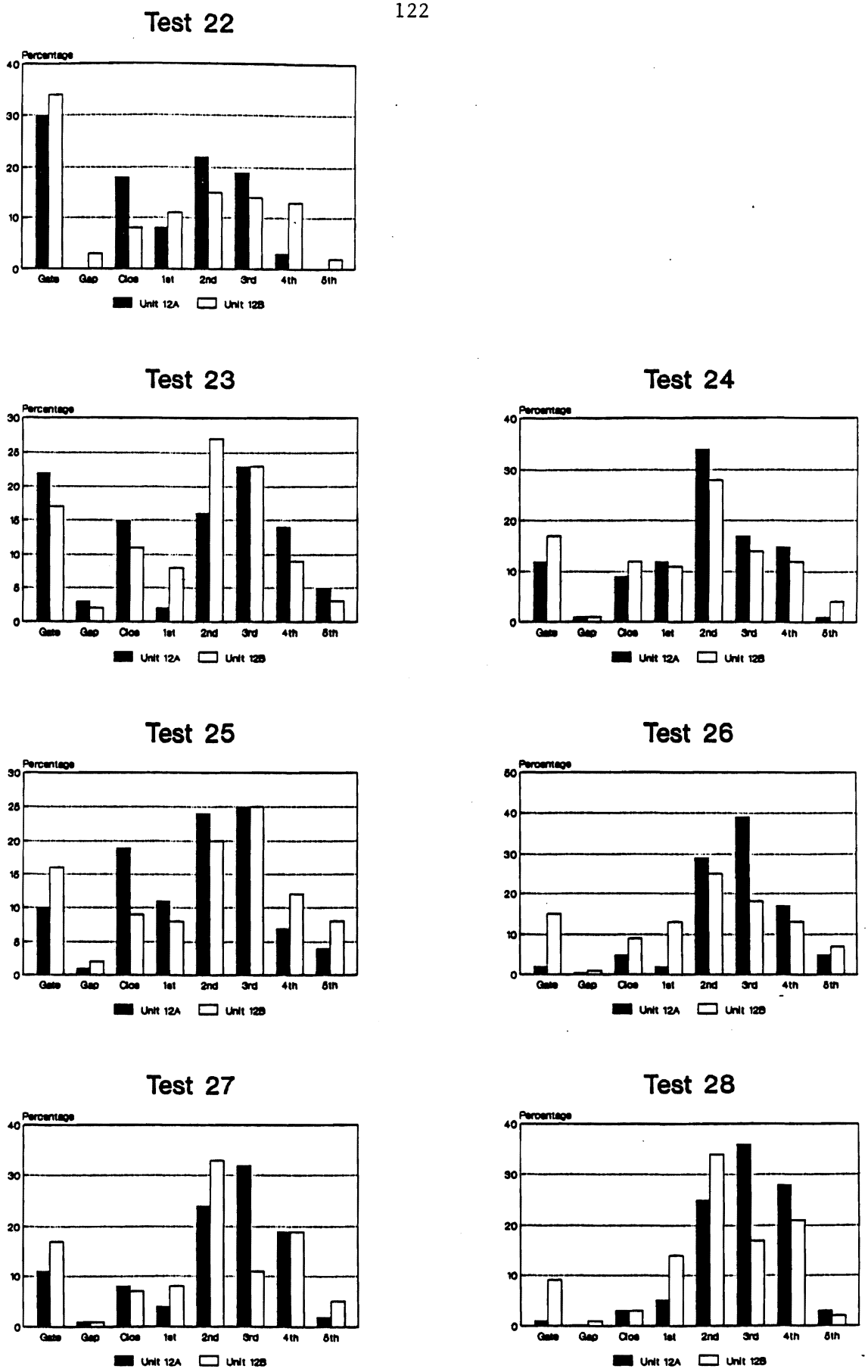




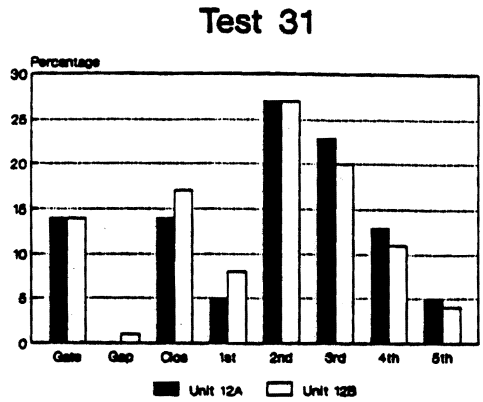


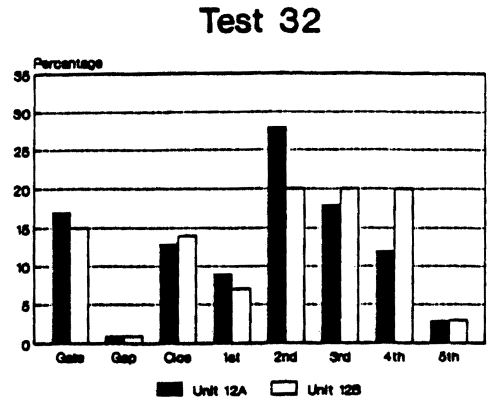


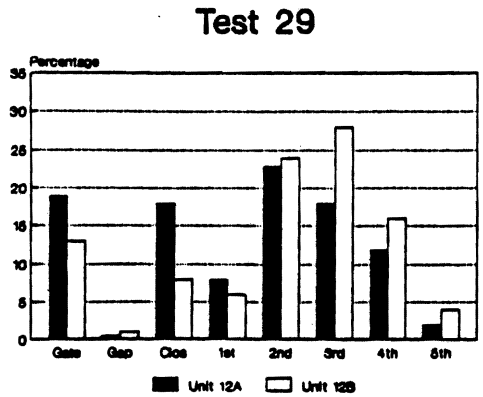
Appendix Figure B1.--Cont.

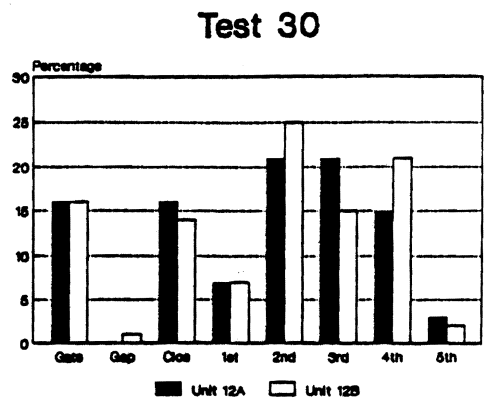


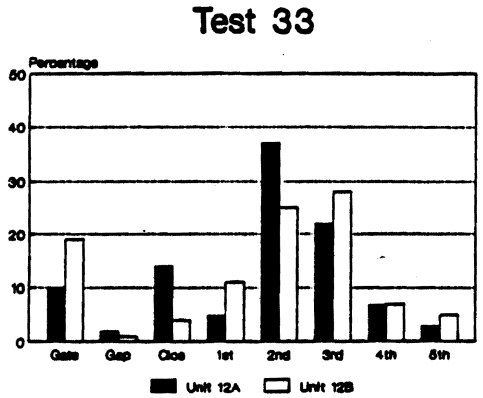
Appendix Figure B2.--Results of STS tests for subyearling chinook salmon showing FGE and percentage of fish captured at the various net levels Bonneville Dam Second Powerhouse, 1987. Test numbers correspond to tests as listed in Table 1 (refer to this for complete test details).

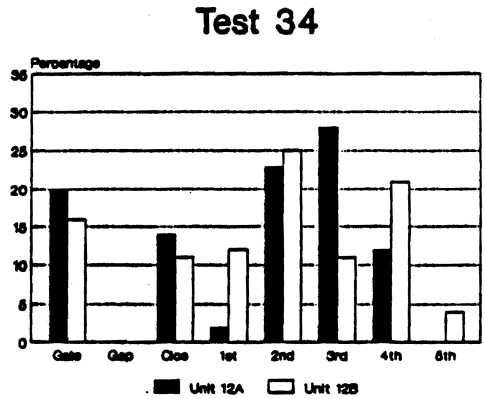


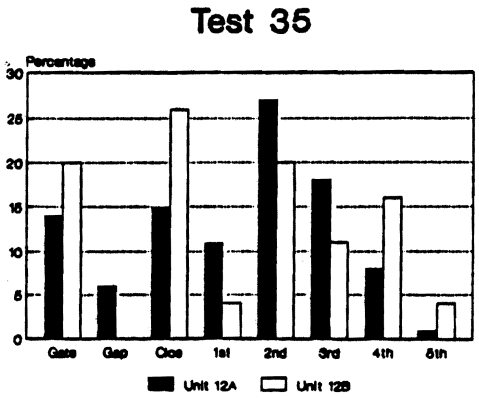


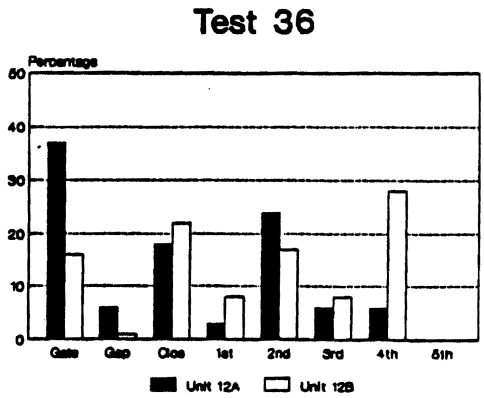












Appendix Figure B2.--Cont.

APPENDIX C

First Powerhouse Indexing Facility Standard Operating Procedures

GENERAL OPERATING PROCEDURES FOR THE DOWNSTREAM MIGRANT (DSM) FACILITY FIRST POWERHOUSE

Sequence for switching DSM channel from south to north flow

1. Close add-in and emergency gates.

2. Use fill valve to fill area beneath inclined screen to elevation 58 ft. This will take 3-4 hours (leakage past the inclined screen weir gate prevents filling above this point).

3. Adjust the inclined screen to the lower limit.

4. Close all orifices, starting with unit 10 and progressing south. Initial closure of north orifice is intended to minimize the tendency of fish to be attracted upstream as water in the transportation channel drops. The water level in channel should be monitored closely so that fish are not stranded.

5. Close south gate.

6. Open two or three orifices to bring water level in the transportation channel up to elevation 58 ft. then pull north bulkhead. It is important to use orifices in low-passage units to reduce the number of fish entering the channel while the water level is still low.

7. Open orifices (6-9), starting with unit 10 and progressing south. To keep fish from accumulating on the dry inclined screen, the water level should be brought up to the screen crest as quickly as possible.

8. When water begins to spill off end of the inclined screen, start raising the screen.

9. Continue opening orifices (3-6 at a time) so that the downwell and 24 in. outfall are filled as soon as possible.

10. Eliminate water by first opening the add-in gate to 15% then opening the emergency gate as required.

11. Final screen and gate settings will depend on forebay level and the desired forebay to channel differential, but the gate settings should be approximately 15% for the add-in gate and 75% for the emergency gate.

12. Close fill valve

Sampling Procedure

1. DSM bypass channel should be running to the north (if not, see above).

2. Using the emergency gate valve, adjust the water level in the DSM channel to attain the desired differential between forebay and channel level. (In the past this has been 5 ft).

3. Adjust the inclined screen so that the water level over the crest meets the desired criteria (6 in. was used in 1987).

4. Use the add-in gate valve to adjust the water level in the downwell. To avoid flooding the sample tank, the water surface in the downwell can rise no higher than 2 ft. below the sample tank support arm.

5. Turn on process water pump (elevation 66 ft.) and fill collection tank, process tank, and recovery tank.

6. Run trash sweep for two cycles before sample is taken and set on manual so that sweeps do not push debris into sample tank while it is fishing.

7. Close the two outside doors on sample tank and (if a separate center section sample is required) close the inside door to center section.

8. Making sure that sample tank remains level, lower tank to approximately 1 ft. above support beam.

9. If all sample flumes are to be used, lock the three sections together and lower by operating both air valves simultaneously. If center flume is to be used alone, unlock the three sections and lower the center section by operating the center section valve only.

10. After the flume is in place, adjust the amount of water entering the sample tank by; (1) raising or lowering the sample tank or (2) adjusting the emergency gate valve. There seems to be less avoidance of the sample flume if it is fished at a flat angle to the screen crest.

11. After the appropriate time interval raise the sample flumes by operating air valves, then raise sample tank to appropriate height (marked on chain).

12. To release fish into collection tank, secure release flumes to sample tank and open east side hatch. If center flume catch is to be held separate, remove last flume section so that fish fall into next compartment and raise inside hatch of sample tank.

13. To ensure that all fish have exited from tank, open west side hatch and use hose to flush out both the tank and the center compartment (fish tend to remain in center compartment if not thoroughly flushed).

14. After fish have been processed and placed in recovery tank, make sure that water in downwell is at least over the sample tank support beam and that the sample tank is raised before the fish are released.

Sequence for switching DSM channel from north to south flow

1. Close orifices (3-6 at a time) starting with unit 10 and progressing south.

2. Coincident with orifice closure, close add-in and emergency gate at a rate that will allow a small amount of flow over the inclined screen. This will prevent fish from being stranded on a dry screen.

3. When orifices, add-in gate, and emergency gate are closed, open south gate. As water level descends off the inclined screen, personnel should walk down inclined screen in order to scare fish back into the channel away from the screen or to salvage fish that become stranded on the screen.

4. With water in transportation channel at elevation 58 ft., place north bulkhead.

5. Reopen orifices.

6. Recover fish trapped on inclined screen side of the bulkhead. A slight opening of the emergency gate will let water drain gradually during salvage.

7. After fish are removed, complete opening of emergency gate.

Note: Since placement of the north bulkhead can be made before water in the transportation drops to elevation 58 ft., consideration should be given to the trade-off between numbers of fish trapped north of the bulkhead and numbers of fish exposed to low water in the transportation channel. Bulkhead placement at elevation 59-60 ft. might be preferable.

Sequence for emergency north to south flow reversal (ie. if trash sweep breaks and crane service not available to place the north bulkhead)

1. Follow steps 1 through 3 of previous procedure.

2. Raise the inclined screen to the upper limit.

3. Reopen orifices.

Note #1: This can be accomplished by raising the screen and opening the south gate in unison, but care should be taken to avoid stranding fish on the screen.

Note #2: Some spill may occur off the inclined screen into the outfall. During a prior use of this sequence few fish were attracted to the outfall, and of those attracted most avoided being carried over the screen crest.

APPENDIX D

Second Powerhouse Indexing Facility Standard Operating Procedures

GENERAL OPERATING PROCEDURES FOR THE DOWNSTREAM (DSM) FACILITY SECOND POWERHOUSE

Sampling Procedure

1. Turn on raceway water supply valves located at the end of each raceway in the fingerling research lab at elevation 45 ft.

2. Open 18 in. valve completely (wheel valve located beneath the dry separator hopper).

3. Open the valve to the dry separator spray bars completely.

4. Open both of the dry separator accessory water valves completely.

5. Open the adult bypass water valve to 30%.

6. Lower the downstream migrant water level so that water is barely cresting over the inclined screen into the downwell.

7. Lower the 10% sampler. Place holding pins in slots (4 total), turn sampler control to "auto" and push travel button.

8. Raise water in channel back to proper level (8 - 10 in. over crest of inclined screen).

9. Open spray bar "T" valve on wet separator so water sprays up approximately 6 to 8 in.

10. Adjust the remaining "T" valves on the wet separator so that there is a forward movement of water over the grading bars with approximately 0.5 in. of water flowing over the downstream end. (Unless the water level in the separator will be continuously monitored it is recommended that the grading bars not be used).

Fish Release Procedures

Note: The collection pool (downwell) at elevation 45 ft. will now be used only when fish are being released. The personnel running the DSM collection can either call an operator (x222) to put the collection pool in service or carry out the following procedures themselves. (As per memorandum dated 9 February 1988 from Phil Jordan, Chief of Operations).

1. Check that the 24 in. water supply knife valve is closed, then completely open the 24 in. butterfly valve.

2. Open the knife valve approximately 3 in. to work the air out, then open in 1 in. increments until the valve is open 5.5 in. (should take about 10 min.).

3. After the water has stabilized, use the knife valve to adjust the water level to approximately floor level elevation of 45 ft.

4. Release the fingerlings and let the water run for approximately 1 hour.

5. Close the knife valve and then the butterfly valve.

Note: If 8 in. flex hose is used as in the case of a tanker truck dumping fingerlings, be sure the plug is installed in the flex hose at completion of the dump to prevent accidental flooding of the building.