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# MONITORING OF DOWNSTREAM SALMON AND STEELHEAD AT FEDERAL HYDROELECTRIC FACILITIES

Annual Report 1999

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# MONITORING OF DOWNSTREAM SALMON AND STEELHEAD AT FEDERAL HYDROELECTRIC FACILITIES - 1999 Annual Report

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*Abstract.*— 1999 marked the second year of sampling in the new Smolt Monitoring Facility (SMF) at John Day Dam. A new high for sample numbers was established in 1999 due to The Dalles Dam spillway survival study collecting fish for PIT tagging from our samples. Collection and index numbers roughly doubled for yearling and subyearling chinook and were about a third higher for hatchery steelhead. Descaling and mortality rates were similar to or lower than last year for all species due in large part to excellent migration conditions in 1999. Flows were manageable and debris was light. Dissolved gas levels were generally below the Oregon and Washington water quality standards. Migration duration was longer this year for all species except for subyearling chinook and sockeye. The PIT tag detection aspect of the facility performed well again this year. Total detections were 138,705, up from 49,615 detections last year. The Separation by Code component of the system also worked well being utilized by 3 studies.

At Bonneville Dam, sampling occurred only in the first powerhouse because the lab for second powerhouse sampling was not completed. Fish guided into the bypass system of the second powerhouse were routed to the new outfall site but condition monitoring was not possible. Sample numbers were down for hatchery sockeye, about the same for wild steelhead and up for all other species. The collection estimate was up 70% for yearling chinook but the index was about the same as last year. Collection and index numbers were up slightly for subyearling chinook, hatchery steelhead, and wild sockeye, but down for wild steelhead, coho, and hatchery sockeye. River conditions were similar to those described for John Day Dam; manageable with little debris. Passage timing was similar to last year for all species and duration for the middle 80% was slightly longer for all species. Descaling rates were below last year and the historical average for all species, but mortality, while still quite low at less than 1.0% for all species, was up slightly for coho and sockeye, compared to last year. PIT tag detection shot up to 130,998 from 43,131 last year.

## PREFACE

Project 84-014 has been part of the annual integrated and coordinated Columbia River Basin Smolt Monitoring Program since 1984, and currently addresses measure 5.9A.1 of the 1994 Northwest Power Planning Council's (NPPC) Fish and Wildlife Program. The program is coordinated by the Fish Passage Center and funded by the Bonneville Power Administration. This National Marine Fisheries Service (NMFS) project was established to: 1) collect and report daily fish capture, fish condition, dam operations, and river flow data to water managers to improve the scientific information on which to base in–season operations of the hydro system, and 2) analyze the collected data and characterize juvenile fish passage at main stem federal dams and transfer this information, learning, and understanding to the fisheries community through technical reports and publications. In the 1980s, this project conducted the smolt monitoring at Lower Granite, Lower Monumental, McNary, John Day, and Bonneville dams. Since the early 1990s, the smolt monitoring at the Snake River dams and McNary Dam has been assumed by non-federal entities, mainly the states of Washington and Oregon, and this project has performed the smolt monitoring at John Day, The Dalles (1989 – 1991), and Bonneville dams.

In 1999 the contract for project 84-014, which was the remaining federal portion of the Smolt Monitoring Program (SMP), was not renewed. The work previously done under this contract was combined with the non-federal portion of the SMP, project 87-127. This consolidation was done to facilitate review and reduce administrative costs.

The following report presents results from the 1999 smolt monitoring season at John Day and Bonneville dams and represents the sixteenth annual report for SMP activities at these two sites. The report also contains summaries of data for all years of the program at John Day and Bonneville dams in Appendices C and D.

# INTRODUCTION

The seaward migration of juvenile salmonids was monitored by the Pacific States Marine Fisheries Commission (PSMFC) at John Day Dam, located at river mile 216, from 1 April to 26 October 1999 and at Bonneville Dam, located at river mile 145, from 13 March to 29 October (Figure 1). The PSMFC Smolt Monitoring Project is part of a larger Smolt Monitoring Program (SMP) coordinated by the Fish Passage Center (FPC) for the Columbia Basin Fish and Wildlife Authority. This program is carried out under the auspices of the Northwest Power Planning Council's Fish and Wildlife Program and is funded by the Bonneville Power Administration.

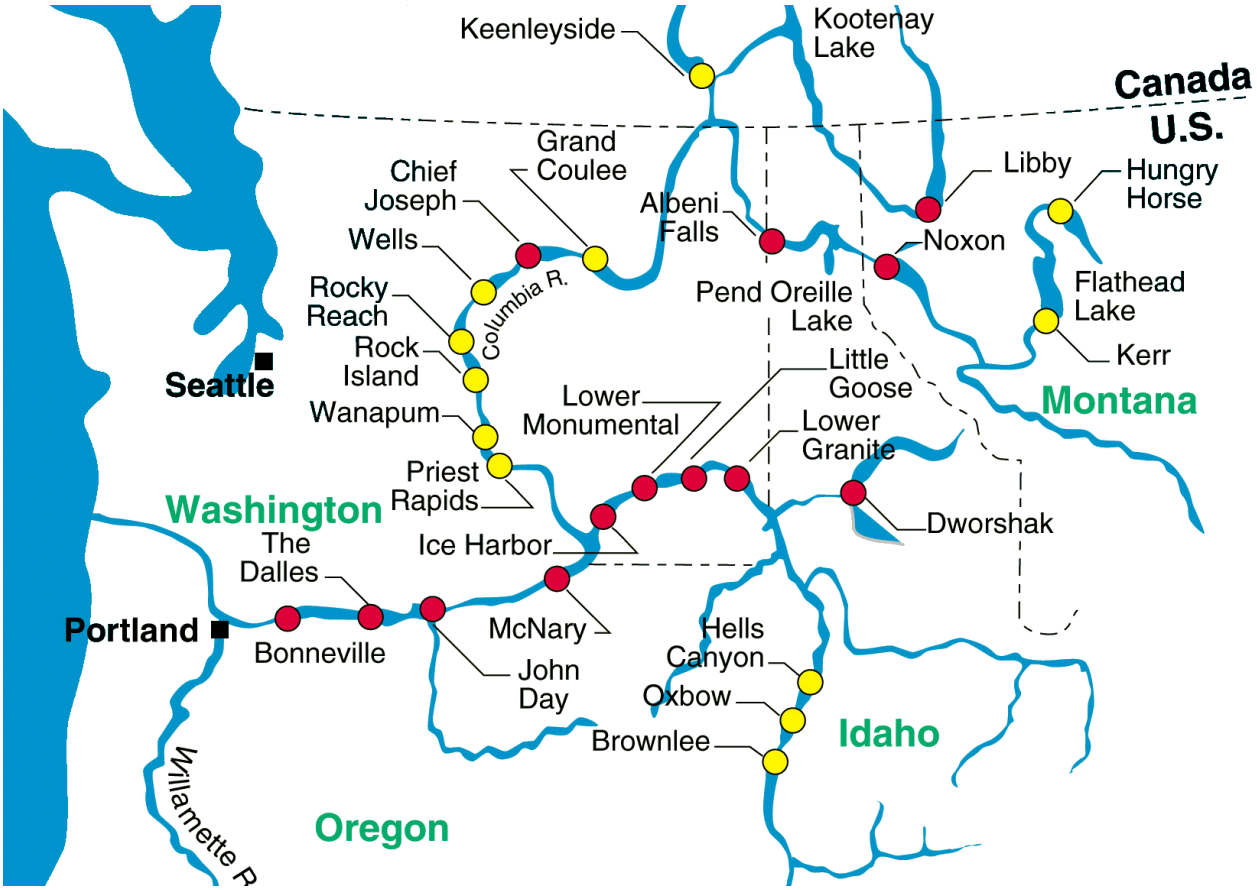


Figure 1. Hydroelectric projects on the Snake and Columbia Rivers. This figure is reprinted courtesy of the U.S. Army Corps of Engineers, Portland District.

The purpose of the SMP is to monitor the timing and magnitude of the juvenile salmonid out-migration in the Columbia basin and make flow and spill recommendations designed to facilitate fish passage. Data are also used for travel time and survival estimates and to build a time series data set for future reference. The purpose of the PSMFC portion of the program is to provide the FPC with species and project specific real time data from John Day and Bonneville dams.

# METHODS AND MATERIALS

## JOHN DAY DAM

### Sampling

In 1999, the second year of sampling in the new monitoring facility at John Day, sampling commenced on 1 April and ended on 26 October. The sample day start and stop time changed from 0700 to 0700 hours last year to

midnight to midnight this year. This was done primarily to make sample collection times coincide with flow data summaries and calendar days. Samples were collected seven days a week, as in past years. Each sample day was divided into four sample periods. Fish collected during the first (0000-0300) and fourth (2000-0000) sample periods were processed hourly. This is done to reduce delay to actively migrating smolts during peak passage hours and to accommodate the research fish collection needs. Fish collected during the second (0300-1400) and third (1400-2000) sample periods were processed at the end of their respective collection periods. At the end of the sample day, the total of the four sample periods comprised the daily count.

Prior to 1998, samples were collected from one or two of 48 gatewells with an airlift pump system of the type described by Brege et al. (1990), and depicted in Figure E-3. Through 1994, all fish collected were sampled. In 1995, subsampling was introduced to reduce the number of fish handled. Subsample rates were 25%, 33%, and 50%. Beginning in 1998 and henceforth, the new SMF expanded the sample rate range to 0.67% - 100%, and began collecting samples from the bypass channel, which contains all of the guided fish. The sample rate and number of diversions per hour, which ranged from 2 - 6, were entered at the top of the hour for consistency and fish collected at different sample rates were kept separate. During the spring, with more species present, the target sample size range was 500 - 750 fish per day. During the summer/fall migration, with mainly subyearling chinook present, the target sample range was 350 - 500 fish per day. Sample rates were adjusted as needed to achieve these target sample sizes. Timed subsamples are collected using a 3-way rotational gate. When the gate rotates left, all fish are diverted into the sample holding tank. The center flume is the bypass-to-river flume and a rotation to the right diverts fish into the PIT tag flume and one of two PIT tag-holding tanks (Figure E-2). The 3-way gate can also be programmed to collect specific PIT tagged fish detected in the coils just upstream, a feature referred to as Separation by Code. For a complete summary of sample rates and target estimates, see Table C-10.

Fish were collected in a 6,796 liter (1,795 gal) holding tank located inside of the sampling lab. At the end of a sample period, the crowder was moved forward and the next sample was collected behind it. Approximately 50 - 75 smolt were then crowded into a 20 by 24-inch pre-anesthetic (PA) chamber using a panel net. The water level in the PA chamber was lowered to about 8 inches (48 liters) and fish were anesthetized with MS-222 at a concentration of about 51 mg/L. Once anesthetized, fish were gravity fed via a 6 inch PVC pipe onto a final dewatering screen and into the examination trough that contained about 36 mg/L of MS-222 to minimize stress during examination. A recirculating system was used to minimize MS-222 usage and a chiller kept examination trough water temperature consistent with river water temperature. Following examination, all sampled fish were gravity fed via a 4 inch PVC pipe to a 2,726 liter (720 gal) recovery tank and held for a minimum of twenty minutes before being returned to the bypass system. This process was repeated until the entire sample had been examined. All holding and recovery tanks had a constant exchange of river water. Diagrams showing the footprint of the facility and the schematic of the lab are presented in Figures E-1and E-2, respectively.

**BONNEVILLE DAM**

Smolt monitoring began on 13 March and concluded on 29 October. Fish samples were collected from the bypass channel of the first powerhouse using the downstream migrant trap. Gessel (1986) described the trap operation and a cross sectional diagram of it can be seen in Figure E-4. There was no sampling at the second powerhouse this year because of construction activity in that area. Specifically, the collection channel and dewatering system underwent major revision. The dewatering system was converted from a floor screen to a wall screen system and the remaining flow was directed into a 48" pipe rather than the downwell. The 1.7 mile long pipe led to a new monitoring facility that was not completed. Lyle Gilbreth, of the National Marine Fisheries Service, collected some fish in temporary facilities for post construction evaluation, but no other sampling was conducted. Please see Krcma et al. (1984) for a description of the system used prior to 1997. For a description of the system used in 1997 and 1998 see the 1998 report for this project, Martinson, et. al. 1998, and for diagrams of the system see Figures E-7 and E-8. Figure E-6 shows the fish processing area of the second powerhouse used through 1998.

**First Powerhouse**

Sampling effort in PH1 remained at 8 hours per day in 1999. Samples were collected hourly, from 1600 to 2400 hours, seven days per week. The sample rate was adjusted on an hourly basis from 30 seconds to 15 minutes per hour (0.83% - 25%). Sample time was split into two samples of equal duration per hour, except during periods of high passage, when only one sample of 30, 36, 48, or 72 seconds was taken. Samples were collected by lowering a wedge wire screen into the bypass channel at the end of the inclined screen, diverting fish into a 2,415 liter (638 gal) tank suspended in the downwell (Figure E-4). Collected fish were drained from the tank to a stainless steel holding

tank via a rectangular chute. From there, about 50 fish at a time were crowded into a PA chamber (a modification for 1999) and anesthetized with MS-222 at a concentration of about 51 mg/l. Once anesthetized, fish were net transferred from the holding tank to the sorting trough. The sorting trough contained the same anesthetic at a weaker concentration, about 42 mg/l, to minimize stress during handling. Also added to the sorting trough was about 15 ml (0.16 mg/l) of a water conditioner called PolyAqua. It was intended to aid mucous layer regeneration on descaled fish. After processing, sampled fish passed through a tunnel PIT tag detector before emptying into a recovery tank. The practice of diverting PIT tagged fish to a separate recovery tank for collection of condition data was dropped this year. The data was spotty, difficult to collect and in some cases, was unjustifiably stressful to the fish. Fish were allowed to recover for at least 30 minutes before releasing them into the Juvenile Bypass System (JBS) via a 6-inch PVC pipe. A diagram of the PH1 sampling area is presented in Figure E-5.

**Flat Plate Operation**

The flat plate was operated concurrent with sampling (1600-2400 hours) from 23 March through 31 March, and again from 15 September through 29 October. From 1 April through 14 September, when fish passage was higher, the flat plate was operated 24 hours per day. The flat plate antennae system consists of two detection coils, each sealed in individual watertight casings. The cases were fitted in a frame mounted on top of the collection tank and attached with a pivoting arm in each corner. A pneumatic cylinder was used to raise or lower the flat plate system. Between samples, the flat plate was lowered onto the tank and the tank was lowered to sampling position. When the screen was lowered, fish passing over the flat plate were scanned for PIT tags. For sample collection, the flat plate was raised and fish were diverted into the collection tank.

**Gas Bubble Trauma Subsampling**

From 6 April through 29 August, 100 fish per day were examined for the presence of gas bubbles. Examinations were performed on unpaired fins, eyes, and the lateral line using a variable power magnification (6X to 40X) dissecting microscope. Steelhead and the most abundant chinook, yearling or subyearling, were examined on alternating days. Bubbles were quantified as the "percent of the lateral line occluded" or, on fins, "percent of surface area covered" and assigned a severity ranking. If occlusion was less than 5%, a rank of 1 was assigned. A rank of 2 was used for the 6% - 25% range, rank 3 for the 26% - 50%, and a rank 4 for greater than 50%.

**JOHN DAY AND BONNEVILLE**

**Subsampled Fish Condition**

Detailed fish condition monitoring was performed on a target sample size of 100 individuals per species, three days per week. Steelhead and sockeye were examined Tuesday, Thursday, and Saturday, whereas chinook and coho were examined Monday, Wednesday, and Friday. The sample crews attempted to choose fish at random and to select fish throughout the sample day. In addition to fin clips and marks (brands or tags), smolts were examined for descaling, injuries to the head and body, parasites, disease, and signs of predation. Fork lengths were also recorded so that length averages could be calculated for all subsampled fish. At John Day, condition data was collected on yearling chinook, steelhead, coho, and sockeye from 9 April to 12 June and subyearling chinook were examined from 12 June to 1 October. Bonneville condition data was collected on yearling chinook, steelhead, coho, and sockeye from 16 March to 24 June and subyearling chinook were examined from 11 June to 10 September.

**Performance Monitoring**

Tests to evaluate species identification, brand recognition, descaling assessment, and data recording accuracy of SMP personnel were conducted during the migration season. A subsample of ten fish were randomly selected, anesthetized, and placed into a compartmentalized divider located in the sorting trough. Fish were processed independently and specific details were recorded for each fish including: 1) species, 2) fin clip, 3) level of descaling, and 4) presence of external marks or tags. Coworkers then compared and discussed results. This approach has several advantages over previously used methods, including: 1) increased frequency of tests, 2) up to three people are able to test concurrently, 3) promotes teamwork and builds consistency between coworkers, and most importantly, 4) the ability to discuss discrepancies with fish in hand.

**Data Collected**

Items 1-5 of the following list were reported to the Fish Passage Center daily; item 6, the PIT tag data, was automatically uploaded to the PTAGIS data center four times per day.

1) Species specific hourly and daily sample totals
2) Brands and fin clips
3) Descaling and mortality
4) Species specific length and condition data (subsampling only)
5) River, powerhouse, turbine, and spill flow data
6) PIT tag detection

## DEFINITION OF TERMS

Three types of numbers are discussed in the report, defined as follows:

1) Total Sample: actual fish counts, number of fish handled.

2) Estimated Collection: total sample number divided by sample rate, resulting in an estimated number of fish passing through collection system.

3) Fish Passage Indices: estimated collection counts divided by the proportion of total river flow passing through the sample system resulting in a relative indicator of fish abundance with no adjustment for Fish Guidance Efficiency, horizontal, vertical or temporal fish distribution.

As stated in the Fish Passage Center Annual Reports, Fish Passage Indices (FPI) are used as relative indicators of population abundance, and assumes that fish pass through spill and powerhouse units in numbers proportional to the flow through those passage routes. Indices are not estimates of total daily passage, but rather a relative measure of how the migration is progressing over the season for a given species.

In the past, both sites have generated hourly and daily indices, and these numbers are still listed in some of the historical tables in Appendices C and D, so they are defined as follows:

Hourly Resolution FPI divides hourly collection counts by the proportion of river flow through the sampled unit or powerhouse for that hour, then sums hourly subtotals to get the daily total. There is no expansion for 8 hour monitoring at Bonneville.

Daily Resolution FPI divides daily collection counts by the proportion of daily average river flow through the sampled unit (JDA) or powerhouse (BO1) for the day.

# RESULTS AND DISCUSSIONS

## JOHN DAY DAM

### The Numbers

#### Sample Numbers

The total number of fish handled at John Day in 1999 was 560,708 (Table 1), about a 7-fold increase over the 1998 total of 83,311. Species specific sample numbers expressed as a percent of 1998 sample numbers are as follows: wild sockeye, 1,249%; subyearling chinook, 745%; coho, 712%; hatchery sockeye, 682%; hatchery steelhead, 676%; yearling chinook, 578%; and wild steelhead, 400%. See Table 1 for the actual numbers and Table C-10 for a comparison to previous years. The large increase in sample numbers is the result of a National Marine Fisheries Service study to evaluate survival of fish passing over The Dalles Dam spillway. Fish for the study were collected at John Day Dam.

The species composition, expressed as a percent of all the fish sampled, was higher this year than last year for subyearling chinook, 41.4%/37.4%; coho, 6.8%/6.4%; and sockeye, 9.8%/5.4%. It was lower for yearling chinook, 28.6%/33%; and wild steelhead, 6%/10.1%; and stayed the same for hatchery steelhead, 7.5%/7.5%.

#### Collection Estimates

The total collection estimate of 6,370,374 is about twice the 1998 collection estimate, which was larger than all but one of the previous *Fish Passage Indices (1995)*. Increases ranged from 101% for wild steelhead to 211% for yearling chinook. Collection estimates for the remaining species, expressed as a percent of last year, are as follows: subyearling chinook, 195%; hatchery steelhead, 144%; wild sockeye, 121%; hatchery sockeye, 105%; and coho, 105%. The large increase in collection estimates from 1997 to 1998 can be explained by the transition from the "single gatewell airlift sampling system" to the "whole bypass sampling system" which is much more representative of the actual numbers passing through the bypass system. However, the increases for yearling and subyearling chinook and hatchery steelhead in 1999 must be due to other factors. Possible explanations include: less spill in April and May this year, resulting in more fish passing the dam through the bypass system, increased wild or hatchery production resulting in more fish in the system, reduced transportation of the species whose numbers increased, or a combination of these factors.

#### Fish Passage Indices

Collection numbers are divided by the proportion of river flow through the sample unit to get a Fish Passage Index (FPI). The 1999 index total for all species combined was 8,512,862, the largest index ever recorded at John Day and about 1.5 times greater than the 1998 FPI of 5,489,754, which itself was 3.5 times greater than any previous index. The possible explanations for such a large increase are the same as those listed in the Collection Estimates section. A breakdown by species for sample, collection, and index numbers can be found in Table 1 and a comparison of 1999 numbers to all previous years can be found in Table C-10. For more information on collection and index estimates see the Fish Passage Center Annual Report.

### River Conditions

#### River Flow

The 1999 spring (April & May) river flow averaged 275.9 kcfs, similar to the 263.3 kcfs for the same period last year. The spring peak flow of 380.8 kcfs occurred on 28 May and was about 55 kcfs smaller than last years 31 May peak of 435.4 kcfs. Flows were above 300 kcfs for all of June, averaging 343.7 kcfs for the month. In July, the average was about 100 kcfs less at 249.7 kcfs for the month. In August, the decline was about half that seen in July, down to an average of 204.8 kcfs. For June, July, and August, river flow averaged 265.2 kcfs. For September and October, flows ranged between 88 kcfs and 180.9 kcfs, averaging 131.1 kcfs for the period (Figure 3).

Table 1. Summary of 1999 smolt monitoring at John Day and Bonneville dams.

| Species | Site | Sample | | Collection[1] | | FPI[2] | Descaling[3] | | Mortality[4] | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Number | Percent Comp. | Number | Percent Comp. | | # | % | # | % |
| Yearling Chinook | John Day | 160,378 | 28.6 | 1,597,819 | 25.1 | 2,193,904 | 9,952 | 6.2 | 882 | 0.55 |
| | Bonneville PH #1 | 15,279 | 21.9 | 165,918 | 19.1 | 341,171 | 482 | 3.2 | 37 | 0.24 |
| Subyearling Chinook | John Day | 232,131 | 41.4 | 3,090,201 | 48.5 | 3,962,632 | 2,094 | 0.9 | 282 | 0.12 |
| | Bonneville PH #1 | 35,637 | 51.2 | 474,874 | 54.8 | 1,692,665 | 339 | 1.0 | 71 | 0.20 |
| Wild Steelhead | John Day | 33,545 | 6.0 | 299,072 | 4.7 | 418,515 | 649 | 1.9 | 36 | 0.11 |
| | Bonneville PH #1 | 2,549 | 3.7 | 28,834 | 3.3 | 108,164 | 29 | 1.1 | 4 | 0.16 |
| Hatchery Steelhead | John Day | 42,003 | 7.5 | 586,952 | 9.2 | 820,431 | 2,537 | 6.1 | 83 | 0.20 |
| | Bonneville PH #1 | 5,647 | 8.1 | 65,488 | 7.6 | 243,147 | 170 | 3.0 | 4 | 0.07 |
| Coho | John Day | 37,941 | 6.8 | 388,932 | 6.1 | 543,318 | 1,397 | 3.7 | 78 | 0.21 |
| | Bonneville PH #1 | 8,411 | 12.1 | 98,370 | 11.4 | 375,644 | 94 | 1.1 | 31 | 0.37 |
| Wild Sockeye | John Day | 53,236 | 9.5 | 391,416 | 6.1 | 551,580 | 4,262 | 8.1 | 616 | 1.16 |
| | Bonneville PH #1 | 2,008 | 2.9 | 31,706 | 3.7 | 112,797 | 152 | 7.6 | 15 | 0.75 |
| Hatchery Sockeye | John Day | 1,474 | 0.3 | 15,982 | 0.3 | 22,483 | 69 | 4.7 | 3 | 0.20 |
| | Bonneville PH #1 | 110 | 0.2 | 1,394 | 0.2 | 5,406 | 3 | 2.7 | 0 | - |
| SEASON TOTALS | John Day | 560,708 | | 6,370,374 | | 8,512,862 | 20,960 | 3.8 | 1,980 | 0.35 |
| | Bonneville PH #1 | 69,641 | | 866,584 | | 2,878,994 | 1,269 | 1.8 | 162 | 0.23 |

[1] Collection numbers are sample numbers divided by sample rate.

[2] FPI (Fish Passage Index) is collection divided by the proportion of daily average river flow through the powerhouse

[3] Descaling numbers are based on sample numbers minus mortality numbers

[4] Mortality numbers are based on sample numbers.

**Spill and Dissolved Gas**

Lower river flows in 1999 resulted in less spill volume and a lower proportion of total river being spilled in April and May. Spill, expressed as a percent of total river flow, averaged 22% in April and May (spill for juvenile migration began 12 April) compared to 27% for the same period last year. Throughout the rest of the spill program, June, July, and August, spill averaged 27% of river flow, similar to last year. The addition of flow deflectors at the base of the spill bays helped keep dissolved gas levels low this year, averaging just 113.4 % in the John Day tailrace for April and May. This compares to an average of 116 % last year. For the rest of the spill program for juveniles, June through August, percent saturation in the tailrace averaged 117.9% in 1999. These levels of spill enabled the total dissolved gas limits imposed by the Washington and Oregon water quality departments to generally be maintained. For more detail on dissolved gas levels and monitoring results, see the Fish Passage Center annual report.

**Temperature**

Spring water temperature in the fish handling facility ranged from $45.8^0$F to $59^0$F and averaged $51.5^0$F, a couple degrees cooler than last years average of $53.8^0$ F for the same period. During June and July the range was $56.7^0$F to $68^0$F with an average of $62.1^0$F, about 5 degrees cooler than the same period last year. In August and September, the range was $63.8^0$F to $71^0$F, with an average of $67.9^0$ F. The highest temperature of the year was $71^0$ F recorded on 9 and 10 August.

**Passage Patterns**

**Seasonal**

The relative run timing (10, 50, and 90% passage dates) and the duration of the middle 80% (in days) for 1999 are compared to the median dates in Figure 2. Compared to historical medians, the 10% passage dates were earlier or the same for all species except subyearling chinook. The 90% passage dates were also very similar or later for yearling chinook, wild steelhead, hatchery steelhead, and coho. This resulted in the middle 80% of the outmigrants taking longer to pass John Day Dam for those species (Figure 2). This shifting of the migration to later in May for these three groups can be seen in Figure C-1. For subyearling chinook, the 90% passage date was much earlier than the historical median resulting in a more condensed migration, 38 days compared to 66 days, respectively. This was due mostly to a passage peak of about 7% of the total occurring for 3 days, 27, 28, and 29 of June (Figure C-1). Sockeye migration timing was very similar to the historical median in duration and consisted of distinct passage peaks for wild and hatchery fish (Figure 3). Yearling chinook passage was very similar to 1998 and previous years in both timing and magnitude (Figure 2 and C-2).

When the duration of the 1999 passage is compared to 1998 and previous years, the patterns are very similar to those seen when comparing 1999 to the historical median 10% and 90% passage dates. Wild and hatchery steelhead patterns are worth noting, establishing a new record for days required for the middle 80% of the migration to pass John Day Dam (Figure C-2 and Table C-2). Similarly, the middle 80% of the coho migration was protracted compared to previous years, with just one year, 1997, taking longer to pass John Day Dam.

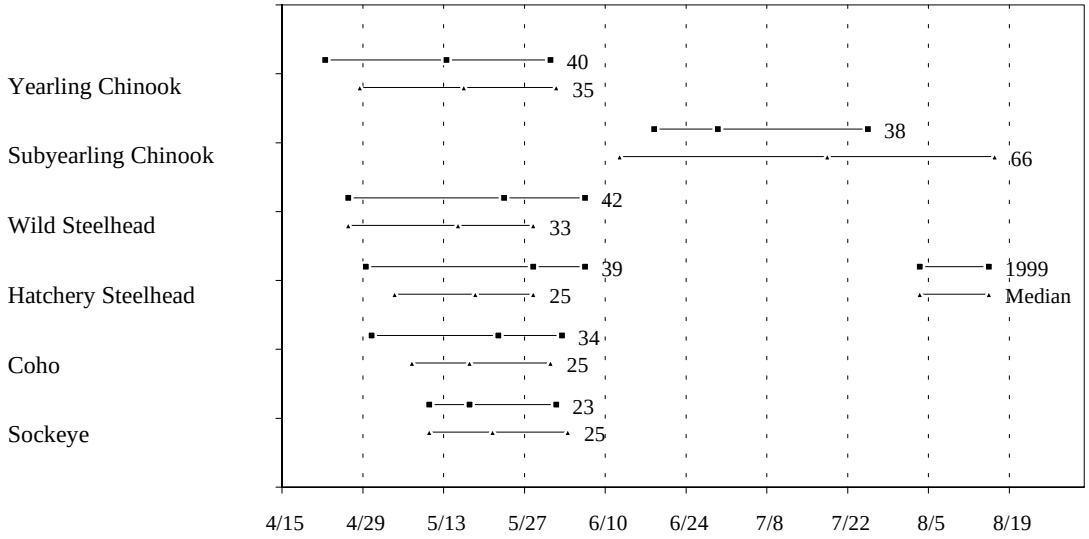


Figure 2. 10%, 50%, and 90% passage dates and the historical median at John Day Dam, 1999. The duration between the 10% and 90% passage dates is indicated for each line.

Conversely, subyearling chinook passage at John Day was among the quickest ever recorded with just 2 years, 1985 and 1994 taking fewer days for the middle 80% to pass John Day Dam (Figure C-2 and Table C-2).

Yearling chinook passage began increasing in the middle of April and continued through the first week of June. Passage peaked in mid May at about 4% of the season total (Figure 3). Wild and hatchery steelhead and coho passage patterns were similar this year. Passage began increasing about the 22$^{nd}$ of April, held steady to varying degrees until the end of May, first of June, when passage increased to the seasonal high of about 5 to 6% of the total. Sockeye passage was marked by distinct peaks for wild and hatchery fish. Wild sockeye passage peaked on May 16 at about 8% of total while hatchery sockeye passage peaked later, about the 5$^{th}$ of June at almost 13% of total. Subyearling chinook passage was highest in the last three days of June at about 7% of the total index and remained below 3% of total for nearly the rest of the season.

The average passage pattern for all species with the standard deviation for each day are presented in Figure C-1. Wild steelhead show the most variability around the beginning and end of the migration, while the other stocks showed more variance around the peak of the migration.

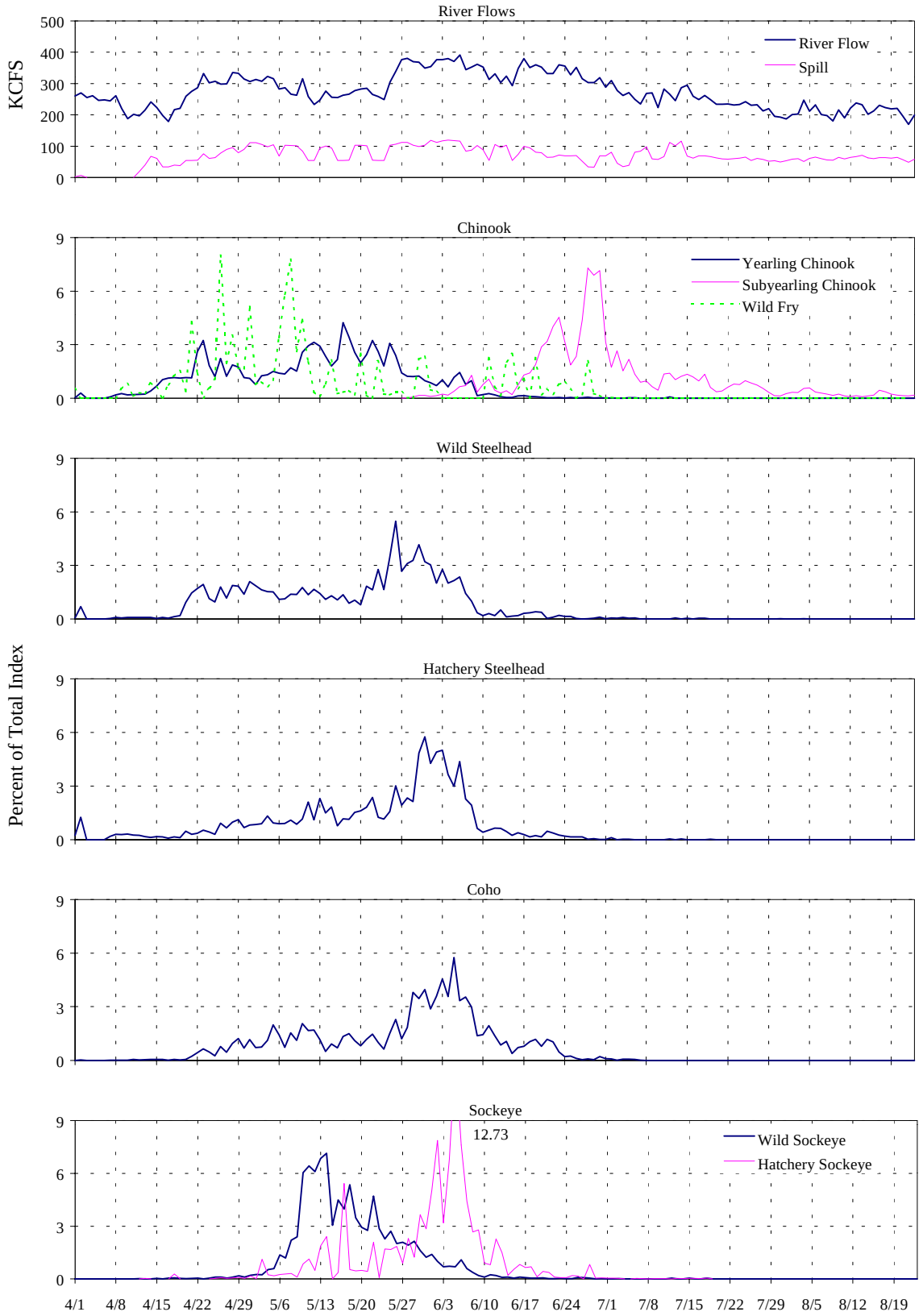


Figure 3. Seasonal passage patterns and daily average river flows for John Day Dam, 1999.

**Diel**

With the relocation of sampling to the new smolt monitoring facility in 1998, the collection of the hourly passage detail was discontinued. However, the diel data collected between 1985 and 1997 is presented several ways in Appendix C. Table C-1 presents the total percent of night passage by species for each year. Figure C-3 is a graphical presentation of the diel pattern for all years, averaged and presented with standard deviation for each hour. Figure C-4 shows the percent of night passage as a bar graph for each year and species, with the average for each species shown as a line. Table C-3 shows the percent of total passage each year by hour for each species.

**Fish Condition**

Descaling in 1999 was lower than last year and the historical average for subyearling chinook, hatchery steelhead, coho, and sockeye. Descaling was slightly higher than last year but still below the historical average for yearling chinook and wild steelhead. Debris in the river, which is the biggest contributor to fish descaling and injury, was light again this year and generally made for good migration conditions. The largest decline in descaling from last year to this year was for sockeye, going from 16.3% to 8% (Figure 4 and Table C-4).

Descaling for yearling chinook fluctuated between 5% and 10% all season, with three exceptions, one on 15 April of about 11%, and two others on 4 and 6 June of 11.7% and 12%, respectively (Figure A-1). For the season, yearling chinook descaling averaged 6.2%, among the lowest of rates recorded for that species at John Day. Wild steelhead daily descaling was between 1% and 3% most of the season. On 15 and 16 June, near the end of the migration, 9 of 39 (23%) and 13 of 123 (10%), respectively, of the wild steelhead were descaled (Figure A-1). The seasonal average of 1.9% is up just slightly from the lowest descaling ever recorded (1.6% in1998) for this species at John Day (Table C-4 and Figure C-5). Hatchery steelhead descaling ranged from 4% to about 15%, with the highest rates at the end of the migration (Figure A-2). The average for the season was 6.2%, the second lowest ever recorded at John Day. Coho descaling was below 6% throughout May, peaked at about 9% a couple of times in June, and averaged just 3.7% for the season, the second lowest at John Day.

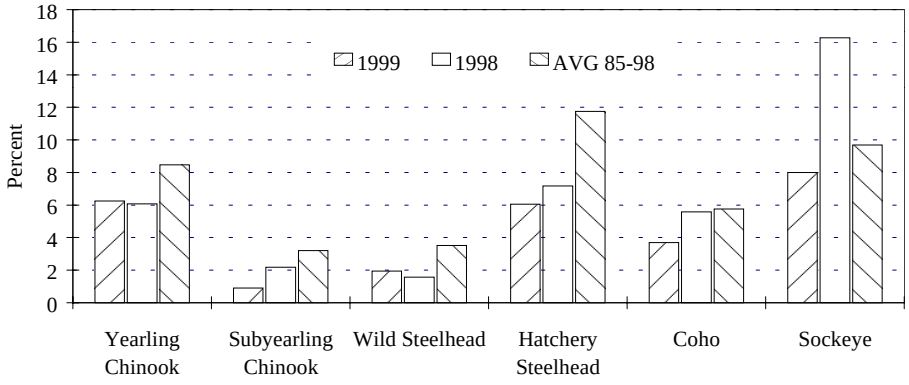


Figure 4. Total descaling for 1999, compared to 1998 and to the 85-98 average at John Day Dam.

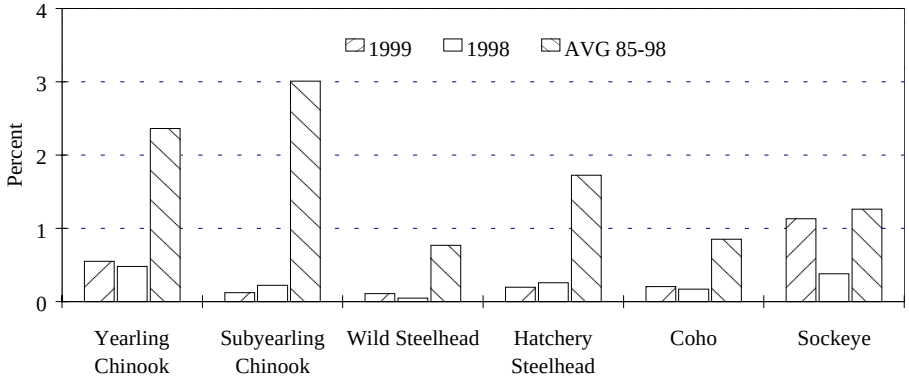


Figure 5. Total mortality for 1999, compared to 1998 and to the 85-98 average at John Day Dam.

Sockeye descaling was highly variable from day to day, routinely fluctuating between 5% and 15%, and occasionally climbing to 24%. The seasonal average was 8%, about half of last years rate and slightly below the historical average of 10.1%. The number of hatchery sockeye sampled was so small (1,474) compared to the wild fish number (53,236), that for most analyses, the two were added together. Subyearling chinook descaling went to 10% on 4 June but for the rest of the season stayed below 5% (Figure A-1) and averaged just 0.9% for the season,

the lowest ever recorded at John Day. Historical descaling data are presented in Table C-4 and Figure C-5.

Mortality rates in 1999 were very similar to last year. The one notable exception was sockeye which were at 1.1% for the year, up from 0.4% last year and just 0.8% below the historical average (Figure 5, Figure C-6, Table C-4).

**Subsampled Fish Condition**

In 1999, 21,375 smolts were examined for detailed condition information. Partial descaling (3-19% on one side) was higher for all species except subyearling chinook, which went from 7.7% to 4.8%, the second lowest ever recorded. The amount of increase for the other species ranged from about 3 to 7 percentage points. Sockeye set a new high for partial descaling at 19.05%. Hatchery steelhead had the highest incidence of operculum damage at 2.4%, which is 0.1% higher than last year. Again, as in past years, the incidence of attempted bird predation was much higher on hatchery steelhead (8.4%) than any other species (0.3% - 4.9%). All species exhibited an increase in the frequency of body injuries in 1999, in the range of 1 to 2 percentage points. Hatchery steelhead had the highest incidence at 4.3%, up from 0.5% observed in 1998. The number of parasites on wild steelhead doubled from 2.4% in 1998 to 5% in 1999. Columnaris infection in subyearling chinook was up slightly from 0.06% last year to just 0.1% this year. See Methods section for a complete list of possible conditions and techniques. For a historical summary of condition subsampling results, see Table C-5.

**Gas Bubble Trauma Monitoring**

No sampling of juvenile salmonids for Gas Bubble Trauma was done at John Day in 1999.

**Length Averages**

Since high percentages of outmigrating smolts are of hatchery origin, length data are primarily a function of smolt size at the time of release. However, graphing the data does show relative size differences and trends throughout the season. Hatchery steelhead were consistently the largest fish sampled until late June. Subyearling chinook and wild steelhead increased in size as the season progressed and all other species varied (Figure 6).

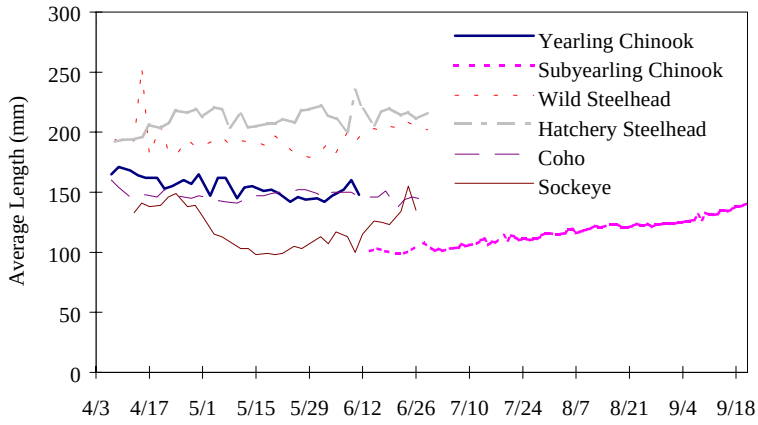


Figure 6. Average length of juvenile salmonids at John Day Dam, 1999.

**PIT Tags and External Marks**

**Passive Integrated Transponder (PIT) Tags**

Total PIT tag detections increased almost 3 fold this year, going from 49,615 in 1998 to 138,705 in 1999. The increase is not surprising considering the 170% increase in collection numbers and increased use of PIT tags in the basin. When these numbers are compared to the previous high of 3,784 detected in 1996 while sampling in two gatewells, the utility of this facility for research is clear (Table C-6). Chinook (53%) and steelhead (43%) combined constituted 96% of all detections. About 1% of the detections were from "holdovers", or fish that were scheduled to migrate in some year other than 1999. A summary for this year by species, run, rearing type, and scheduled migration year, can be found in Table A-1.

**Elastomer Tags**

One of the more popular tags replacing freeze brands is the elastomer tag. These are small pieces of colored plastic that are injected into tissue posterior of the eye. A total of 6,057 elastomer tags were recorded this year, which is 7.2 times the number observed in 1998, a direct correlation to the increase in sample numbers. Table A-2 contains details for these marks.

**Freeze Brands**
A total of 55 freeze brands were observed in 1999, down from 84 last year. All were on hatchery steelhead from 1 of 3 release sites, Lyons Ferry hatchery, Cottonwood Acclimation Pond, or the Tucannon River (Table A-2). See Table C-7 for a summary of brands per year by species, which shows the declining use of freeze brands.

**Performance Monitoring**
*Personnel*
As part of our quality control program we have developed a method of checking species identification, fin clips, descaling, and brand/tag recognition skills. In short, up to three people look at the same 10 fish and compare results. Any discrepancies are discussed while the fish is "in hand". For a full explanation of the test protocol, see the Methods section. Overall, coworkers were in agreement with each other 98.8% of the time. No mistakes were made identifying fish to species or spotting marks (elastomer tags, freeze brands, and PIT tag scars). Clips were spotted 98.8% of the time and the descaled determination was made accurately 97.6% of the time.

Table 2. Results of the quality control tests.

| Category | Fish ID | Clip | Descaled | Mark | Total |
|---|---|---|---|---|---|
| Errors | 0 | 2 | 4 | 0 | 6 |
| Possible | 170 | 170 | 170 | 6 | 516 |
| % Correct | 100 | 98.8 | 97.6 | 100 | **98.8** |

*Equipment*
Lost or biased sample time totaled 169 hours, which represented 3.4% of the 1999 sampling season. Lost sample time was due to 3-way rotational gate malfunction, scheduled and unscheduled inspections, and scheduled hydrological evaluations by CoE district personnel. The screen cleaning system was out of service for approximately 77 days, or 37% of the sampling season. The system had both electrical and mechanical problems throughout the season (April - October). Fortunately, the debris load in the river was light again this year, which helped us avoid the serious damage to equipment and salmonids that can occur when debris is allowed to accumulate. See Table A-4 for details on biased sample days.

**Fry Incidence**
The number of summer/fall chinook fry ($\leq$ 60mm) collected this season was 7,012. This is approximately 1.7 times the 4,229 collected in 1998, three times the 2,342 collected in 1997, and 32 times the 217 collected in 1996. In 1999, 32% of the fry were collected in April, 46% were collected in May, and 21% in June (Figure 3). See Table C-9 for a summary of chinook fry collection estimates since 1987.

**Adult Catch**
Although the facility is equipped with an adult sampling system, it was not operational in 1999 and all fallbacks were returned directly to the river. However, to gauge the quantity of fish exiting the primary dewatering structure (PDS) a hinged gate was installed on the end of the Fish and Debris Separator (FDS). When an adult fish passed through this gate, it was tallied on a counter attached to the gate. A total of 9,725 adult fish were tallied between 18 May and 26 October. It wasn't possible to collect species detail so non-salmonids are included in the count. Approximate passage times were recorded to document any obvious passage timing trends. Day and night passage were fairly equal, with 41% passing during the day and 59% at night. This is similar to what we saw in 1998, when 51% passed during the day and 49% at night. See Table C-7 for a summary of fallbacks for all years of sampling.

There is some concern about adult salmonids "holding" in the Primary Dewatering Structure (PDS) so it is periodically dewatered in an attempt to gauge the problem. In 1999, it was dewatered once for this reason, twice for maintenance or inspection and again at the end of the sampling season. The first dewatering occurred in April and was done to repair the switch gate. The second occurred on 9 June and was done to inspect the system. There were about 40 adult salmonids observed. The third inspection on 21 September was done specifically to gauge the "holding" problem and about 200 adult salmonids were observed. A similar number were observed at the final dewatering. Without conducting a formal study it is impossible to say with any certainty that there is or isn't a holding problem in the PDS. We do see a lot of adult salmonids in the system when we dewater later in the year, but we also count many fish exiting the system on a daily basis. This would suggest that fish do delay in the PDS, but they eventually move out and pass through the system. Perhaps it is a density dependent situation where fish

accumulate until a certain density is reached and then as more fish enter the PDS, some leave, and so on. For a historical summary of fallbacks see Table C-8 and more details on dewaterings see Table C-9.

**Incidental Catch**

American shad (*Alosa sapidissima*) were by far the most common incidental species captured at John Day this season. Juvenile shad passage started in mid August, increased steadily until the end of August, then dropped off for a few days before peaking for the season on 3 September at an estimated 420,606 fish passing through the bypass system. After that peak, through the end of the season, shad passage averaged about 40,000 per day (Figure A-2).
The total estimated collection number for 1999 is 5,235,479, about 4 times the 1998 total of 1,281,697. Incidental catch collection estimates were dramatically affected by the switch to the full bypass sampling system, which is obvious in Table C-10 and Figure C-7.

The other incidental species present in our samples in large numbers is the juvenile Pacific Lamprey (*Lampetra tridentata).* Juvenile lamprey were found in our samples throughout the season but do have distinct passage peaks. The first and highest was 12,422 on 23 April. The second occurred from 3 - 6 June when daily passage averaged 11,077. A third smaller peak occurred from 27 June through 3 July and averaged 3,989 per day (Figure A-2).
The total estimated collection for 1999 is 167,856. The majority (80%) were smolted. This is up slightly from last years estimate of 149,483 and again dramatically higher than all years prior to 1998 due to the switch from "single gatewell" to "full bypass" sampling (Table C-10 and Figure C-7).

**Research**

During the season, smolt-monitoring personnel provided support to 12 research projects, listed below by agency. Support included activities such as: fish collection and enumeration, equipment set up/modification, and handling. Fish were collected from the general sample or with the Separation by Code (SBC) system.

**U.S. Geological Service-Biological Resources Division, (USGS-BRD)**

1. *Movement and Distribution of Radio-Tagged Juvenile Salmonids Passed into The Dalles Dam Tailrace Via Spill.* Principal Investigator: Theresa Liedtke. The study objectives were to describe the distribution, movement, and behavior of juvenile salmonids passed into the tailrace of The Dalles Dam under 30% or 65% spill conditions. A total of 481 yearling chinook and 495 subyearling chinook were collected at the Smolt Monitoring Facility (SMF) for this research in 1999.

2. *Movement and Distribution of Radio-Tagged Juvenile Salmonids at John Day, The Dalles, and Bonneville Dams.* Principal Investigator: John Plumb. Fish were radio tagged for use in evaluating various passage situations at John Day Dam, The Dalles Dam, and Bonneville Dam. The evaluations for John Day and The Dalles were to determine Fish Passage Efficiency (FPE) and Spill Passage Efficiency (SPE). The evaluation at Bonneville was to determine general juvenile salmonid behavior and the efficiency of the Prototype Surface Collector (PSC) at Powerhouse One. A total of 1,265 yearling chinook, 907 steelhead, and 420 subyearling chinook were collected at the John Day SMF for this research.

3. *Movement and Distribution of Radio-Tagged Juvenile Salmonids at John Day, The Dalles, and Bonneville dams.* Principal Investigator: Jill Hardeman. Fish were radio tagged for use in evaluating various passage situations at John Day Dam, The Dalles Dam, and Bonneville Dam. The evaluations for John Day Dam involved releasing radio tagged smolt from the SMF laboratory to compare with up river and forebay releases. The tagged fish then passed to The Dalles Dam where they helped to determine Fish Passage Efficiency (FPE) and Spill Passage Efficiency (SPE). The evaluation at Bonneville was to determine general juvenile salmonid behavior and the efficiency of the Prototype Surface Collector (PSC) at Powerhouse One. A total of 392 yearling chinook smolt and 409 steelhead smolt were collected and radio tagged at the John Day SMF for this research.

4. *Evaluation of Tagging Techniques for Pacific Lamprey*. Principal Investigator: Jennifer Bayer. The objective of the study was to evaluate the utility of visible implant (VI) and Passive Integrated Transponder (PIT) tags in lamprey ammocoetes and macropthalmia, using short and long-term survival as evaluation criteria. SMP personnel collected about 404 juvenile lamprey for this particular study in 1999.

5. *Growth Rates of PIT Tagged Hanford Reach Fall Chinook.* Principal Investigator: Ken Tiffan. Fish were collected using the Separation by Code (SBC) capabilities at John Day Dam SMF. The objective of his study was to collect growth rate data on Hanford Reach fall chinook. The SBC system diverted a total of 69 target fall chinook and 127 non-target salmon smolts.

A cooperative effort between USGS-BRD and:

6. **Oregon Cooperative Fish and Wildlife Research Unit, OSU.** *Effectiveness of Radio Tagging Juvenile Pacific Lamprey*. Principal Investigator: Darren Lerner. Through the development of a tagging protocol, working to develop a means whereby the passage of post-metamorphic Pacific lamprey through Columbia River dams can be evaluated. A total of 500 juvenile Pacific lamprey were collected for use in this research during the 1999 out-migration, primarily in May and June.

**National Marine Fisheries Service, Fish Ecology Division**.

7. *Post-Construction Evaluation of the Smolt Monitoring Facility (SMF) at John Day Dam.* Principal Investigator: Randy Absolon. The study objective was to evaluate the passage of salmonid fry through the juvenile bypass system at John Day Dam. Approximately 600 Spring Creek Hatchery subyearling chinook fry were used in the evaluation. Three groups of 200 fish each were released at three separate locations below the tainter gate and were diverted to the sampling facility. Of the 600 fish released, 599 were successfully recaptured and examined for descaling and condition.

8. *The Dalles Dam Spillway Survival Study*. Principal Investigators: Earl Dawley and Randy Absolon. Approximately 305,803 smolt (22,165 coho, 116,911 yearling chinook, and 166,727 subyearling chinook) were PIT tagged for use in evaluating the relative survival through the spillway at The Dalles Dam at various spill rates. For the duration of the 12-week tagging period, the SMP sample rate was increased at night to get enough fish for tagging. Three PIT tagging stations were plumbed and installed inside the Smolt Monitoring Facility (SMF) laboratory. Approximately 5,000 - 6,000 smolts were needed for each night of tagging. All PIT tagged fish were routed to transport tanks and held for about one day before release into The Dalles Dam forebay.

9. *Evaluation of the Effectiveness of Extended-length Submersible Bar Screens (ESBS) at John Day Dam.* Principal Investigator: Dean Brege. The ESBS's, equipped with perforated plate and inlet flow vane modifications, were evaluated using fish guidance efficiency (FGE), orifice passage efficiency (OPE), and descaling and mortality data. During the first week of June, approximately 883 yearling chinook smolt were collected and PIT tagged at the John Day SMF for use in this study. These fish were released in the forebay and recaptured at the SMF utilizing the Separation by Code (SBC) capabilities.

A cooperative effort between the NMFS-Northwest Fisheries Science Center and :

10. **Yakama Indian Nation.** *Physiological Assessments of Wild and Hatchery Juvenile Salmonds.* Principal Investigators: NMFS: Donald Larson, Yakima Nation: Bruce Watson. This study collected fish using the Separation by Code (SBC) capabilities at John Day SMF. The objective of their research was to make physiological assessments of wild and hatchery juvenile salmon during the 1999 out-migration. The SBC system diverted a total of 98 target chinook and 182 non-target salmon smolts.

11. **Pacific Northwest National Laboratory-Battelle.** *Bypass System Effects on Juvenile Pacific Lamprey.* Principal Investigator: Russel Moursund. Conducted a study to evaluate the effects of juvenile bypass screens and other project operations on juvenile Pacific lamprey survival. Laboratory studies included evaluating potential injury mechanisms and turbine passage conditions affecting survival, behavior, and threshold impingement velocities. Approximately 514 juvenile Pacific lamprey were collected from May through August for this research in 1999.

12. **Idaho Cooperative Fishery Research Unit, University of Idaho.** *Effects of Multiple Dam Passage on the Physiological Condition of Juvenile Salmonids.* Principal Investigators: James Congleton and Bill LaVoie. Fish were collected using the Separation by Code (SBC) capabilities of the system. The objective of this research was to evaluate the effects of multiple dam passage on the physiological condition of salmon smolts. The SBC system diverted a total of 292 target hatchery spring chinook and 868 non-target salmon smolts.

## BONNEVILLE DAM

Included in this year's report are program summary tables. See Table D-12 (PH1) and Table D-13 (PH2) for a summary of all years of sampling, including sample dates, sampling effort, sample, collection, and index numbers.

### River Conditions

#### River Flow

Spring river flow, through May, averaged 280.5 kcfs, compared to 240.7 kcfs in 1998. The peak flow for this period, and the season, was 384.3 kcfs on 28 May. Last year, the high flow for this same period was 419.9 kcfs on 31 May. For June and July, river flow averaged 299.7 kcfs, about 45 kcfs higher than the 255.1 kcfs for the same period last year. Flows for the late summer/fall period, August through October, were higher than for the same period in 1998, averaging 161.1 versus 125.6 kcfs last year.

Spill during the 10 day period following the 18 March release of 4.1 million tule fall chinook from Spring Creek National Fish Hatchery (SCNFH) averaged about 138.6 kcfs or 51% of river flow (Table 4). Spill averaged 107.5 kcfs (34% of river flow) between 23 April and 2 May to facilitate passage of the 3.5 million tule fall chinook released from SCNFH on 22 April. For the third SCNFH release of 3.0 million fish on 13 May, spill averaged 93.6 kcfs or 34% of river flow for the 10 days following the release (Table 4).

Table 3. 1999 Spring Creek National Fish Hatchery releases.

| Release Date | Number (millions) | Peak PH1 Passage | Avg. River Flow | Spill as % of River |
|---|---|---|---|---|
| March 18 | 4.1 | 19 March | 138.6 | 51 |
| April 22 | 3.5 | 23 April | 107.5 | 34 |
| May 13 | 3.0 | 15 May | 93.6 | 34 |

Shifting of flow from PH2 to spill following a Spring Creek release is thought to increase the number of those fish passing the project via the spillway and improve survival.

### The Numbers

#### Sample Numbers

The total number of fish sampled in the first powerhouse at Bonneville Dam in 1999 was 69,641, a 35% increase over last years 51,565. With the exception of hatchery steelhead and hatchery sockeye, sample numbers were up, with the greatest increase (223%) seen in yearling chinook. Species specific sample numbers can be found in Table 1, comparisons to previous years can be found in Table C-11. Subyearling chinook constituted 51.2% of the sample numbers, followed by yearling chinook (21.9%), coho (12.1%), hatchery steelhead (8.1%), wild steelhead (3.7%), and sockeye (3.1%) (Table 1).

#### Collection Estimates

Collection estimates represent the number of fish passing through the bypass system at the first powerhouse and are calculated by dividing the sample number by the sample rate. In 1999, an estimate of 866,584 is 109% of the 1998 estimate of 794,789 fish. Wild steelhead, coho, and hatchery sockeye estimates were down while yearling and subyearling chinook, hatchery steelhead and wild sockeye collection estimates were up. There are numerous components that affect collection estimates, but the primary factor is flow distribution. If more water is spilled, or run through the second powerhouse, fewer fish go through the first powerhouse. Other factors include Fish Guidance Efficiency (FGE), wild and hatchery production, transportation, research activities, and others.

#### Fish Passage Indices

Collection numbers are divided by the proportion of river flow through powerhouse 1 to get a Fish Passage Index (FPI) for the entire project. Even though sampling is done hourly at Bonneville, hourly detail is not recorded so an hourly index number is not calculated. A daily index number is calculated and will be the one referenced here. See the Methods section for definitions. The Index represents the total number of fish passing the project. It is affected by the same factors as the collection estimates, discussed above, and others. It is most useful for in-season monitoring of run timing and size. The 1999 index total for all species combined was 2,878,994, about 97% of the

1998 FPI of 2,963,511. Lower indices for wild steelhead, coho, and hatchery sockeye offset higher indices for subyearling chinook and wild sockeye, resulting in an index estimate very similar to last years. Sample, collection, and index numbers for this year can be found in Table 1.

For a complete listing of sample, collection, and index numbers by species for all years of sampling, including season dates and sampling effort, see Table D-12.

Sampling in the **Second powerhouse** could not be conducted in 1999. In the past, the effort was simply to monitor fish condition as an indicator of the condition of the bypass system. To review the history of condition monitoring in the second powerhouse, see Table D-13.

**Passage Patterns**

**Seasonal**

The run timing and duration at Bonneville this year was similar to the historical median for all species. All of the spring migrants, except yearling chinook, reached their 10% passage date earlier and the 90% date later, resulting in a longer middle 80% passage duration (Figure 7). The exception is the subyearling chinook which took 5 fewer days for the middle 80% to pass Bonneville. For the exact dates, refer to Table D-2. Although the timing and duration were similar to the historical median, there were some differences in distribution of fish within the middle 80% of the migration. Yearling chinook and coho had passage peaks later than what is normally seen and sockeye had a larger push of fish at the beginning of the migration than normally seen ( Figure D-1).

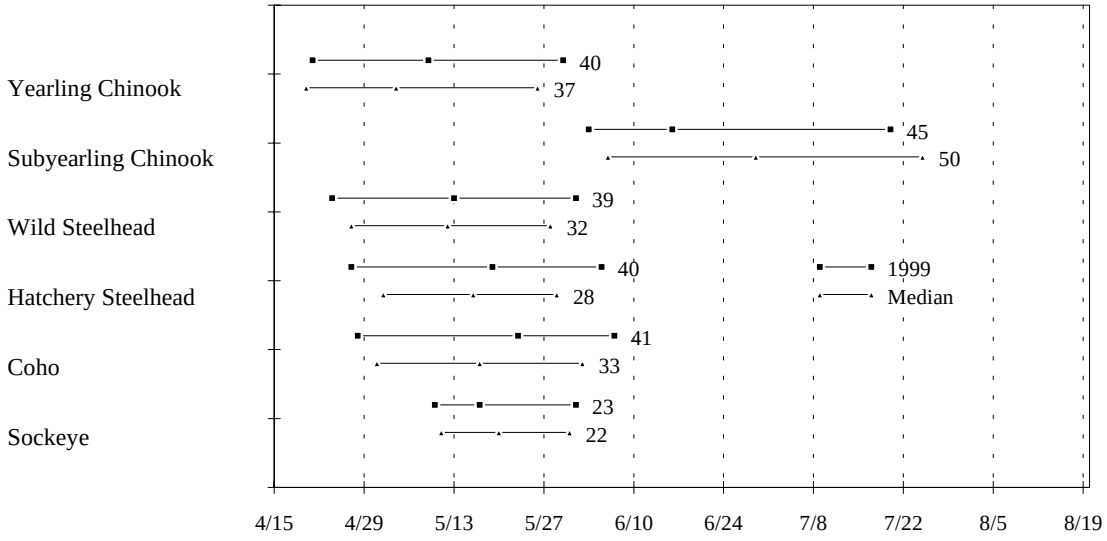


Figure 7. 10%, 50%, and 90% passage dates and the historical median at Bonneville Dam, PH1, 1999. The duration in days between the 10% and 90% passage dates is indicated for each line.

When compared to previous years graphed separately, the middle 80% of the migration for yearling chinook and coho tied the second longest duration recorded at 40 and 41 days, respectively. Wild steelhead tied the longest duration ever recorded at 39 days, and hatchery steelhead set a new record for days required for the middle 80% to pass Bonneville Dam, at 40. Subyearling chinook and sockeye were in the middle of the range for those two species. Passage timelines for all years and species are shown in Figure D-2.

Yearling chinook passage peaked on 23 April at about 6% of the season total. The rest of the season the daily percent of total stayed around 2 - 3%. Wild steelhead passage fluctuated below 4% of the season total per day all season. Hatchery steelhead passage peaked on 4 June at about 5% of total and was variable but stayed below 5% of total per day for the rest of the season. Coho passage peaked on 25 May at about 5% of total. The spring passage pattern (before June 1) for subyearling chinook mainly represents large releases of tule stock into the Bonneville pool from Spring Creek National Fish Hatchery (Table 4). No passage dates are calculated for these fish. The

summer passage pattern for subyearlings (after June 1) is composed mainly of upriver bright stock. These fish passed Bonneville in greatest numbers (about 6% of total) on 29 June. Chinook fry passage peaked on 21 April at about 18% of total, with two other peaks later in the season (14 May and 25 July). Two distinct peaks marked sockeye passage, the first was composed of wild fish and occurred on 15 May and was about 9% of the season total. The other was composed of hatchery fish and occurred on 4 June and constituted 10.66% of the season total. Both groups had several other passage peaks but generally stayed below 5%. See Figure 8 for a complete depiction of these results, and Figure D-1 for a historical comparison.

**Diel**

In 1999, sampling in the first powerhouse at Bonneville Dam remained at 8 hours per day, from 1600 to 2400 hours, but the hourly detail was not recorded. However, crew reports of passage patterns were consistent with previous years data. Passage for all species increased at dusk and peaked between 2100 and 2200 hours. This is consistent with the passage pattern established during the 4 years of 24 hour monitoring (92-95) (Figure D-3, Figure D-4). For a total percent night passage by species for each year of 24 hour monitoring, see Table D-1, and for percent of total passage per hour by species for the four years of diel monitoring, see Table D-3.

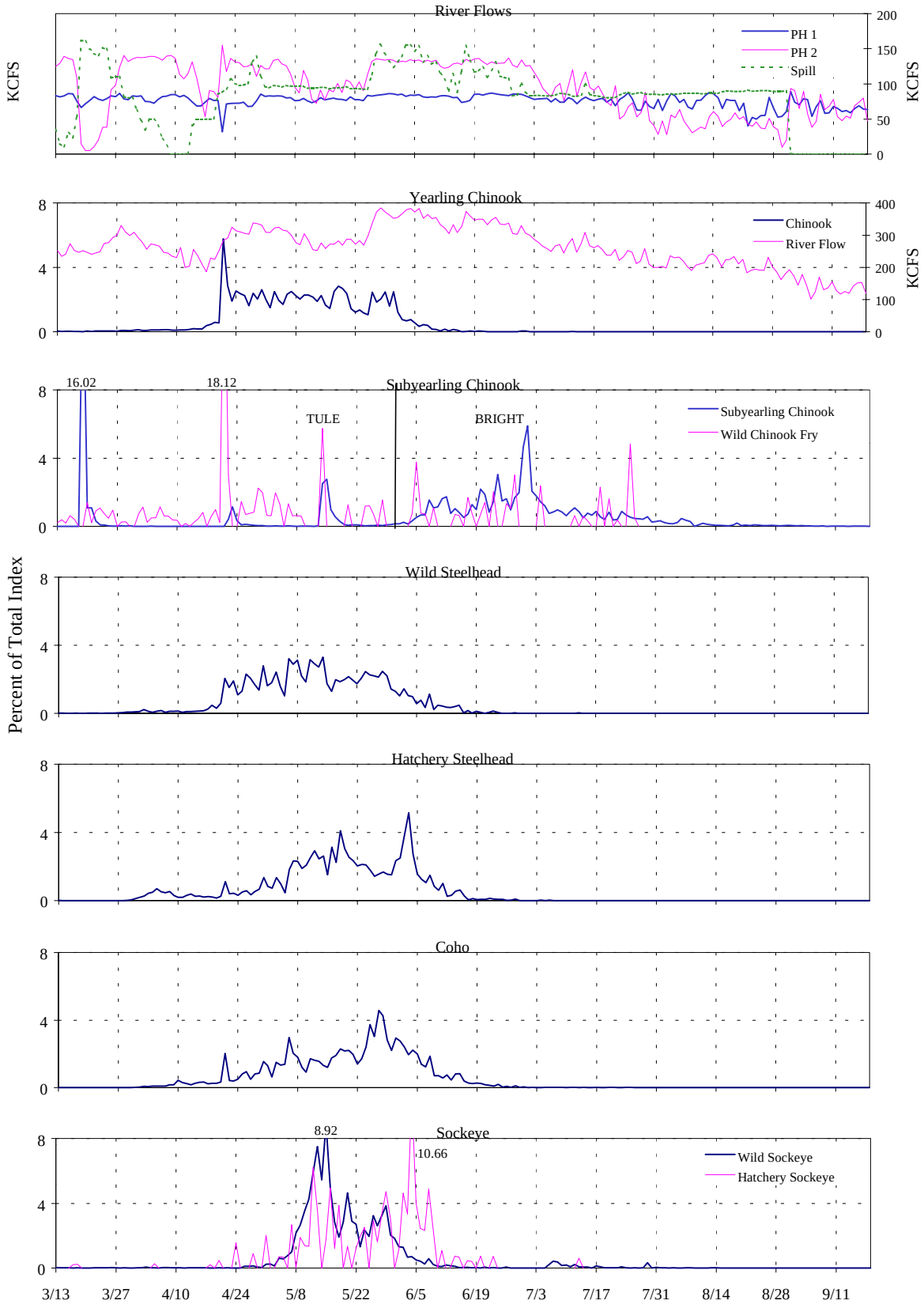


Figure 8. Seasonal passage patterns and daily average river flows at Bonneville Dam, 1999.

## Fish Condition

### Powerhouse 1

Descaling in 1999 was lower than last year and the historical average for all species (Figure 9, Table D-10, and Figure D-5). The greatest improvement was for sockeye, going from 17.3% last year to 7.4% this year, second only to the 6.2% rate observed in 1996 (Table D-4). Hatchery steelhead also improved dramatically this year, going from 6.3% last year to 3.0% this year (Figure 9, Table D-4).

Daily descaling was highly variable for all species, but in general was highest at the beginning and end of the migration for yearling and subyearling chinook and hatchery steelhead. For wild steelhead and coho, descaling fluctuated all season but never exceeded 5% (Figure B-1). Overall mortality rates were less than 0.1% for all species this year (Figure 10 and Table D-4). This low level of recorded mortality is consistent with previous years (Figure D-6).

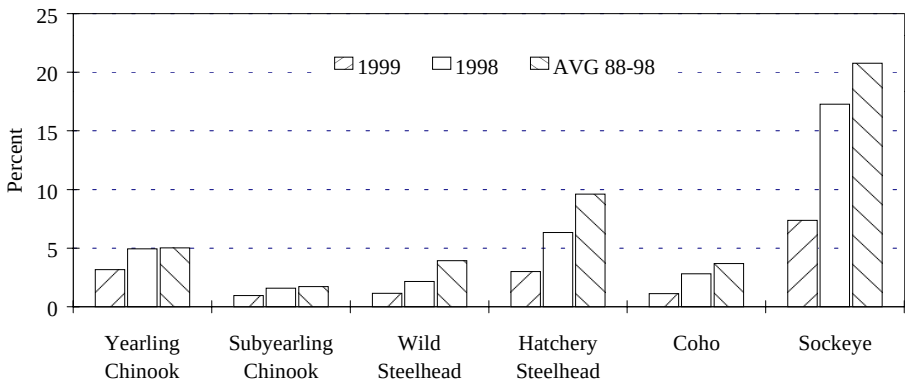


Figure 9. Total descaling for 1999, compared to 1998 and the 88-98 average at Bonneville Dam, PH1.

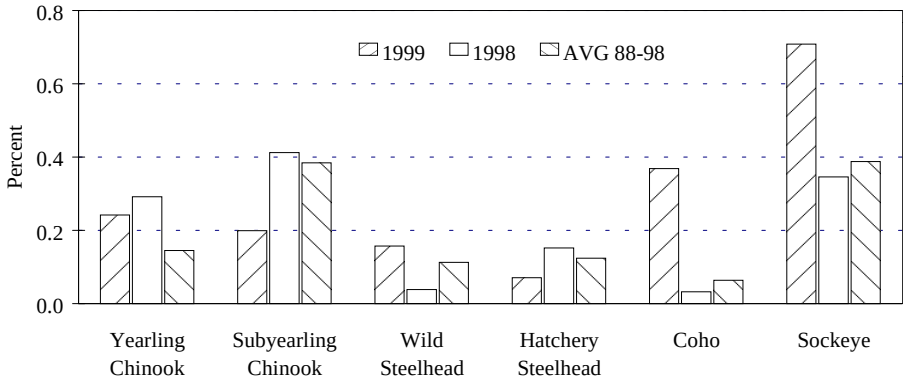


Figure 10. Total mortality for 1999, compared to 1998 and the 88-98 average at Bonneville Dam, PH1.

### Powerhouse 2

There was no sampling done in the second powerhouse due to the new sampling facility not being ready for operation. Therefore no condition data is available.

## Subsampled Fish Condition

A total of 14,679 smolts were examined for detailed condition subsampling in 1999. As in previous years, partial descaling (3-19%) was the most prevalent condition and rates were similar to last year. The range was from 31.4% for sockeye to 6.2% for subyearling chinook. The incidence of attempted bird predation was down slightly for hatchery steelhead to 5.7% from 7.5% in 1998, and about the same for wild steelhead, about 2%. After several years of decline, 19.3% in 1995, 8.1% in 1996, and 4.6% in 1997 and 1998, the incidence of external parasites on wild steelhead increased to 9.7% this year. Incidence of fungus was highest in coho at 3.7% while other species were at 1% or less. For more details on this data and a historical summary of condition subsampling, see Table D-6.

## Gas Bubble Trauma Examinations

Gas bubbles were found in 17 of 5,515 fish examined in 1999 for an overall incidence of 0.31%. About half of the bubbles were in the unpaired fins, 44% were found in the lateral line and about 6% were found in or around the eyes. Almost 89% of symptoms on the unpaired fins were of rank 1 or 2, so to facilitate discussion, all of the observations, regardless of rank or location, were lumped together. Spring chinook had the highest incidence of

bubbles at 0.5% (8 of 1,587). Steelhead were next at 0.32% (6 of 1,863) and three of 2,065 subyearling chinook had bubbles, for a rate of 0.15%. The symptoms were pretty evenly dispersed in April, May, and June at 29%, 23%, and 29%, respectively. About 12% of the bubbles were seen in July and about 6% were seen in August (Table B-5). For more details on the Gas bubble monitoring results, see the Fish Passage Center annual report.

## Length Averages

Individual fish lengths were obtained in conjunction with the fish condition subsampling described above. The results are intended to show relative length trends throughout the season and are presented in Figure 11. Hatchery steelhead, as in past years, remained the largest juvenile salmonid sampled throughout the season. Similar length trends were exhibited in 1998 and 1999. Both hatchery steelhead and subyearling chinook showed increasing size trends as the season progressed, while wild steelhead, yearling chinook, coho, and sockeye size varied over the course of the migration.

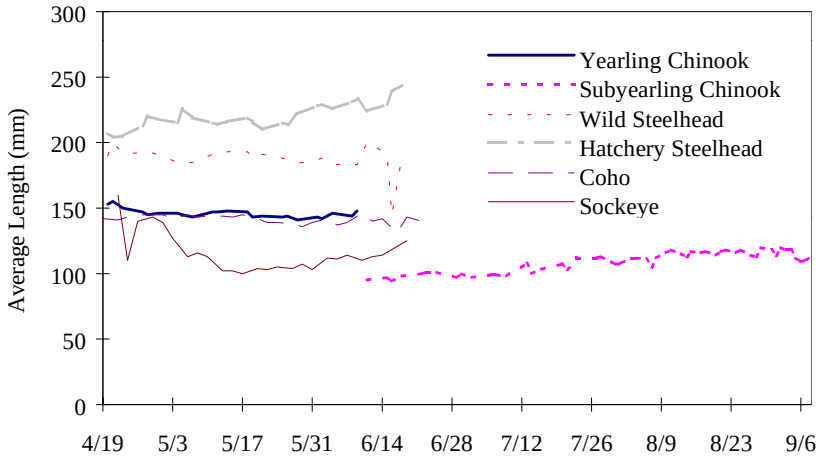


Figure 11. Average length of juvenile salmonids at Bonneville Dam, PH1, 1999.

## PIT tags and External Marks

### PIT Tags

A total of 130,957 PIT tags were detected at Bonneville this year, a 304% increase over 1998 (43,131) and a 513% increase over 1997 (25,507). The increase is due to a continuing Corps of Engineers funded research project, conducted by the National Marine Fisheries Service, to evaluate survival through The Dalles Dam spillway and the increased use of PIT tags throughout the Columbia River system. A summary (by species, run, and rearing type) of PIT tags detected at Bonneville Dam for 1999 can be found in Table B-2. Table D-7 summarizes PIT tag records by year for all years of interrogation at Bonneville Dam.

### Elastomer Tags

At PH1, 185 elastomer tags were recorded this year, down from 219 in 1998. Over 67% (105 of 156) of the tagged yearling chinook originated in Lyons Ferry Hatchery while the remainder can be traced to the Clearwater River, Pittsburg Landing, and Captain John's Acclimation Pond. All of the tagged summer steelhead (29) originated in Chiwawa Hatchery (Table B-3).

### Freeze Brands

At PH1, one freeze brand was recorded this year, down from seven last year. The brand was found on a hatchery summer steelhead released from Lyons Ferry Hatchery (Table B-3). Table D-8 lists the number of brands for each species for all years of monitoring.

## Fry Incidence

The number of chinook fry (< 60mm) sampled this season was 154, while coho fry totaled 10. When expanded by sample rate, these numbers generated a collection estimate of 1,451 chinook fry and 64 coho fry, down considerably from last year's 8,116 chinook fry and 452 coho fry. In 1999, 10% of the fry were collected in March, 32% in April, 21% in May, 20% in June, and 17% in July. See Table D-11 for a summary of sample and collection numbers for fry by year.

## Adult Catch

The sample collection equipment in powerhouse 1 is designed to pass adult fish. As a result, very few, if any, adults are collected in our samples. No adults have been captured during the last two years.

**Incidental Catch**

American Shad *(Alosa sapidissima)* juveniles were present in the samples from mid August through the end of the season and passage peaked on 28 October (Figure B-2). The collection count was 187,300, less than 25% of the 1998 total. Pacific Lamprey *(Lampetra tridentata)* juveniles were found infrequently in samples from 13 March through 10 July. The total number of lamprey sampled was 23, all but one were smolted. Sample numbers expanded by sample rate generated a collection estimate of 185, about 40 percent of the 1998 total. No discernable trends are apparent given the low sample and collection numbers (Figure B-6). A historical summary of incidental catch is presented in Table D-10. A graphical summary of juvenile shad and lamprey collection estimates by year is presented in Figure D-7.

**Performance Monitoring**

**Personnel**

As part of our quality control program, we developed a method of checking species identification, fin clips, descaling, and brand/tag recognition skills. In short, up to three people look at the same 10 fish and compare results. Any discrepancies are discussed while the fish is "in hand". For a full explanation of the test protocol, see the Methods section. The "Descaled" category generated the lowest efficiency rating at 99.7%. Overall, coworkers were in agreement 99.9% of the time (Table 5).

Table 4. Results of quality control tests.

| Category | ID | Clip | Descaled | Mark | Total |
|---|---|---|---|---|---|
| Errors | 0 | 2 | 4 | 0 | 6 |
| Possible | 1400 | 1400 | 1400 | 4 | 4204 |
| % Correct | 100 | 99.9 | 99.7 | 100 | **99.9** |

**Equipment**

At PH1, a total of 12 hours of sampling were missed, about 0.6% of the season. See Table B-5 for more details on lost sample time.

**Research**

During the season, smolt-monitoring personnel provided support to one research project listed below. Support included activities such as: fish collection and enumeration, equipment set up/modification, and handling. Fish were collected from the general sample.

**United States Geological Survey, Biological Resources Division**. Principal Investigator: Glen Holmberg. This study was designed to evaluate passage and stress conditions within the B2 juvenile bypass system. From 6 May through 9 July, 245 yearling chinook, 175 steelhead, and 308 subyearling chinook were held for radio tagging purposes. Of those, 171 yearling chinook, 127 steelhead, and 180 subyearling chinook were tagged, while the remainder were returned to the river.

## ACKNOWLEDGMENTS

Support for this monitoring project comes from the region's electrical ratepayers through the Bonneville Power Administration under the Northwest Power Planning Council's Fish and Wildlife Program. The success of this program continues to involve cooperative interaction with the Fish Passage Center staff, the Corps of Engineers project personnel, National Marine Fisheries Service biologists, and the Pacific States Marine Fisheries Commission.

We acknowledge the very capable efforts of our Biological technicians and laborers, including at Bonneville: John Barton, Larry Dick, Mildred Johnson, Robert B. Mills, Carol Morat, and Thomas Ryan; and at John Day: Mike Friese, Robert Heacock, Tammy Mackey, and William Myers.

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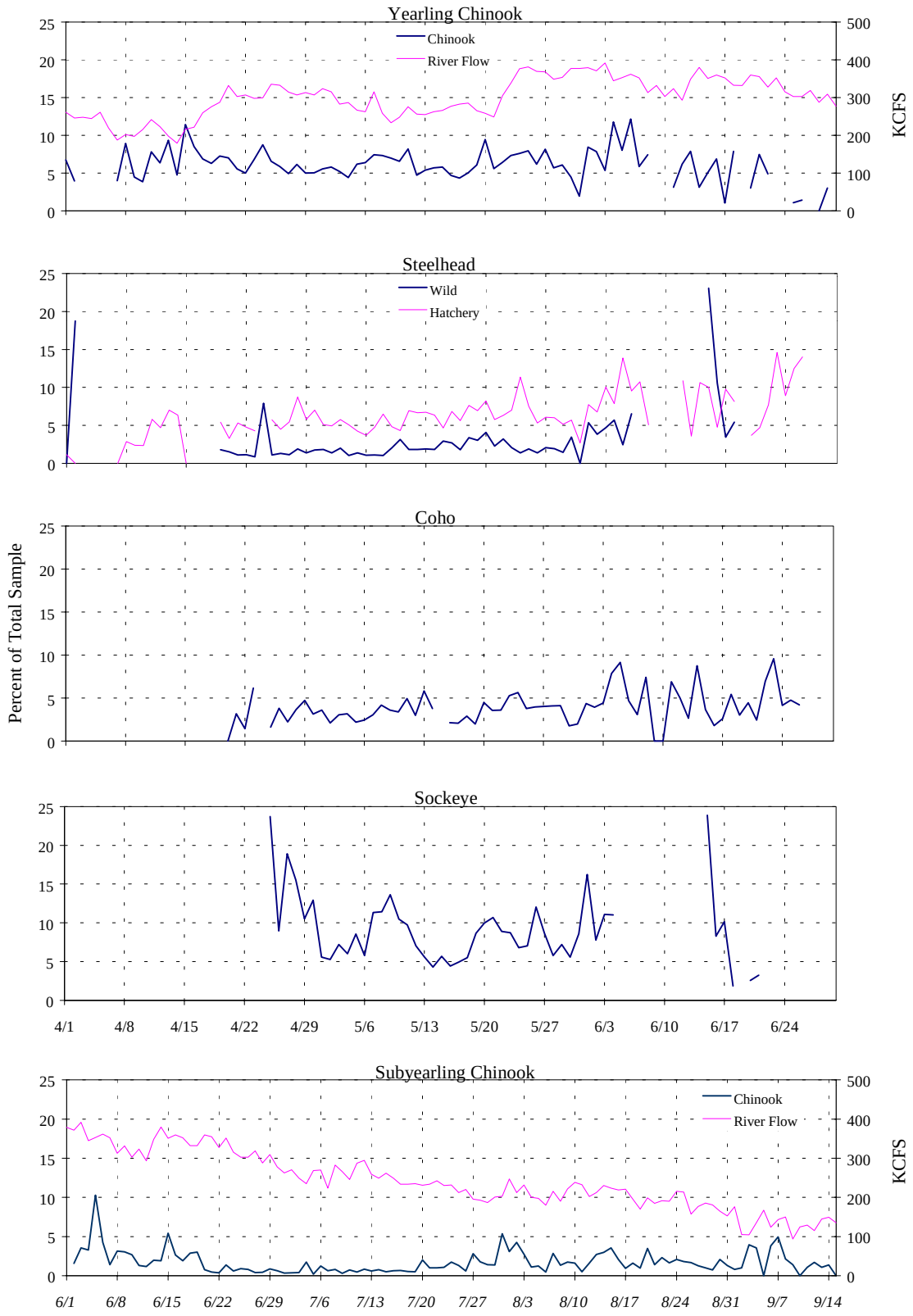


Figure A-1. Daily percent descaling and river flow at John Day Dam, 1999. Days with sample size of less than 30 have been excluded.


Figure A-2. Seasonal juvenile shad and lamprey collection at John Day Dam, 1999.

Table A-1. Summary of PIT tag detections at John Day Dam, 1999.

| Migration Year | Species | Run | Rear | Observations | Species Totals | Migration Year Totals |
|---|---|---|---|---|---|---|
| **1996** | Steelhead | Summer | Wild | 4 | 4 Steelhead | **4** |
| **1997** | Chinook | Summer | Wild | 1 | | |
| | Chinook | Unknown | Hatchery | 2 | | |
| | Chinook | Unknown | Unknown | 10 | 13 Chinook | |
| | Coho | Fall | Hatchery | 131 | 131 Coho | |
| | Steelhead | Summer | Hatchery | 5 | | |
| | Steelhead | Summer | Unknown | 1 | | |
| | Steelhead | Summer | Wild | 22 | 28 Steelhead | **172** |
| **1998** | Chinook | Spring | Hatchery | 59 | | |
| | Chinook | Spring | Wild | 26 | | |
| | Chinook | Summer | Hatchery | 1 | | |
| | Chinook | Summer | Wild | 8 | | |
| | Chinook | Fall | Hatchery | 396 | | |
| | Chinook | Fall | Wild | 20 | | |
| | Chinook | Unknown | Hatchery | 15 | | |
| | Chinook | Unknown | Unknown | 14 | | |
| | Chinook | Unknown | Wild | 7 | 546 Chinook | |
| | Steelhead | Summer | Hatchery | 136 | | |
| | Steelhead | Summer | Unknown | 1 | | |
| | Steelhead | Summer | Wild | 50 | 187 Steelhead | **733** |
| **1999** | Chinook | Spring | Hatchery | 21,869 | | |
| | Chinook | Spring | Wild | 3,769 | | |
| | Chinook | Summer | Hatchery | 2,501 | | |
| | Chinook | Summer | Wild | 3,015 | | |
| | Chinook | Fall | Hatchery | 6,650 | | |
| | Chinook | Fall | Unknown | 7,205 | | |
| | Chinook | Fall | Wild | 532 | | |
| | Chinook | Unknown | Hatchery | 17,632 | | |
| | Chinook | Unknown | Unknown | 5,724 | | |
| | Chinook | Unknown | Wild | 3,941 | 72,838 Chinook | |
| | Coho | Spring | Hatchery | 1 | | |
| | Coho | Fall | Hatchery | 4,302 | | |
| | Coho | Fall | Unknown | 562 | | |
| | Coho | Unknown | Hatchery | 1 | 4,866 Coho | |
| | Steelhead | Spring | Wild | 327 | | |
| | Steelhead | Summer | Hatchery | 54,994 | | |
| | Steelhead | Summer | Unknown | 16 | | |
| | Steelhead | Summer | Wild | 4,007 | 59,344 Steelhead | |
| | Sockeye | Summer | Hatchery | 207 | | |
| | Sockeye | Summer | Wild | 30 | | |
| | Sockeye | Unknown | Hatchery | 37 | | |
| | Sockeye | Unknown | Wild | 442 | 716 Sockeye | **137,764** |
| **2000** | Chinook | Spring | Wild | 9 | 9 Chinook | |
| | Steelhead | Summer | Wild | 23 | 23 Steelhead | **32** |
| | | | | **Total Observations at John Day Dam:** | | **138,705** |

| **Species Summary** | Chinook | Coho | Steelhead | Sockeye |
|---|---|---|---|---|
| Number | 73,406 | 4,997 | 59,586 | 716 |
| Percentage | 53% | 4% | 43% | 1% |

Table A-2. External mark recapture data from John Day Dam, 1999.

**Elastomer Tags**

| Species | Location | Color | Release Site | Release Number | Number Recaptured |
|---|---|---|---|---|---|
| | Left | Blue | Cpt.John Acclimation Pond | 150,000 | 267 |
| Yearling | Left | Green | Clearwater River | 228,000 | 383 |
| Fall | Left | Red | Lyons Ferry Hatchery | 450,000 | 4,373 |
| Chinook | Right | Blue@ | Cpt.John Acclimation Pond | 150,000 | 1 |
| | Right | Green | Pittsburg Landing | 150,000 | 256 |
| Summer | Left | Greeen | Chiwawa Hatchery | 37,132 | 261 |
| Steelhead | Left | Orange | Chiwawa Hatchery | 82,684 | 295 |
| | Left | Red | Chiwawa Hatchery | 53,051 | 221 |
| | | | | Total Elastomer Tags= | **6,057** |

@ = one tag identified on the right side was probably a mismarked left side.

**Freeze Brands**

| Species | Location* | Code | Orient. | Release Site | Release Number | Number Recaptured |
|---|---|---|---|---|---|---|
| | RA,LA, LD^ | IV | 1 | Lyons Ferry Hatchery | 40,000 | 25 |
| Summer | RA, LA | IV | 3 | Lyons Ferry Hatchery | 40,000 | 19 |
| Steelhead | RA | IT | 3 | Cottonwood Acclim. Pond | 90,000 | 5 |
| | RA | IT | 1 | Tucannon River | 40,000 | 6 |
| | | | | | Total Freeze Brands= | **55** |

* LA = left anterior, RA = right anterior

^LD = left dorsal, one brand identified as a LD in the lab was probably a mismarked LA.

Table A-3. Interruption of sampling summary for John Day Dam, 1999.

| End Date | Batch # | Reason for interruption | Hours missed |
|---|---|---|---|
| 2-April | 99002 | 3-way rotating gate malfunction | 12:00 |
| 3-April | 99003 | Monitoring facility dewatered | 24:00 |
| 4-April | 99004 | Monitoring facility dewatered | 24:00 |
| 5-April | 99005 | Monitoring facility dewatered | 24:00 |
| 6-April | 99006 | Monitoring facility dewatered | 24:00 |
| 7-April | 99007 | Monitoring facility dewatered | 20:00 |
| 14-April | 99014 | 3-way rotating gate repairs | 6:00 |
| 9-June | 99070 | Scheduled inspections and repairs | 13:30 |
| 10-June | 99071 | Crest gate malfunction | 10:30 |
| 15-July | 99106 | 3-way rotating gate malfunction | 1:00 |
| 21-Sept | 99174 | Scheduled dewatering | 5:45 |
| 23-Sept | 99176 | Hydrological evaluations of SMF | 3:30 |
| 24-Sept | 99177 | Hydrological evaluations of SMF | 0:40 |
| | | Minimum total sample hours missed = | 168:55 |

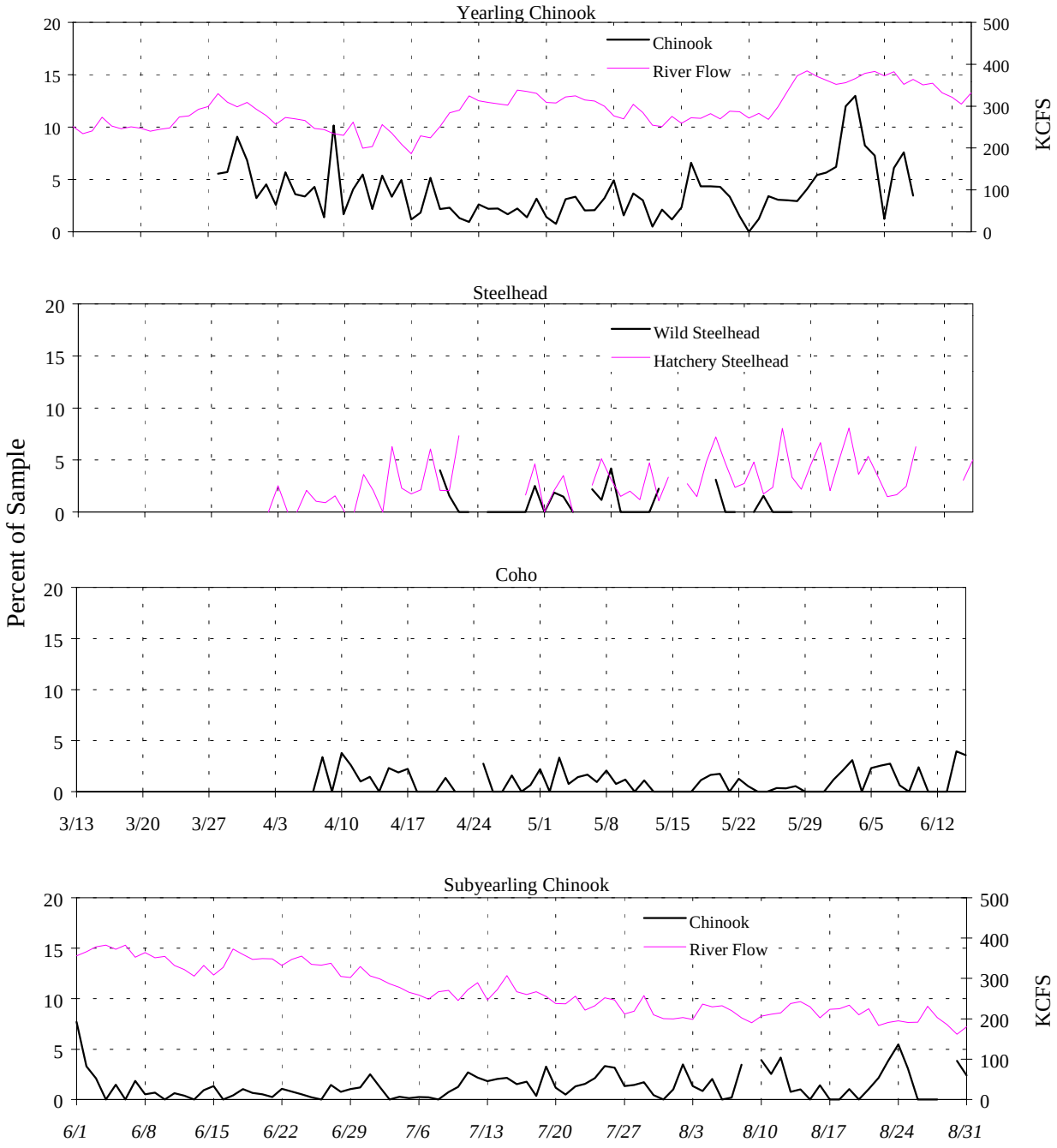


Figure B-1. Daily percent descaling and river flow at Bonneville Dam, PH1, 1999. Days with sample size of less than 30 have been excluded.

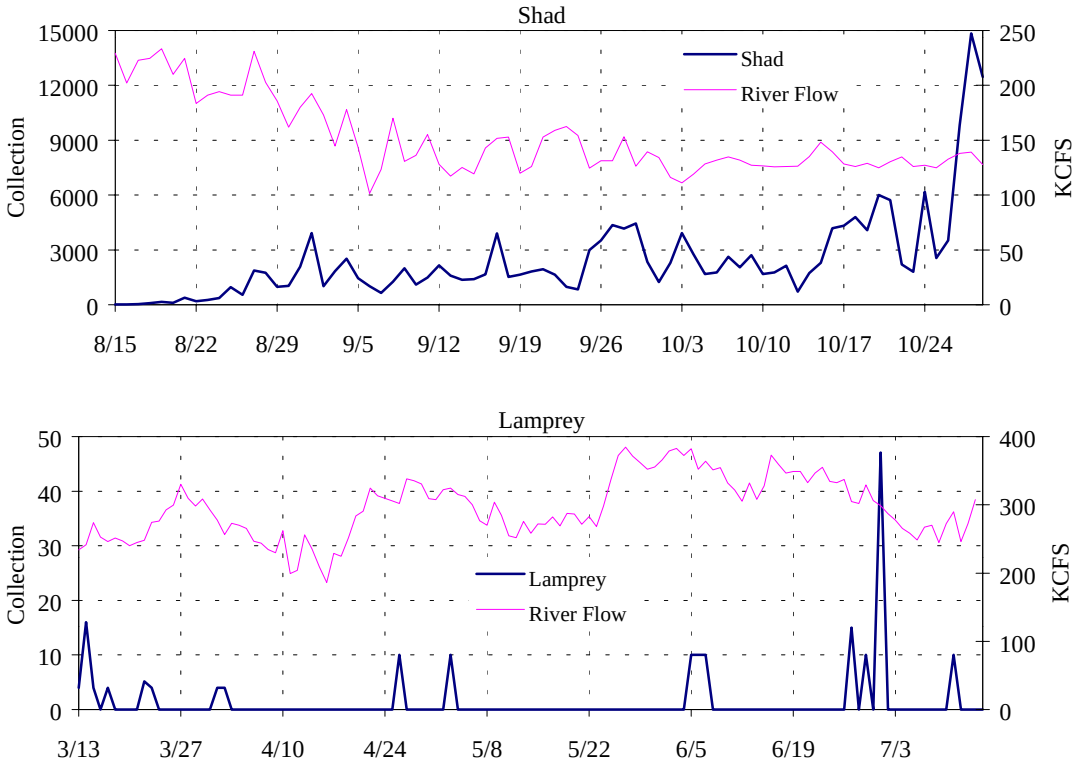


Figure B-2. Seasonal juvenile shad and lamprey collection at Bonneville Dam, 1999.

Table B-1. Summary of PIT tag detections at Bonneville Dam, 1999. Fish shown in years prior to 1999 are holdover fish.

| Migration | | Chinook | | | | | | | | | | Coho | | | | | Sockeye | | | | Steelhead | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Hatchery | | | | Unknown | | Wild | | | | Hatchery | | | Unknown | | Hatchery | | Wild | | Hatchery | | Unknown | Wild | | |
| Year | Site | FA | SP | SU | UN | FA | UN | FA | SP | SU | UN | FA | SP | UN | FA | SP | SU | UN | SU | UN | SP | SU | SU | SP | SU | **Totals** |
| **1989** | B2J | | 1* | | | | | | | | | | | | | | | | | | | | | | | **1** |
| **Total 1989** | | | **1** | | | | | | | | | | | | | | | | | | | | | | | **1** |
| **1996** | B2J | | | | | | | | | | | | | | | | | | | | | | | | 2 | **2** |
| | BVX | | | | | | | | | | | | | | | | | | | | | | | | 1 | **1** |
| **Total 1996** | | | | | | | | | | | | | | | | | | | | | | | | | 3 | **3** |
| **1997** | B2J | | | 1 | | | 2 | | | | | 25 | | | | | | | | | | | | | 10 | **38** |
| | BVX | | | | | | | | | | | 8 | | | | | | | | | | 2 | | | 3 | **13** |
| **Total 1997** | | | | **1** | | | **2** | | | | | **33** | | | | | | | | | | **2** | | | **13** | **51** |
| **1998** | B2J | 115 | 30 | | 1 | | 3 | 3 | 14 | 3 | 2 | | | | | | | | | | | 46 | | | 32 | **249** |
| | BVJ | 4 | 1 | | | | | 1 | | | | | | | | | | | | | | 3 | | | 1 | **10** |
| | BVX | 91 | 28 | 1 | | | | 6 | 10 | 2 | 4 | | | | | | | | | | | 54 | | | 12 | **208** |
| **Total 1998** | | **210** | **59** | **1** | **1** | | **3** | **10** | **24** | **5** | **6** | | | | | | | | | | | **103** | | | **45** | **467** |
| **1999** | B2J | 2,307 | 17,172 | 2,039 | 9,292 | 19,620 | 2,314 | 146 | 9,109 | 998 | 1,370 | 858 | 1 | 2 | 184 | 4,222 | 55 | 14 | 6 | 188 | 1 | 17,445 | | 101 | 1,921 | **89,365** |
| | BVJ | 48 | 220 | 22 | 95 | 320 | 20 | 2 | 199 | 31 | 45 | 9 | | | 1 | 54 | 1 | 1 | | 2 | | 276 | 1 | 2 | 27 | **1,376** |
| | BVX | 1,369 | 8,519 | 1,142 | 4,736 | 4,227 | 763 | 72 | 3,528 | 1,080 | 1,425 | 433 | | | 61 | 764 | 45 | 5 | 4 | 58 | | 10,292 | | 85 | 1,127 | **39,735** |
| **Total 1999** | | **3,724** | **25,911** | **3,203** | **14,123** | **24,167** | **3,097** | **220** | **12,836** | **2,109** | **2,840** | **1,300** | **1** | **2** | **246** | **5,040** | **101** | **20** | **10** | **248** | **1** | **28,013** | **1** | **188** | **3,075** | **130,476** |
| **Season** | B2J | 2,422 | 17,203 | 2,040 | 9,293 | 19,620 | 2,319 | 149 | 9,123 | 1,001 | 1,372 | 883 | 1 | 2 | 184 | 4,222 | 55 | 14 | 6 | 188 | 1 | 17,491 | 0 | 101 | 1,965 | **89,655** |
| **Total** | BVJ | 52 | 221 | 22 | 95 | 320 | 20 | 3 | 199 | 31 | 45 | 9 | 0 | - | 1 | 54 | 1 | 1 | 0 | 2 | - | 279 | 1 | 2 | 28 | **1,386** |
| | BVX | 1,460 | 8,547 | 1,143 | 4,736 | 4,227 | 763 | 78 | 3,538 | 1,082 | 1,429 | 441 | 0 | - | 61 | 764 | 45 | 5 | 4 | 58 | - | 10,348 | 0 | 85 | 1,143 | **39,957** |
| **Totals** | | **3,934** | **25,971** | **3,205** | **14,124** | **24,167** | **3,102** | **230** | **12,860** | **2,114** | **2,846** | **1,333** | **1** | **2** | **246** | **5,040** | **101** | **20** | **10** | **248** | **1** | **28,118** | **1** | **188** | **3,136** | **130,998** |

* adult fallback

Sp=Spring, SU=Summer, FA=Fall, UN=unknown

BVX=Bonneville first powerhouse, B2J=Bonneville second powerhouse, BVJ=Bonneville PIT tag sample collection station at first powerhouse.

Table B-2. External mark recapture data from Bonneville Dam, PH1, 1999.

**Elastomer Tags**

| Species | Location | Color | Release Site | Release Number | Number Recaptured |
|---|---|---|---|---|---|
| Yearling Fall Chinook | Left | Blue | Cpt.John Acclim. Pond | 150000 | 11 |
| | Left | Green | Clearwater R. | 228000 | 26 |
| | Left | Red | Lyons Ferry Hatchery | 450000 | 105 |
| | Right | Green | Pittsburg Landing | 150000 | 12 |
| | Right | Red | Unknown | | 2 |
| Summer Steelhead | Left | Green | Chiwawa Hatchery | 37132 | 7 |
| | Left | Orange | Chiwawa Hatchery | 82684 | 10 |
| | Left | Red | Chiwawa Hatchery | 53051 | 12 |
| | | | | Total Elastomer tags = | **185** |

**Freeze Brands**

| Species | Location* | Code | Orient. | Release site | Release number | Number Recaptured |
|---|---|---|---|---|---|---|
| Summer Steelhead | RA | IV | 3 | Lyons Ferry Hatchery | 20000 | 1 |
| | | | | | Total Freeze Brands = | **1** |

* RA = right anterior

Table B-3. Interruptions in the sampling season at Bonneville Dam, PH1, 1999.

| Date | Batch Number | Reason for Outage | Hours Missed |
|---|---|---|---|
| 17-March | 99005 | PIT Tag coil maintenance. | 1 |
| 31-Mar | 99019 | Cable maintenance and replacement. | 2 |
| 7-May | 99056 | End-of-screen sweep repairs and ERG Limit switch replacement. | 1 |
| 9-August | 99150 | Small, dewatering screen sweep and motor repairs. | **8** |
| | | **Total hours missed** | **12** |

Table B-4. Gas bubble trauma (GBT) examination summary for Bonneville Dam, 1999.

| | | | Incidence of Gas Bubble Trauma symptoms | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | % of monthly sample* | | | | Smolt Affected | | Monthly % |
| Month | Species | Sample Size | Lateral line | Eyes | unpaired fins ranks 1 and 2 | unpaired fins ranks 3 and 4 | Number | Percent | of Season Totals |
| **April** | Spring Chinook | 687 | 0.00% | 0.00% | 0.44% | 0.00% | 3 | 0.44% | 17.65% |
| | Wild Steelhead | 245 | 0.00% | 0.00% | 0.00% | 0.00% | 0 | 0.00% | 0.00% |
| | Hatchery Steelhead | 471 | 0.21% | 0.00% | 0.21% | 0.21% | 2 | 0.42% | 11.76% |
| Monthly Total | | 1403 | 0.07% | 0.00% | 0.29% | 0.07% | 5 | 0.36% | **29.41%** |
| | | | | | | | | | |
| **May** | Spring Chinook | 900 | 0.11% | 0.00% | 0.00% | 0.00% | 1 | 0.11% | 5.88% |
| | Wild Steelhead | 343 | 0.29% | 0.00% | 0.29% | 0.00% | 2 | 0.58% | 11.76% |
| | Hatchery Steelhead | 552 | 0.18% | 0.00% | 0.00% | 0.00% | 1 | 0.18% | 5.88% |
| Monthly Total | | 1795 | 0.21% | 0.00% | 0.07% | 0.00% | 4 | 0.22% | **23.53%** |
| | | | | | | | | | |
| **June** | Spring Chinook | 146 | 2.05% | 0.00% | 0.68% | 0.00% | 4 | 2.74% | 23.53% |
| | Fall Chinook | 600 | 0.00% | 0.00% | 0.00% | 0.00% | 0 | 0.00% | 0.00% |
| | Wild Steelhead | 43 | 0.00% | 0.00% | 0.00% | 0.00% | 0 | 0.00% | 0.00% |
| | Hatchery Steelhead | 209 | 0.00% | 0.48% | 0.00% | 0.00% | 1 | 0.48% | 5.88% |
| Monthly Total | | 852 | 0.30% | 0.10% | 0.10% | 0.00% | 5 | 0.59% | **29.41%** |
| | | | | | | | | | |
| **July** | Fall Chinook | 800 | | | | | | | |
| Monthly Total | | 800 | 0.00% | 0.00% | 0.25% | 0.00% | 2 | 0.25% | **11.76%** |
| | | | | | | | | | |
| **August** | Fall Chinook | 665 | | | | | | | |
| Monthly Total | | 665 | 0.15% | 0.00% | 0.00% | 0.00% | 1 | 0.15% | **5.88%** |
| | | | | | | | | | |
| **Season Totals** | Spring Chinook | 1587 | 0.23% | 0.00% | 0.23% | 0.00% | 8 | 0.50% | |
| | Fall Chinook | 2065 | 0.05% | 0.00% | 0.10% | 0.00% | 3 | 0.15% | |
| | Wild Steelhead | 631 | 0.16% | 0.00% | 0.16% | 0.00% | 2 | 0.32% | |
| | Hatchery Steelhead | 1232 | 0.16% | 0.08% | 0.08% | 0.08% | 4 | 0.32% | |
| Season Total | | 5515 | 0.14% | 0.02% | 0.14% | 0.02% | **17** | **0.31%** | |
| Total number of symptoms in each location | | | 8 | 1 | 8 | 1 | 18 | | |
| % of symptoms in each location | | | 44.4% | 5.6% | 44.4% | 5.6% | | | |

NOTE: GBT symptoms were ranked as follows: 0 = 0% coverage, 1 = 1-5% coverage, 2 = 6-25% coverage, 3 = 26-50% coverage, and 4 = greater than 50% coverage.

* some smolt exhibited symptoms in multiple locations

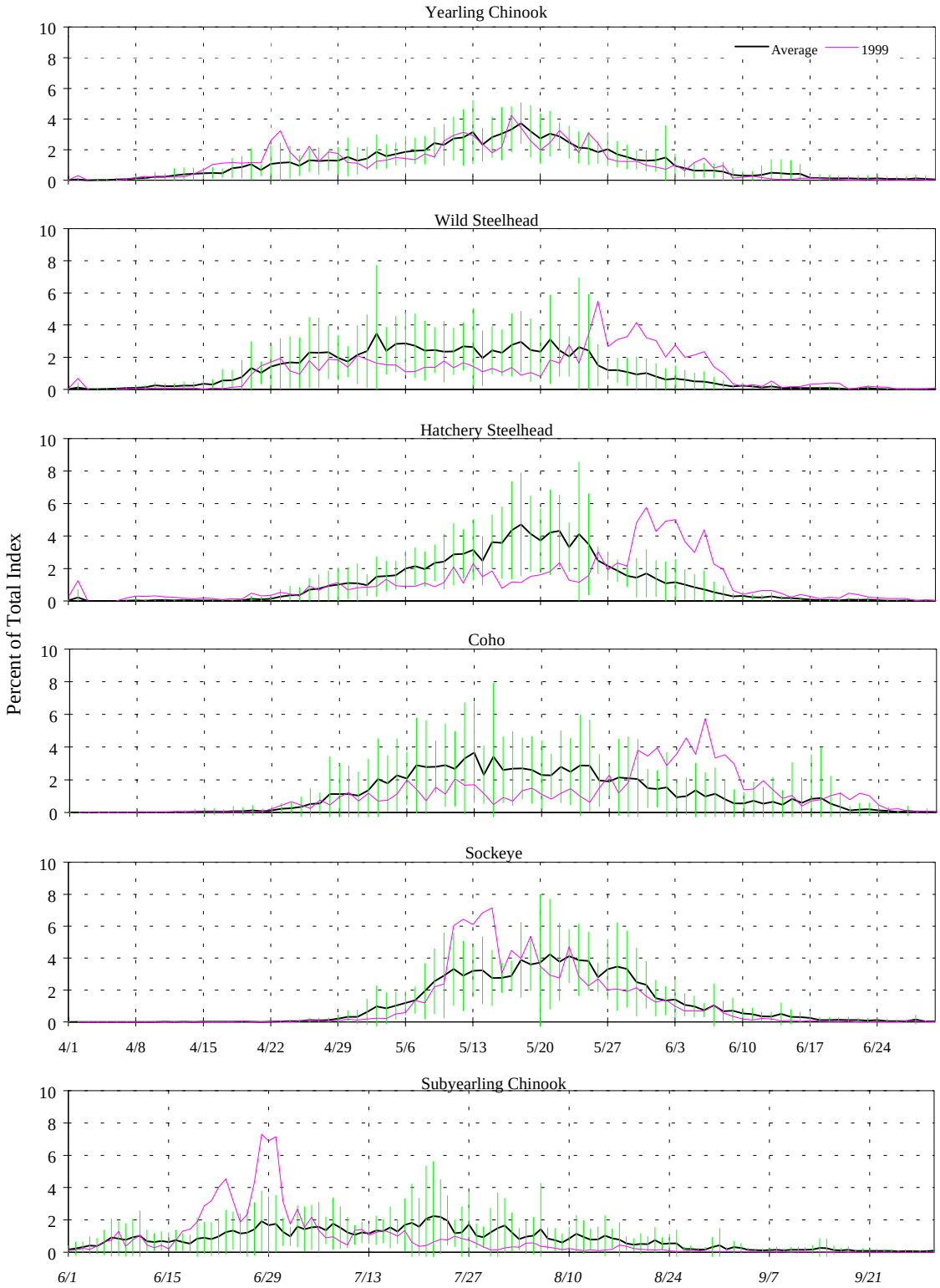


Figure C-1. Historical average passage pattern with standard deviation, John Day Dam, 1985-1999.

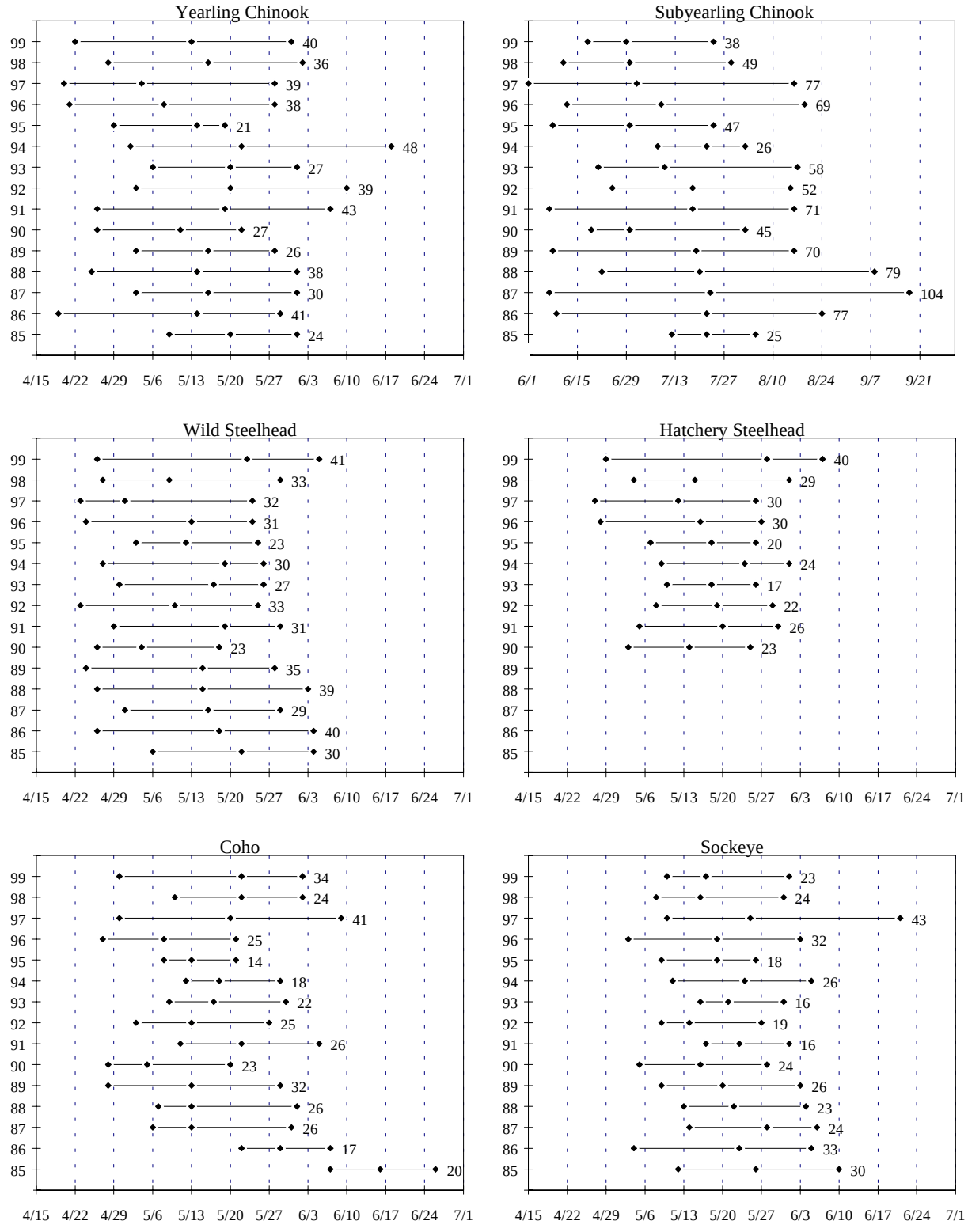


Figure C-2. 10%, 50%, and 90% passage dates at John Day Dam, by species, 1985-1999. The duration between 10-90% dates (in days) is indicated for each line. Hatchery and wild steelhead were not differentiated before 1990.

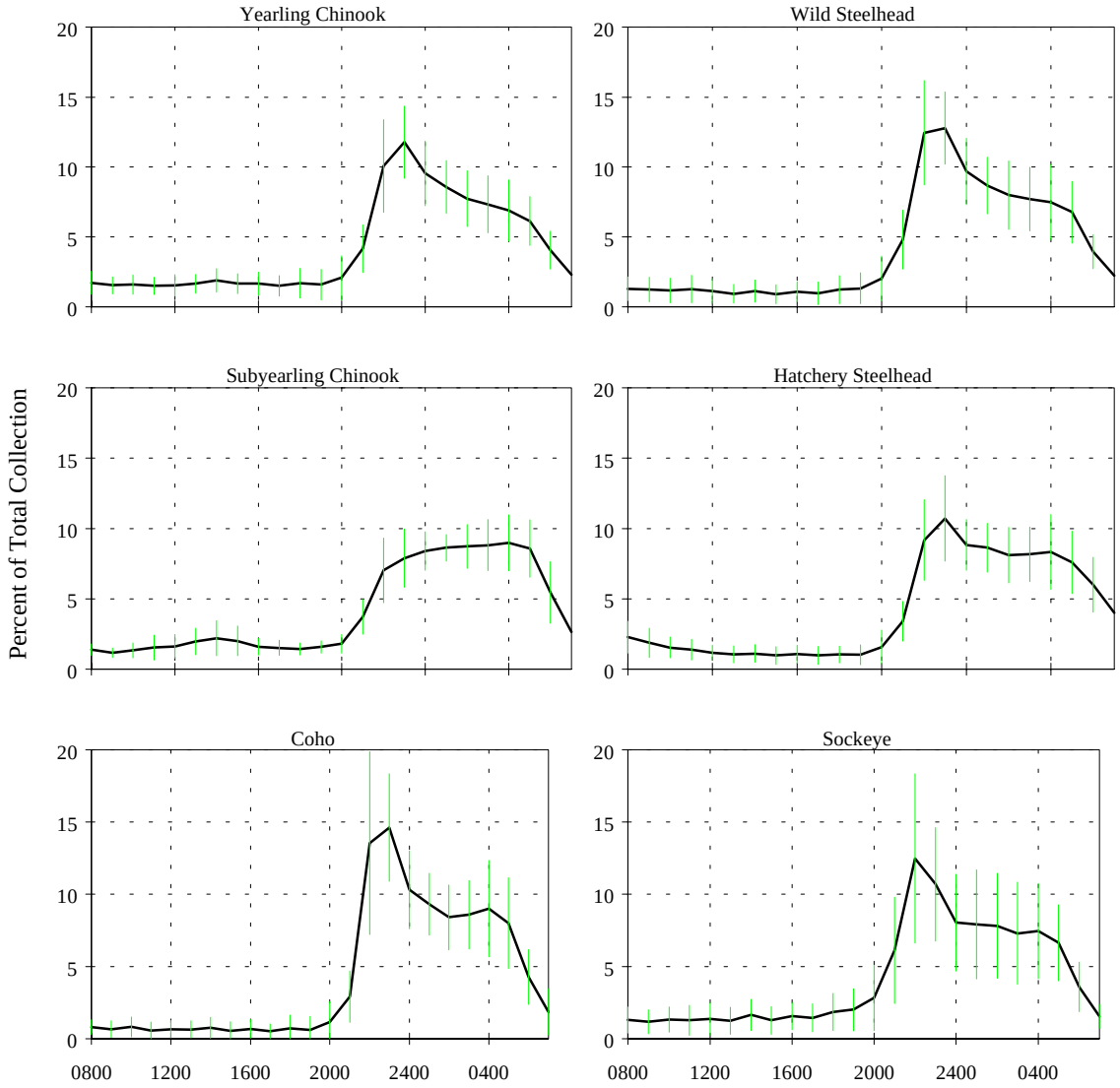


Figure C-3. Historical average diel passage with standard deviation, John Day Dam, 1985-1997. Hourly detail was not collected in 1998 or 1999.

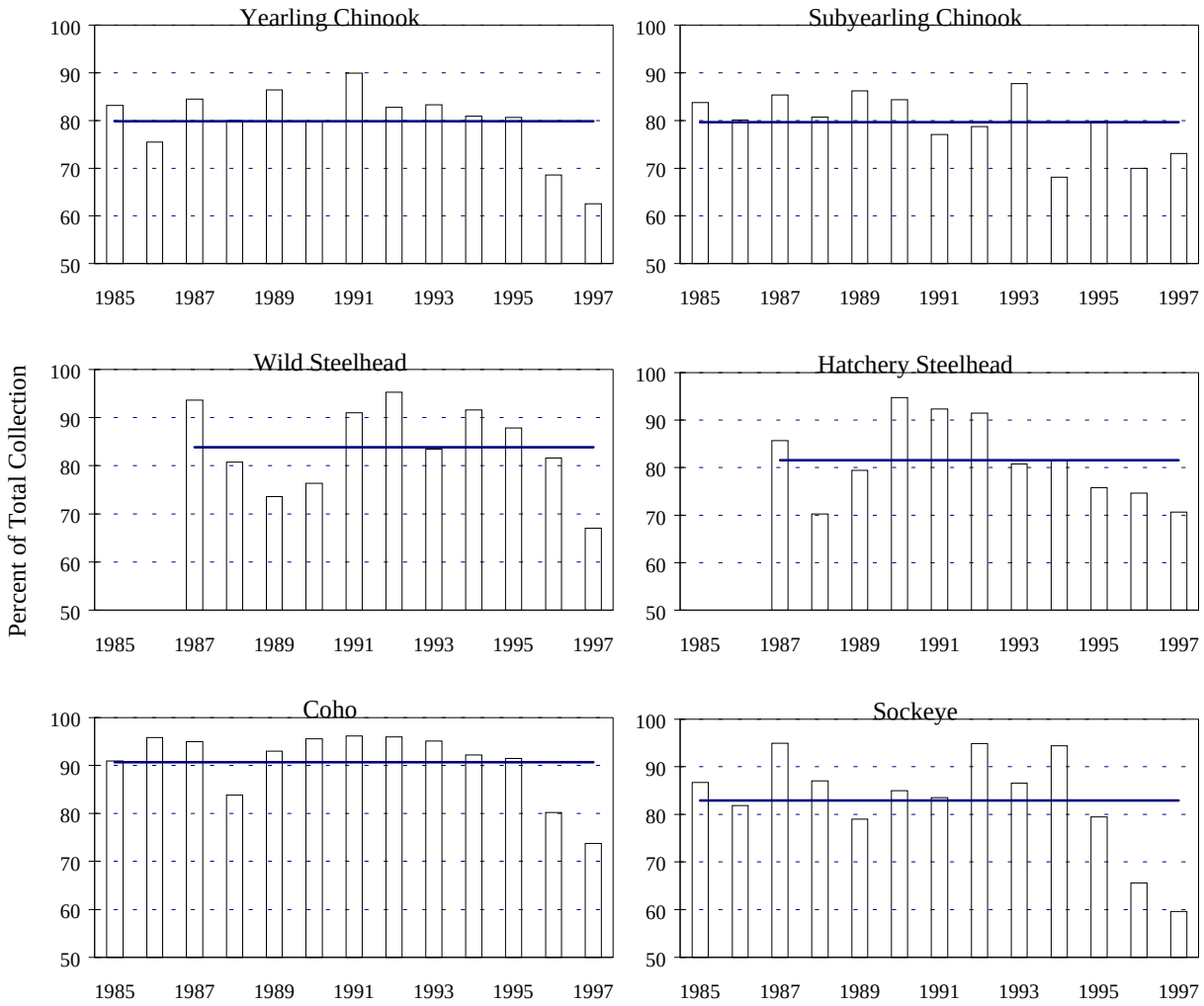


Figure C-4. Percent night passage (1800-0600) for each season at John Day Dam, by species, including the average for all years, 1985-1997. Hourly detail was not collected in 1998 or 1999.

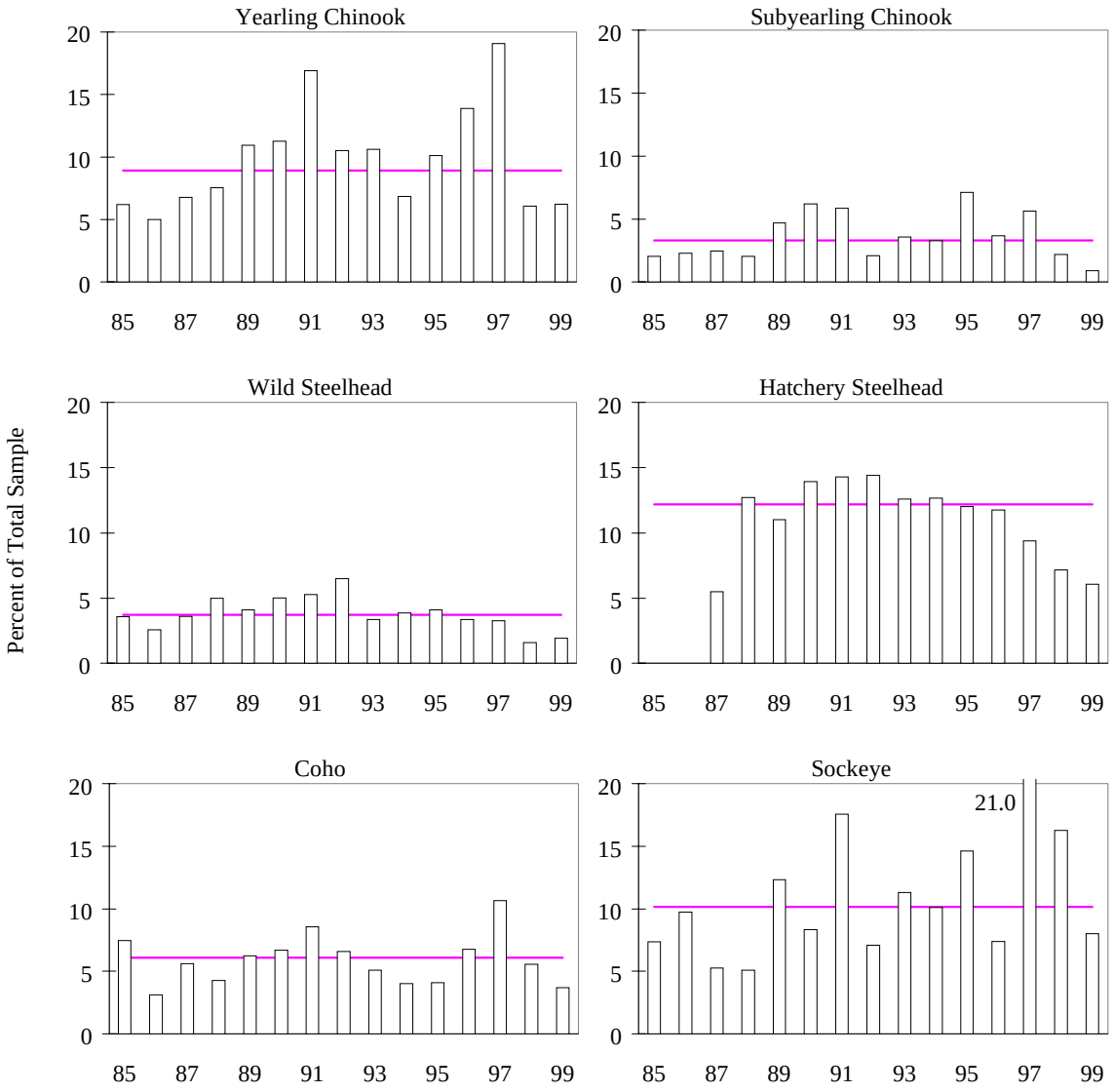


Figure C-5. Historical descaling percentages, John Day Dam, 1985-1999. Hatchery and wild steelhead not differentiated before 1987.

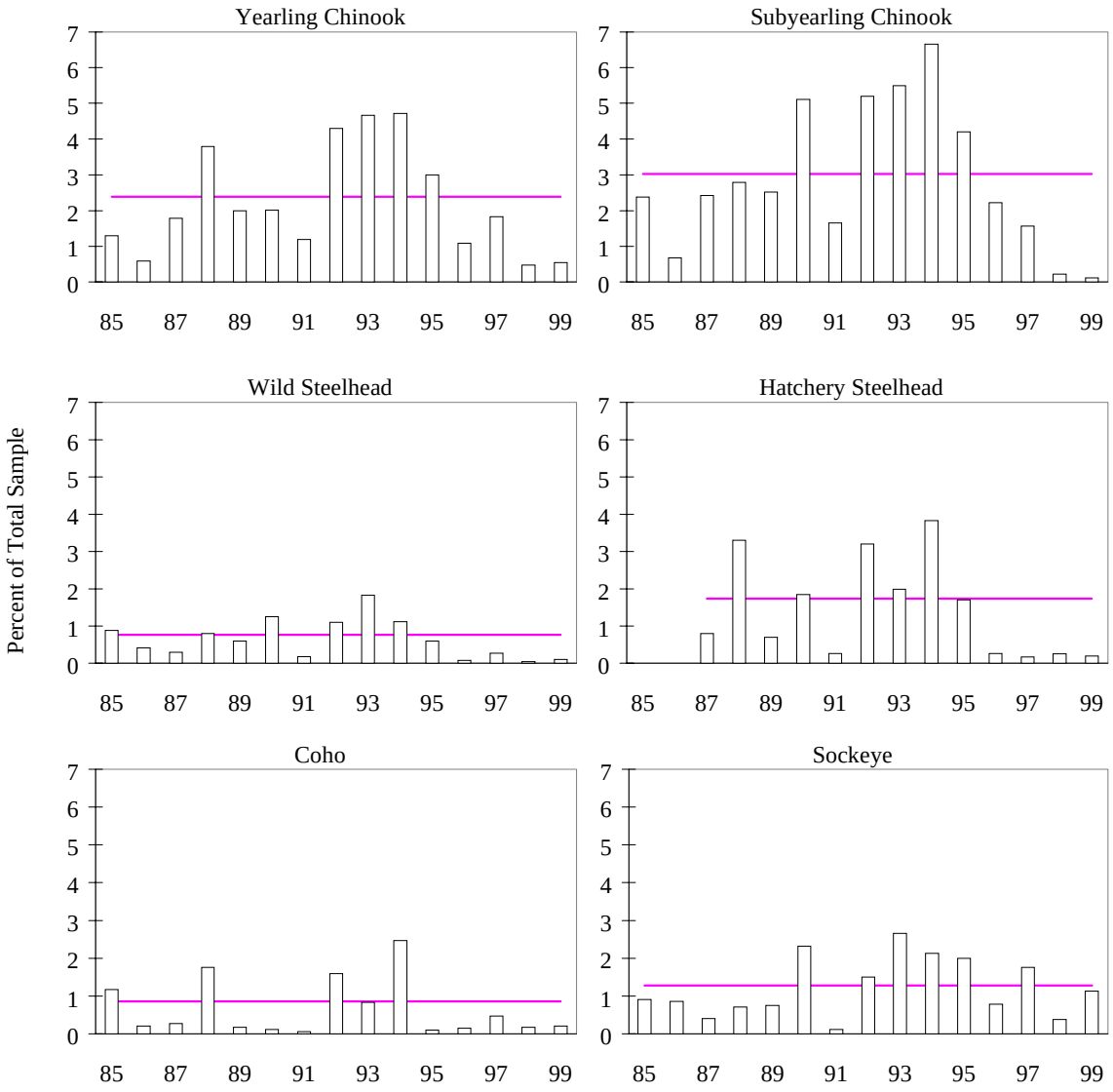


Figure C-6. Historical mortality percentages, John Day Dam, 1985-1999. Hatchery and wild steelhead were not differentiated before 1987.

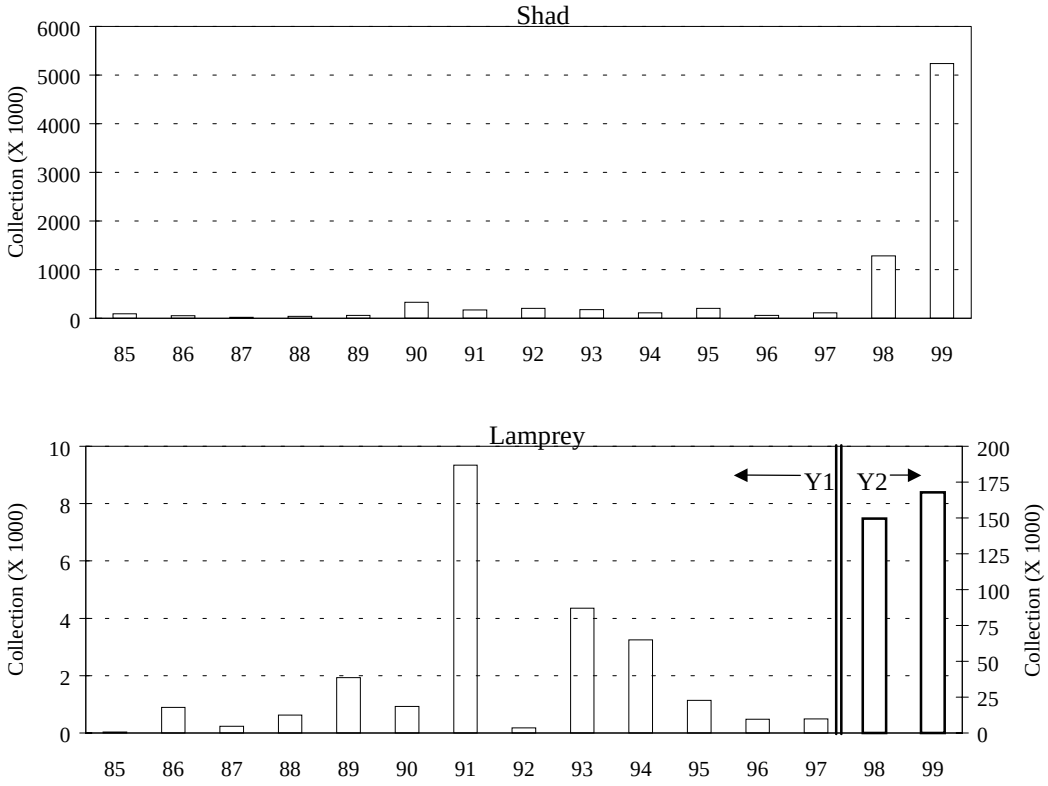


Figure C-7. Historical juvenile shad and lamprey counts at John Day Dam, 1985-1999.

Table C-1. Percent night passage (1800-0600) for each season at John Day Dam, 1985-1997. Hourly detail was not collected in 1998 or 1999.

| YEAR | Yearling Chinook | Subyearling Chinook | Wild Steelhead | Hatchery Steelhead | Coho | Sockeye |
|---|---|---|---|---|---|---|
| 1985 | 83.2 | 83.7 | N/A | N/A | 91.0 | 86.8 |
| 1986 | 75.5 | 80.1 | N/A | N/A | 95.9 | 81.9 |
| 1987 | 84.5 | 85.4 | 93.6 | 85.6 | 95.0 | 94.9 |
| 1988 | 80.0 | 80.7 | 80.8 | 70.3 | 83.9 | 87.1 |
| 1989 | 86.4 | 86.2 | 73.6 | 79.4 | 93.0 | 79.0 |
| 1990 | 79.7 | 84.4 | 76.3 | 94.8 | 95.6 | 85.0 |
| 1991 | 89.9 | 77.0 | 91.0 | 92.3 | 96.2 | 83.6 |
| 1992 | 82.8 | 78.7 | 95.3 | 91.5 | 96.0 | 94.9 |
| 1993 | 83.3 | 87.8 | 83.4 | 80.7 | 95.1 | 86.5 |
| 1994 | 80.9 | 68.1 | 91.6 | 81.4 | 92.2 | 94.5 |
| 1995 | 80.7 | 79.7 | 87.9 | 75.8 | 91.5 | 79.5 |
| 1996 | 68.6 | 70.0 | 81.6 | 74.7 | 80.2 | 65.6 |
| 1997 | 62.6 | 73.1 | 67.0 | 70.6 | 73.7 | 59.6 |
| AVERAGE | 79.8 | 79.6 | 83.8 | 81.5 | 90.7 | 83.0 |
| MIN | 62.6 | 68.1 | 67.0 | 70.3 | 73.7 | 59.6 |
| MAX | 89.9 | 87.8 | 95.3 | 94.8 | 96.2 | 94.9 |

Table C-2. 10%, 50%, and 90% passage dates at John Day Dam, 1985 to 1999.

| Yearling Chinook | | | | |
|---|---|---|---|---|
| | 10 % | 50% | 90 % | # of Days |
| 1985^ | 9-May | 20-May | 1-Jun | 24 |
| 1986 | 19-Apr | 14-May | 29-May | 41 |
| 1987 | 3-May | 16-May | 1-Jun | 30 |
| 1988 | 25-Apr | 14-May | 1-Jun | 38 |
| 1989 | 3-May | 16-May | 28-May | 26 |
| 1990^ | 26-Apr | 11-May | 22-May | 27 |
| 1991 | 26-Apr | 19-May | 7-Jun | 43 |
| 1992 | 3-May | 20-May | 10-Jun | 39 |
| 1993 | 6-May | 20-May | 1-Jun | 27 |
| 1994 | 2-May | 22-May | 18-Jun | 48 |
| 1995 | 29-Apr | 14-May | 19-May | 21 |
| 1996 | 21-Apr | 8-May | 28-May | 38 |
| 1997 | 20-Apr | 4-May | 28-May | 39 |
| 1998 | 28-Apr | 16-May | 2-Jun | 36 |
| 1999 | 22-Apr | 13-May | 31-May | 40 |
| **MEDIAN** | 28-Apr | 16-May | 1-Jun | 35 |
| **MIN** | 19-Apr | 4-May | 19-May | 21 |
| **MAX** | 9-May | 22-May | 18-Jun | 48 |

| Subyearling Chinook | | | | |
|---|---|---|---|---|
| | 10 % | 50% | 90 % | # of Days |
| 1985^ | 12-Jul | 22-Jul | 5-Aug | 25 |
| 1986 | 9-Jun | 22-Jul | 24-Aug | 77 |
| 1987 | 7-Jun | 23-Jul | 18-Sep | 104 |
| 1988 | 22-Jun | 20-Jul | 8-Sep | 79 |
| 1989 | 8-Jun | 19-Jul | 16-Aug | 70 |
| 1990^ | 19-Jun | 30-Jun | 2-Aug | 45 |
| 1991 | 7-Jun | 18-Jul | 16-Aug | 71 |
| 1992 | 25-Jun | 18-Jul | 15-Aug | 52 |
| 1993 | 21-Jun | 10-Jul | 17-Aug | 58 |
| 1994 | 8-Jul | 22-Jul | 2-Aug | 26 |
| 1995 | 8-Jun | 30-Jun | 24-Jul | 47 |
| 1996 | 12-Jun | 9-Jul | 19-Aug | 69 |
| 1997 | 1-Jun | 2-Jul | 16-Aug | 77 |
| 1998 | 11-Jun | 30-Jun | 29-Jul | 49 |
| 1999 | 18-Jun | 29-Jun | 25-Jul | 38 |
| **MEDIAN** | 12-Jun | 18-Jul | 16-Aug | 66 |
| **MIN** | 1-Jun | 29-Jun | 24-Jul | 25 |
| **MAX** | 12-Jul | 23-Jul | 18-Sep | 104 |

| Wild Steelhead | | | | |
|---|---|---|---|---|
| | 10 % | 50% | 90 % | # of Days |
| 1985*^ | 6-May | 22-May | 4-Jun | 30 |
| 1986* | 26-Apr | 18-May | 4-Jun | 40 |
| 1987* | 1-May | 16-May | 29-May | 29 |
| 1988* | 26-Apr | 15-May | 3-Jun | 39 |
| 1989* | 24-Apr | 15-May | 28-May | 35 |
| 1990^ | 26-Apr | 4-May | 18-May | 23 |
| 1991 | 29-Apr | 19-May | 29-May | 31 |
| 1992 | 23-Apr | 10-May | 25-May | 33 |
| 1993 | 30-Apr | 17-May | 26-May | 27 |
| 1994 | 27-Apr | 19-May | 26-May | 30 |
| 1995 | 3-May | 12-May | 25-May | 23 |
| 1996 | 24-Apr | 13-May | 24-May | 31 |
| 1997 | 23-Apr | 1-May | 24-May | 32 |
| 1998 | 27-Apr | 9-May | 29-May | 33 |
| 1999 | 26-Apr | 23-May | 5-Jun | 41 |
| **MEDIAN** | 26-Apr | 15-May | 28-May | 33 |
| **MIN** | 23-Apr | 1-May | 18-May | 23 |
| **MAX** | 6-May | 23-May | 5-Jun | 41 |

| Hatchery Steelhead | | | | |
|---|---|---|---|---|
| | 10 % | 50% | 90 % | # of Days |
| 1985*^ | | | | |
| 1986* | | | | |
| 1987* | ALL STEELHEAD IN WILD | | | |
| 1988* | | | | |
| 1989* | | | | |
| 1990^ | 3-May | 14-May | 25-May | 23 |
| 1991 | 5-May | 20-May | 30-May | 26 |
| 1992 | 8-May | 19-May | 29-May | 22 |
| 1993 | 10-May | 18-May | 26-May | 17 |
| 1994 | 9-May | 24-May | 1-Jun | 24 |
| 1995 | 7-May | 18-May | 26-May | 20 |
| 1996 | 28-Apr | 16-May | 27-May | 30 |
| 1997 | 27-Apr | 12-May | 26-May | 30 |
| 1998 | 4-May | 15-May | 1-Jun | 29 |
| 1999 | 29-Apr | 28-May | 7-Jun | 40 |
| **MEDIAN** | 4-May | 18-May | 28-May | 25 |
| **MIN** | 27-Apr | 12-May | 25-May | 17 |
| **MAX** | 10-May | 28-May | 7-Jun | 40 |

| Coho | | | | |
|---|---|---|---|---|
| | 10 % | 50% | 90 % | # of Days |
| 1985^ | 7-Jun | 16-Jun | 26-Jun | 20 |
| 1986 | 22-May | 29-May | 7-Jun | 17 |
| 1987 | 6-May | 13-May | 31-May | 26 |
| 1988 | 7-May | 13-May | 1-Jun | 26 |
| 1989 | 28-Apr | 13-May | 29-May | 32 |
| 1990^ | 28-Apr | 5-May | 20-May | 23 |
| 1991 | 11-May | 22-May | 5-Jun | 26 |
| 1992 | 3-May | 13-May | 27-May | 25 |
| 1993 | 9-May | 17-May | 30-May | 22 |
| 1994 | 12-May | 18-May | 29-May | 18 |
| 1995 | 8-May | 13-May | 21-May | 14 |
| 1996 | 27-Apr | 8-May | 21-May | 25 |
| 1997 | 30-Apr | 20-May | 9-Jun | 41 |
| 1998 | 10-May | 22-May | 2-Jun | 24 |
| 1999 | 30-Apr | 22-May | 2-Jun | 34 |
| **MEDIAN** | 7-May | 17-May | 31-May | 25 |
| **MIN** | 27-Apr | 5-May | 20-May | 14 |
| **MAX** | 7-Jun | 16-Jun | 26-Jun | 41 |

| Sockeye (Wild + Hatchery) | | | | |
|---|---|---|---|---|
| | 10 % | 50% | 90 % | # of Days |
| 1985^ | 12-May | 26-May | 10-Jun | 30 |
| 1986 | 4-May | 23-May | 5-Jun | 33 |
| 1987 | 14-May | 28-May | 6-Jun | 24 |
| 1988 | 13-May | 22-May | 4-Jun | 23 |
| 1989 | 9-May | 20-May | 3-Jun | 26 |
| 1990^ | 5-May | 16-May | 28-May | 24 |
| 1991 | 17-May | 23-May | 1-Jun | 16 |
| 1992 | 9-May | 14-May | 27-May | 19 |
| 1993 | 16-May | 21-May | 31-May | 16 |
| 1994 | 11-May | 24-May | 5-Jun | 26 |
| 1995 | 9-May | 19-May | 26-May | 18 |
| 1996 | 3-May | 19-May | 3-Jun | 32 |
| 1997 | 10-May | 25-May | 21-Jun | 43 |
| 1998 | 8-May | 16-May | 31-May | 24 |
| 1999 | 10-May | 17-May | 1-Jun | 23 |
| **MEDIAN** | 10-May | 21-May | 3-Jun | 25 |
| **MIN** | 3-May | 14-May | 26-May | 16 |
| **MAX** | 17-May | 28-May | 21-Jun | 43 |

* Years in which no differentiation was made between wild and hatchery steelhead for index purposes.

^ Years in which the sample unit was out of service (1990: May 30 to June 9, and 1985: April 2 to April 26).

Table C-3. Percent of total passage per hour, John Day Dam, 1985-1997. Hourly detail not available in 1998 or 99.

**Yearling Chinook**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1985 | 0.9 | 1.1 | 1.3 | 1.5 | 1.1 | 1.6 | 1.8 | 1.7 | 1.5 | 1.6 | 1.6 | 1.3 | 1.6 | 4.9 | 11.3 | 11.6 | 10.8 | 10.1 | 8.4 | 7.5 | 7.1 | 6.0 | 2.5 | 1.0 |
| 1986 | 1.3 | 1.6 | 1.9 | 1.9 | 1.9 | 2.0 | 2.4 | 2.3 | 2.7 | 2.5 | 2.5 | 2.4 | 3.6 | 8.4 | 15.3 | 13.1 | 7.5 | 6.0 | 4.9 | 4.3 | 3.5 | 3.6 | 2.6 | 1.4 |
| 1987 | 1.3 | 1.0 | 1.0 | 0.8 | 0.8 | 1.8 | 1.7 | 1.6 | 1.1 | 0.9 | 1.1 | 0.9 | 1.1 | 2.4 | 5.5 | 11.5 | 11.0 | 10.3 | 9.9 | 8.9 | 9.5 | 8.1 | 5.5 | 2.4 |
| 1988 | 2.7 | 2.1 | 2.4 | 0.9 | 0.9 | 1.0 | 1.2 | 1.1 | 1.2 | 1.2 | 1.0 | 1.2 | 1.5 | 4.2 | 7.2 | 9.7 | 7.8 | 7.5 | 8.3 | 9.2 | 8.1 | 8.1 | 7.2 | 4.2 |
| 1989 | 2.2 | 1.1 | 0.8 | 0.7 | 0.8 | 0.7 | 0.8 | 0.7 | 0.9 | 0.6 | 0.8 | 0.7 | 0.9 | 2.8 | 9.1 | 12.1 | 10.6 | 10.2 | 9.4 | 9.5 | 8.9 | 6.9 | 5.5 | 3.6 |
| 1990 | 1.0 | 1.7 | 2.0 | 1.7 | 2.0 | 1.9 | 2.9 | 1.5 | 2.2 | 1.2 | 1.4 | 0.8 | 1.2 | 4.3 | 8.6 | 10.9 | 9.7 | 8.6 | 8.2 | 7.9 | 8.2 | 7.6 | 3.6 | 0.7 |
| 1991 | 0.6 | 0.5 | 0.8 | 0.8 | 0.9 | 1.0 | 1.0 | 1.0 | 1.0 | 0.9 | 0.8 | 0.9 | 1.0 | 3.2 | 14.9 | 17.4 | 13.9 | 10.2 | 7.8 | 6.6 | 6.1 | 4.9 | 2.9 | 0.7 |
| 1992 | 1.1 | 1.3 | 1.3 | 2.1 | 1.9 | 2.1 | 1.8 | 1.5 | 1.2 | 1.4 | 0.7 | 0.6 | 0.7 | 2.4 | 6.0 | 11.6 | 11.7 | 10.8 | 10.4 | 9.5 | 8.8 | 6.7 | 3.5 | 1.0 |
| 1993 | 2.6 | 1.7 | 1.4 | 1.1 | 1.0 | 0.9 | 0.8 | 0.8 | 0.8 | 1.0 | 1.1 | 1.1 | 1.5 | 2.8 | 14.8 | 16.2 | 10.3 | 7.8 | 7.2 | 6.1 | 6.1 | 5.5 | 3.9 | 3.4 |
| 1994 | 1.2 | 1.3 | 1.2 | 1.7 | 1.5 | 2.1 | 2.3 | 1.9 | 1.8 | 1.4 | 1.3 | 1.1 | 1.0 | 4.1 | 7.9 | 8.8 | 8.9 | 8.7 | 9.4 | 9.3 | 9.4 | 8.3 | 4.0 | 1.4 |
| 1995 | 1.5 | 2.1 | 1.2 | 1.1 | 1.0 | 0.9 | 1.6 | 1.6 | 1.2 | 1.2 | 1.8 | 1.9 | 2.5 | 3.3 | 10.6 | 10.5 | 9.8 | 9.6 | 7.5 | 7.5 | 6.5 | 6.4 | 4.5 | 4.2 |
| 1996 | 2.4 | 2.2 | 2.4 | 2.4 | 2.7 | 2.6 | 3.0 | 2.9 | 2.2 | 2.2 | 3.6 | 3.7 | 5.5 | 5.9 | 11.1 | 11.2 | 6.9 | 6.8 | 4.2 | 4.0 | 3.2 | 3.2 | 2.9 | 2.7 |
| 1997 | 3.2 | 2.8 | 2.9 | 2.5 | 3.2 | 2.6 | 3.3 | 2.8 | 3.6 | 3.3 | 4.0 | 3.8 | 4.8 | 5.3 | 8.4 | 8.5 | 5.2 | 4.7 | 4.8 | 4.6 | 4.3 | 4.3 | 3.9 | 3.3 |
| AVG | 1.6 | 1.5 | 1.5 | 1.4 | 1.3 | 1.6 | 1.8 | 1.7 | 1.6 | 1.5 | 1.7 | 1.6 | 2.1 | 4.4 | 10.5 | 11.9 | 9.6 | 8.7 | 7.7 | 7.2 | 6.8 | 6.1 | 4.0 | 2.4 |
| MIN | 0.6 | 0.5 | 0.8 | 0.7 | 0.8 | 0.7 | 0.8 | 0.7 | 0.8 | 0.6 | 0.7 | 0.6 | 0.7 | 2.4 | 5.5 | 8.5 | 5.2 | 4.7 | 4.2 | 4.0 | 3.2 | 3.2 | 2.5 | 0.7 |
| MAX | 3.2 | 2.8 | 2.9 | 2.5 | 3.2 | 2.6 | 3.3 | 2.9 | 3.6 | 3.3 | 4.0 | 3.8 | 5.5 | 8.4 | 15.3 | 17.4 | 13.9 | 10.8 | 10.4 | 9.5 | 9.5 | 8.3 | 7.2 | 4.2 |

**Subyearling Chinook**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1985 | 0.8 | 1.0 | 1.3 | 3.1 | 1.8 | 1.3 | 1.6 | 1.0 | 0.9 | 1.1 | 1.1 | 1.0 | 1.2 | 5.0 | 12.1 | 8.1 | 8.5 | 8.7 | 10.1 | 7.9 | 8.9 | 8.0 | 4.2 | 1.2 |
| 1986 | 1.9 | 1.4 | 1.3 | 1.4 | 1.5 | 2.5 | 1.6 | 1.4 | 1.2 | 1.3 | 1.3 | 1.4 | 1.4 | 4.0 | 5.4 | 7.9 | 8.3 | 8.8 | 8.6 | 8.7 | 9.4 | 9.2 | 7.1 | 3.1 |
| 1987 | 2.0 | 0.8 | 0.9 | 0.7 | 0.8 | 0.8 | 1.0 | 1.0 | 1.1 | 1.1 | 1.2 | 2.0 | 2.1 | 4.5 | 6.7 | 6.5 | 7.3 | 8.7 | 8.3 | 9.9 | 10.0 | 10.8 | 8.6 | 3.1 |
| 1988 | 1.7 | 1.2 | 1.1 | 1.1 | 1.2 | 1.8 | 1.8 | 1.7 | 1.4 | 1.5 | 1.4 | 2.1 | 2.2 | 5.7 | 7.6 | 6.5 | 6.6 | 7.4 | 7.9 | 8.5 | 9.5 | 9.3 | 7.4 | 3.3 |
| 1989 | 1.8 | 1.1 | 1.1 | 0.7 | 0.7 | 0.6 | 0.7 | 0.7 | 0.9 | 0.8 | 0.9 | 1.0 | 0.9 | 2.3 | 3.3 | 4.4 | 6.6 | 8.5 | 11.6 | 12.4 | 12.9 | 12.8 | 9.4 | 3.8 |
| 1990 | 0.9 | 0.8 | 0.8 | 1.2 | 1.3 | 1.7 | 1.8 | 1.9 | 1.8 | 1.2 | 1.2 | 1.2 | 1.4 | 2.9 | 7.3 | 12.1 | 11.4 | 10.1 | 10.0 | 9.2 | 8.1 | 7.2 | 3.4 | 1.1 |
| 1991 | 1.0 | 0.7 | 0.8 | 1.0 | 1.1 | 3.3 | 4.7 | 4.0 | 1.9 | 1.7 | 1.4 | 1.5 | 1.6 | 3.6 | 7.5 | 10.0 | 8.7 | 8.2 | 8.0 | 8.0 | 8.3 | 7.9 | 3.8 | 1.4 |
| 1992 | 1.1 | 1.2 | 1.3 | 1.6 | 1.6 | 2.9 | 2.4 | 2.2 | 2.2 | 1.9 | 1.9 | 2.2 | 2.7 | 5.7 | 6.2 | 7.0 | 7.8 | 7.9 | 8.6 | 9.0 | 10.1 | 8.5 | 3.1 | 1.1 |
| 1993 | 1.1 | 0.9 | 0.9 | 0.7 | 0.9 | 0.8 | 0.7 | 0.8 | 0.8 | 0.7 | 0.8 | 1.0 | 1.1 | 2.7 | 4.2 | 6.0 | 8.7 | 10.0 | 11.1 | 12.2 | 12.1 | 11.3 | 7.4 | 3.0 |
| 1994 | 1.5 | 1.9 | 2.1 | 3.3 | 3.7 | 3.6 | 3.7 | 3.3 | 2.2 | 1.9 | 1.7 | 1.7 | 3.2 | 4.2 | 6.4 | 7.0 | 7.0 | 7.1 | 6.1 | 6.3 | 7.7 | 7.1 | 4.3 | 3.1 |
| 1995 | 1.1 | 1.1 | 1.6 | 1.1 | 1.6 | 1.6 | 1.9 | 1.9 | 1.9 | 1.8 | 2.1 | 2.1 | 1.8 | 2.4 | 10.1 | 10.5 | 9.7 | 10.0 | 8.2 | 8.0 | 6.8 | 6.7 | 3.5 | 2.6 |
| 1996 | 1.6 | 1.5 | 2.4 | 2.3 | 2.2 | 2.2 | 3.1 | 3.2 | 2.7 | 2.7 | 2.1 | 2.0 | 2.2 | 2.5 | 6.2 | 7.9 | 9.4 | 8.3 | 7.6 | 7.0 | 6.0 | 6.0 | 4.8 | 4.1 |
| 1997 | 1.5 | 1.3 | 2.0 | 1.9 | 2.6 | 2.5 | 3.7 | 3.0 | 1.8 | 1.8 | 1.6 | 1.5 | 1.8 | 2.8 | 8.1 | 8.8 | 9.2 | 8.4 | 7.5 | 7.3 | 7.0 | 6.6 | 4.0 | 3.1 |
| AVG | 1.4 | 1.2 | 1.3 | 1.7 | 1.6 | 1.8 | 1.9 | 1.7 | 1.4 | 1.4 | 1.3 | 1.5 | 1.7 | 3.9 | 7.4 | 7.5 | 8.1 | 8.6 | 8.9 | 8.8 | 9.3 | 8.9 | 5.9 | 2.7 |
| MIN | 0.8 | 0.7 | 0.8 | 0.7 | 0.7 | 0.6 | 0.7 | 0.7 | 0.8 | 0.7 | 0.8 | 1.0 | 0.9 | 2.3 | 3.3 | 4.4 | 6.6 | 7.1 | 6.1 | 6.3 | 6.0 | 6.0 | 3.1 | 1.1 |
| MAX | 2.0 | 1.9 | 2.4 | 3.3 | 3.7 | 3.6 | 4.7 | 4.0 | 2.7 | 2.7 | 2.1 | 2.2 | 3.2 | 5.7 | 12.1 | 12.1 | 11.4 | 10.1 | 11.6 | 12.4 | 12.9 | 12.8 | 9.4 | 4.1 |

**Wild Steelhead**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1985 | 1.0 | 0.8 | 0.8 | 0.8 | 0.7 | 0.9 | 1.0 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.9 | 3.0 | 9.6 | 10.7 | 10.1 | 10.9 | 9.9 | 10.0 | 10.1 | 9.2 | 4.2 | 1.6 |
| 1986 | 2.0 | 1.4 | 1.3 | 0.9 | 0.8 | 0.8 | 1.1 | 0.9 | 1.0 | 1.1 | 1.2 | 1.5 | 3.0 | 6.4 | 10.8 | 13.0 | 9.8 | 8.1 | 7.6 | 6.7 | 5.6 | 5.9 | 5.9 | 3.1 |
| 1987 | 0.7 | 0.4 | 0.5 | 0.4 | 0.5 | 0.4 | 0.6 | 0.3 | 0.6 | 0.2 | 0.4 | 0.3 | 0.5 | 2.7 | 10.9 | 13.4 | 11.2 | 10.7 | 9.6 | 10.1 | 10.7 | 8.7 | 5.1 | 1.5 |
| 1988 | 1.2 | 2.4 | 2.9 | 1.3 | 1.5 | 1.3 | 2.0 | 1.0 | 1.2 | 1.0 | 0.9 | 1.5 | 2.0 | 4.9 | 8.1 | 10.5 | 8.0 | 7.8 | 8.5 | 8.6 | 8.0 | 7.7 | 5.2 | 2.5 |
| 1989 | 2.5 | 1.8 | 2.1 | 3.1 | 2.9 | 1.8 | 2.1 | 1.8 | 2.0 | 2.3 | 2.3 | 3.1 | 3.5 | 7.3 | 12.8 | 9.1 | 6.7 | 6.5 | 5.8 | 6.0 | 5.6 | 4.6 | 2.7 | 1.9 |
| 1990 | 0.4 | 0.3 | 0.7 | 0.2 | 0.4 | 0.2 | 0.7 | 0.2 | 0.5 | 0.2 | 0.6 | 0.2 | 0.7 | 7.3 | 15.7 | 15.7 | 11.1 | 8.1 | 8.8 | 7.6 | 9.2 | 7.7 | 2.9 | 0.4 |
| 1991 | 1.1 | 0.6 | 0.7 | 0.6 | 1.0 | 0.5 | 0.7 | 0.3 | 0.6 | 0.9 | 0.8 | 1.4 | 1.9 | 6.0 | 18.0 | 16.1 | 11.4 | 9.1 | 6.5 | 7.2 | 5.8 | 5.4 | 2.1 | 1.1 |
| 1992 | 0.3 | 0.5 | 0.3 | 0.4 | 0.4 | 0.5 | 0.3 | 0.4 | 0.3 | 0.6 | 0.2 | 0.1 | 0.3 | 2.1 | 8.1 | 13.0 | 13.7 | 12.4 | 12.6 | 11.1 | 9.9 | 8.7 | 3.3 | 0.6 |
| 1993 | 1.9 | 1.5 | 1.1 | 1.2 | 1.1 | 1.1 | 1.1 | 1.2 | 1.4 | 1.2 | 1.4 | 1.5 | 2.2 | 6.5 | 17.2 | 14.8 | 8.9 | 6.9 | 6.5 | 5.0 | 5.0 | 5.3 | 3.6 | 2.3 |
| 1994 | 0.7 | 0.6 | 0.5 | 2.6 | 0.4 | 0.4 | 0.3 | 0.5 | 0.5 | 0.4 | 0.4 | 0.5 | 0.6 | 2.4 | 8.1 | 11.4 | 10.8 | 9.3 | 11.0 | 10.8 | 12.0 | 10.7 | 3.9 | 1.1 |
| 1995 | 0.8 | 1.3 | 0.5 | 0.5 | 0.2 | 0.4 | 0.4 | 0.4 | 0.6 | 0.5 | 0.9 | 0.7 | 1.6 | 2.3 | 12.7 | 12.8 | 10.3 | 10.3 | 8.1 | 8.0 | 7.5 | 7.4 | 6.1 | 5.5 |
| 1996 | 1.5 | 1.6 | 1.1 | 1.2 | 1.4 | 1.2 | 1.4 | 1.3 | 1.4 | 1.0 | 2.1 | 2.0 | 3.8 | 4.3 | 15.3 | 15.1 | 9.0 | 8.9 | 6.2 | 5.9 | 3.9 | 3.6 | 3.7 | 3.1 |
| 1997 | 2.9 | 3.0 | 2.3 | 2.4 | 2.4 | 2.2 | 2.6 | 2.3 | 2.6 | 2.6 | 3.5 | 3.2 | 5.2 | 6.8 | 9.8 | 8.7 | 5.4 | 5.3 | 4.3 | 4.4 | 4.7 | 4.4 | 4.6 | 4.3 |
| AVG | 1.4 | 1.3 | 1.2 | 1.3 | 1.1 | 0.9 | 1.1 | 0.9 | 1.1 | 1.0 | 1.3 | 1.4 | 2.2 | 4.7 | 12.8 | 12.8 | 9.4 | 8.6 | 7.7 | 7.4 | 7.2 | 6.5 | 4.2 | 2.5 |
| MIN | 0.3 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 | 0.3 | 0.2 | 0.2 | 0.1 | 0.3 | 2.1 | 8.1 | 8.7 | 5.4 | 5.3 | 4.3 | 4.4 | 3.9 | 3.6 | 2.1 | 0.4 |
| MAX | 2.9 | 3.0 | 2.9 | 3.1 | 2.9 | 2.2 | 2.6 | 2.3 | 2.6 | 2.6 | 3.5 | 3.2 | 5.2 | 7.3 | 18.0 | 16.1 | 13.7 | 12.4 | 12.6 | 11.1 | 12.0 | 10.7 | 6.1 | 5.5 |

**Hatchery Steelhead**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1985 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1986 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1987 | 1.9 | 1.1 | 1.3 | 0.7 | 0.9 | 0.6 | 1.0 | 0.7 | 0.9 | 0.7 | 0.9 | 0.6 | 0.9 | 2.3 | 6.0 | 9.7 | 8.4 | 8.8 | 9.8 | 10.2 | 10.9 | 10.0 | 7.9 | 3.7 |
| 1988 | 2.8 | 3.0 | 3.1 | 2.2 | 1.8 | 2.1 | 2.6 | 2.0 | 2.1 | 1.7 | 1.5 | 1.5 | 2.0 | 6.0 | 6.9 | 7.6 | 6.5 | 6.6 | 5.7 | 6.6 | 7.2 | 6.6 | 6.9 | 5.0 |
| 1989 | 3.5 | 1.9 | 1.6 | 1.5 | 1.3 | 0.9 | 1.0 | 1.0 | 0.8 | 0.7 | 0.8 | 0.8 | 0.9 | 2.5 | 9.7 | 9.3 | 7.6 | 8.3 | 8.1 | 8.3 | 8.5 | 7.8 | 7.6 | 5.5 |
| 1990 | 0.5 | 0.2 | 0.7 | 0.1 | 0.4 | 0.2 | 0.8 | 0.1 | 0.6 | 0.1 | 0.7 | 0.3 | 0.9 | 3.2 | 10.5 | 12.5 | 10.1 | 9.8 | 9.2 | 9.4 | 11.4 | 11.6 | 5.9 | 0.9 |
| 1991 | 0.9 | 0.7 | 0.8 | 0.6 | 0.5 | 0.5 | 0.6 | 0.4 | 0.5 | 0.5 | 0.7 | 1.1 | 1.5 | 5.2 | 13.8 | 15.0 | 12.0 | 10.0 | 8.6 | 7.5 | 6.9 | 6.5 | 4.3 | 1.0 |
| 1992 | 0.9 | 0.8 | 0.6 | 0.9 | 0.9 | 0.9 | 0.5 | 0.4 | 0.4 | 1.1 | 0.6 | 0.2 | 0.3 | 2.2 | 6.4 | 12.3 | 11.6 | 12.7 | 12.0 | 11.5 | 11.3 | 7.9 | 3.1 | 0.7 |
| 1993 | 3.8 | 2.4 | 1.8 | 1.5 | 1.5 | 0.9 | 0.9 | 0.8 | 0.8 | 0.7 | 0.7 | 0.8 | 1.2 | 3.3 | 13.1 | 16.2 | 9.4 | 8.0 | 6.7 | 6.3 | 6.0 | 5.7 | 4.1 | 3.5 |
| 1994 | 2.3 | 2.1 | 1.5 | 2.3 | 1.1 | 1.1 | 1.0 | 1.3 | 1.3 | 1.0 | 1.0 | 0.9 | 1.0 | 3.7 | 6.5 | 7.8 | 8.5 | 8.0 | 8.8 | 9.9 | 11.3 | 9.2 | 5.8 | 2.8 |
| 1995 | 3.3 | 4.2 | 1.4 | 1.3 | 0.6 | 0.6 | 0.6 | 0.7 | 0.6 | 0.5 | 0.6 | 0.6 | 0.9 | 1.1 | 6.5 | 6.6 | 7.8 | 7.8 | 8.5 | 8.4 | 8.9 | 8.9 | 9.8 | 9.7 |
| 1996 | 2.5 | 2.5 | 1.9 | 1.9 | 1.5 | 1.6 | 1.5 | 1.6 | 1.5 | 1.6 | 1.5 | 1.7 | 3.5 | 3.4 | 10.2 | 10.4 | 8.7 | 8.5 | 6.6 | 6.5 | 4.8 | 4.9 | 5.7 | 5.8 |
| 1997 | 2.6 | 2.5 | 2.2 | 2.1 | 2.1 | 2.0 | 1.9 | 1.8 | 2.2 | 2.2 | 2.5 | 2.7 | 4.1 | 4.5 | 11.4 | 10.5 | 6.6 | 6.5 | 5.1 | 5.2 | 4.4 | 4.5 | 5.1 | 5.1 |
| AVG | 2.5 | 2.3 | 1.5 | 1.4 | 1.1 | 1.0 | 1.1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.1 | 1.8 | 3.4 | 9.6 | 10.8 | 8.8 | 8.4 | 7.8 | 7.7 | 7.5 | 7.1 | 6.2 | 4.8 |
| MIN | 0.5 | 0.2 | 0.6 | 0.1 | 0.4 | 0.2 | 0.5 | 0.1 | 0.4 | 0.1 | 0.6 | 0.2 | 0.3 | 1.1 | 6.0 | 6.6 | 6.5 | 6.5 | 5.1 | 5.2 | 4.4 | 4.5 | 3.1 | 0.7 |
| MAX | 3.8 | 4.2 | 3.1 | 2.3 | 2.1 | 2.1 | 2.6 | 2.0 | 2.2 | 2.2 | 2.5 | 2.7 | 4.1 | 6.4 | 13.8 | 16.2 | 12.0 | 12.7 | 12.0 | 11.5 | 11.4 | 11.6 | 9.8 | 9.7 |

Table C-3. Continued.

**Coho**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1985 | 0.7 | 0.5 | 1.5 | 0.3 | 0.5 | 0.7 | 0.5 | 0.3 | 1.7 | 0.8 | 0.7 | 0.0 | 1.3 | 1.8 | 5.0 | 12.4 | 11.7 | 13.4 | 13.4 | 11.5 | 10.5 | 6.7 | 3.2 | 0.8 |
| 1986 | 0.2 | 0.3 | 0.4 | 0.1 | 0.6 | 0.6 | 0.6 | 0.4 | 0.2 | 0.1 | 0.3 | 0.4 | 0.7 | 1.1 | 9.9 | 22.2 | 16.7 | 12.3 | 9.1 | 8.4 | 7.1 | 6.1 | 1.9 | 0.6 |
| 1987 | 0.6 | 0.5 | 0.7 | 0.2 | 0.3 | 0.2 | 0.3 | 0.1 | 0.3 | 0.1 | 0.3 | 0.1 | 0.3 | 0.5 | 7.1 | 11.0 | 9.4 | 10.8 | 10.6 | 11.0 | 12.6 | 13.6 | 7.9 | 1.4 |
| 1988 | 1.5 | 2.1 | 1.9 | 1.1 | 0.7 | 1.1 | 1.8 | 1.0 | 1.1 | 0.7 | 0.6 | 0.5 | 0.8 | 3.3 | 7.7 | 11.3 | 8.0 | 8.2 | 8.2 | 9.4 | 10.0 | 9.5 | 6.9 | 2.6 |
| 1989 | 1.0 | 0.4 | 0.7 | 0.4 | 0.5 | 0.4 | 0.7 | 0.2 | 0.3 | 0.3 | 0.4 | 0.5 | 0.6 | 6.2 | 15.8 | 13.4 | 10.8 | 9.9 | 8.3 | 8.5 | 8.0 | 7.0 | 4.1 | 1.7 |
| 1990 | 0.3 | 0.2 | 0.5 | 0.2 | 0.6 | 0.3 | 0.8 | 0.2 | 0.5 | 0.2 | 0.4 | 0.0 | 0.3 | 2.5 | 10.2 | 11.6 | 9.1 | 7.8 | 9.1 | 11.3 | 15.3 | 13.3 | 5.2 | 0.3 |
| 1991 | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 | 0.3 | 0.4 | 0.1 | 0.5 | 0.3 | 0.5 | 0.5 | 1.2 | 4.3 | 25.0 | 18.0 | 12.7 | 8.2 | 6.9 | 6.6 | 6.2 | 5.0 | 1.5 | 0.4 |
| 1992 | 0.3 | 0.1 | 0.2 | 0.5 | 0.3 | 0.4 | 0.2 | 0.5 | 0.3 | 0.6 | 0.4 | 0.3 | 0.2 | 3.2 | 12.8 | 15.6 | 11.6 | 10.3 | 9.9 | 9.2 | 11.4 | 8.4 | 3.2 | 0.3 |
| 1993 | 1.0 | 0.4 | 0.3 | 0.3 | 0.3 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.3 | 0.5 | 3.8 | 24.4 | 17.1 | 11.8 | 9.4 | 6.8 | 6.4 | 5.9 | 5.6 | 3.2 | 2.0 |
| 1994 | 0.9 | 0.7 | 0.4 | 0.6 | 0.5 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 1.7 | 10.4 | 10.4 | 9.1 | 8.3 | 9.6 | 12.0 | 12.6 | 11.9 | 5.2 | 1.8 |
| 1995 | 0.6 | 0.8 | 0.2 | 0.2 | 0.1 | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 0.4 | 0.5 | 19.9 | 19.8 | 8.6 | 8.5 | 6.4 | 6.4 | 7.5 | 7.5 | 5.8 | 5.6 |
| 1996 | 1.3 | 1.2 | 1.3 | 1.3 | 1.6 | 1.6 | 1.6 | 1.6 | 1.2 | 1.1 | 1.6 | 1.6 | 2.9 | 3.5 | 14.7 | 14.6 | 8.9 | 8.9 | 5.4 | 5.4 | 4.9 | 4.7 | 4.6 | 4.3 |
| 1997 | 1.7 | 1.4 | 2.3 | 2.1 | 2.3 | 2.1 | 2.5 | 2.0 | 2.1 | 1.9 | 3.5 | 3.4 | 5.2 | 5.4 | 13.1 | 12.3 | 5.7 | 5.0 | 5.5 | 5.5 | 4.9 | 4.8 | 2.8 | 2.5 |
| AVG | 0.9 | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 0.8 | 0.7 | 0.6 | 0.5 | 0.8 | 0.7 | 1.3 | 2.7 | 14.7 | 14.7 | 9.4 | 8.8 | 7.5 | 7.9 | 8.4 | 8.0 | 5.0 | 2.9 |
| MIN | 0.2 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.2 | 0.5 | 5.0 | 10.4 | 5.7 | 5.0 | 5.4 | 5.4 | 4.9 | 4.7 | 1.5 | 0.3 |
| MAX | 1.7 | 2.1 | 2.3 | 2.1 | 2.3 | 2.1 | 2.5 | 2.0 | 2.1 | 1.9 | 3.5 | 3.4 | 5.2 | 6.2 | 25.0 | 22.2 | 16.7 | 13.4 | 13.4 | 12.0 | 15.3 | 13.6 | 7.9 | 5.6 |

**Sockeye**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1985 | 0.8 | 0.8 | 1.0 | 1.1 | 1.0 | 1.5 | 1.6 | 1.1 | 1.1 | 1.1 | 1.2 | 1.1 | 1.2 | 5.5 | 12.2 | 10.1 | 10.7 | 10.4 | 9.2 | 8.2 | 8.9 | 7.1 | 2.1 | 1.0 |
| 1986 | 1.0 | 1.5 | 1.4 | 1.4 | 1.5 | 1.6 | 1.8 | 1.6 | 1.5 | 1.8 | 2.1 | 2.6 | 3.2 | 7.1 | 14.1 | 12.6 | 9.7 | 7.3 | 7.5 | 5.6 | 4.8 | 4.4 | 3.0 | 1.0 |
| 1987 | 0.3 | 0.4 | 0.6 | 0.3 | 0.4 | 0.2 | 0.5 | 0.3 | 0.4 | 0.3 | 0.5 | 0.2 | 0.4 | 1.1 | 5.2 | 8.7 | 12.1 | 14.5 | 13.6 | 12.3 | 12.1 | 10.0 | 4.8 | 0.8 |
| 1988 | 1.2 | 1.1 | 1.3 | 0.7 | 0.6 | 0.6 | 1.3 | 1.0 | 1.3 | 0.6 | 0.7 | 0.4 | 0.9 | 2.4 | 4.9 | 7.3 | 6.8 | 8.8 | 12.3 | 13.0 | 11.9 | 10.3 | 8.0 | 2.5 |
| 1989 | 2.7 | 1.6 | 2.1 | 2.0 | 1.6 | 1.5 | 1.9 | 1.5 | 1.6 | 1.1 | 1.6 | 1.5 | 1.6 | 5.9 | 13.0 | 8.1 | 5.5 | 6.7 | 6.4 | 8.2 | 8.6 | 8.5 | 4.9 | 1.8 |
| 1990 | 1.2 | 0.8 | 1.8 | 0.8 | 1.5 | 0.6 | 2.5 | 0.5 | 2.0 | 0.7 | 1.5 | 1.2 | 2.4 | 8.8 | 12.2 | 8.6 | 9.1 | 7.9 | 8.0 | 7.9 | 9.2 | 7.2 | 2.4 | 1.0 |
| 1991 | 1.2 | 0.8 | 1.1 | 1.1 | 1.3 | 1.6 | 1.3 | 0.8 | 1.8 | 1.9 | 2.2 | 3.1 | 4.8 | 11.6 | 16.8 | 9.0 | 7.0 | 5.9 | 6.1 | 5.1 | 6.4 | 5.5 | 2.3 | 1.3 |
| 1992 | 0.4 | 0.2 | 0.2 | 0.6 | 0.3 | 0.3 | 0.6 | 0.4 | 0.4 | 0.6 | 0.3 | 0.5 | 0.5 | 2.6 | 10.9 | 12.0 | 11.5 | 13.6 | 11.9 | 11.0 | 9.7 | 8.4 | 2.2 | 0.6 |
| 1993 | 0.6 | 0.7 | 0.7 | 1.0 | 1.0 | 1.2 | 0.9 | 1.0 | 1.5 | 2.1 | 2.8 | 3.2 | 3.4 | 13.5 | 24.3 | 11.7 | 5.1 | 3.7 | 3.6 | 4.6 | 4.8 | 5.5 | 3.3 | 1.2 |
| 1994 | 0.6 | 0.4 | 0.4 | 0.4 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.7 | 0.8 | 1.9 | 8.0 | 10.6 | 14.0 | 11.9 | 11.3 | 9.8 | 10.7 | 9.4 | 5.2 | 0.9 |
| 1995 | 1.3 | 1.5 | 1.0 | 1.0 | 1.0 | 1.1 | 1.6 | 1.6 | 2.2 | 2.1 | 3.4 | 3.4 | 5.2 | 5.2 | 22.5 | 22.6 | 3.8 | 3.7 | 2.4 | 2.4 | 3.0 | 2.7 | 2.7 | 2.7 |
| 1996 | 2.7 | 3.0 | 2.3 | 1.9 | 2.6 | 1.9 | 3.7 | 3.5 | 2.8 | 2.7 | 4.2 | 4.2 | 7.3 | 7.7 | 10.5 | 9.9 | 4.9 | 4.3 | 3.7 | 3.2 | 4.0 | 3.3 | 2.6 | 3.2 |
| 1997 | 3.0 | 2.6 | 3.3 | 4.3 | 4.4 | 3.8 | 3.6 | 2.9 | 3.5 | 3.4 | 3.4 | 4.2 | 5.4 | 6.4 | 7.9 | 7.9 | 4.4 | 4.0 | 5.6 | 3.5 | 3.2 | 3.8 | 3.2 | 2.2 |
| AVG | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.2 | 1.4 | 1.2 | 1.4 | 1.4 | 1.9 | 2.1 | 2.7 | 6.1 | 14.4 | 12.4 | 8.1 | 7.8 | 7.4 | 6.9 | 7.0 | 6.2 | 3.5 | 1.5 |
| MIN | 0.3 | 0.2 | 0.2 | 0.3 | 0.3 | 0.2 | 0.4 | 0.3 | 0.4 | 0.3 | 0.3 | 0.2 | 0.4 | 1.1 | 4.9 | 7.3 | 3.8 | 3.7 | 2.4 | 2.4 | 3.0 | 2.7 | 2.1 | 0.6 |
| MAX | 3.0 | 3.0 | 3.3 | 4.3 | 4.4 | 3.8 | 3.7 | 3.5 | 3.5 | 3.4 | 4.2 | 4.2 | 7.3 | 13.5 | 24.3 | 22.6 | 14.0 | 14.5 | 13.6 | 13.0 | 12.1 | 10.3 | 8.0 | 3.2 |

**All Species Combined**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1985 | 0.8 | 1.0 | 1.3 | 2.5 | 1.5 | 1.3 | 1.5 | 1.1 | 1.0 | 1.2 | 1.2 | 1.0 | 1.2 | 4.8 | 11.7 | 9.1 | 9.2 | 9.3 | 9.7 | 8.0 | 8.7 | 7.7 | 3.8 | 1.2 |
| 1986 | 1.7 | 1.4 | 1.5 | 1.5 | 1.5 | 2.1 | 1.8 | 1.6 | 1.6 | 1.7 | 1.7 | 1.7 | 2.3 | 5.7 | 9.3 | 10.3 | 8.3 | 7.9 | 7.4 | 7.1 | 7.1 | 7.0 | 5.4 | 2.5 |
| 1987 | 1.5 | 0.8 | 0.9 | 0.7 | 0.8 | 1.1 | 1.2 | 1.1 | 1.0 | 0.9 | 1.0 | 1.2 | 1.4 | 3.1 | 6.4 | 9.2 | 9.3 | 9.8 | 9.4 | 9.8 | 10.1 | 9.8 | 7.0 | 2.6 |
| 1988 | 2.0 | 1.6 | 1.6 | 1.1 | 1.1 | 1.5 | 1.7 | 1.5 | 1.4 | 1.4 | 1.3 | 1.7 | 1.9 | 5.1 | 7.4 | 7.5 | 6.8 | 7.4 | 8.1 | 8.8 | 9.2 | 8.9 | 7.4 | 3.5 |
| 1989 | 2.0 | 1.2 | 1.1 | 0.9 | 0.9 | 0.7 | 0.8 | 0.8 | 0.9 | 0.8 | 0.9 | 1.0 | 1.0 | 2.9 | 5.8 | 6.7 | 7.5 | 8.7 | 10.5 | 11.1 | 11.3 | 10.8 | 8.0 | 3.7 |
| 1990 | 0.8 | 1.0 | 1.2 | 1.1 | 1.3 | 2.9 | 1.9 | 1.4 | 1.7 | 1.0 | 1.1 | 0.9 | 1.2 | 3.7 | 8.6 | 11.7 | 10.4 | 9.2 | 9.0 | 8.7 | 8.8 | 8.0 | 3.7 | 0.8 |
| 1991 | 0.8 | 0.6 | 0.8 | 0.9 | 0.9 | 2.0 | 2.7 | 2.3 | 1.4 | 1.2 | 1.1 | 1.3 | 1.5 | 4.1 | 12.0 | 13.3 | 10.8 | 8.9 | 7.8 | 7.4 | 7.2 | 6.6 | 3.3 | 1.1 |
| 1992 | 1.0 | 1.1 | 1.1 | 1.6 | 1.5 | 2.2 | 1.8 | 1.7 | 1.5 | 1.5 | 1.3 | 1.3 | 1.6 | 4.1 | 6.7 | 9.6 | 9.8 | 9.6 | 9.7 | 9.5 | 9.9 | 7.9 | 3.2 | 1.0 |
| 1993 | 2.1 | 1.5 | 1.2 | 1.0 | 1.0 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 1.0 | 1.2 | 1.4 | 3.9 | 12.0 | 12.2 | 9.1 | 8.3 | 8.1 | 8.1 | 8.0 | 7.6 | 5.1 | 3.0 |
| 1994 | 1.4 | 1.7 | 1.7 | 2.6 | 2.7 | 2.7 | 2.8 | 2.5 | 1.9 | 1.5 | 1.4 | 1.4 | 2.3 | 3.8 | 7.0 | 7.9 | 8.0 | 7.8 | 7.4 | 7.7 | 8.8 | 8.0 | 4.4 | 2.5 |
| 1995 | 1.6 | 2.1 | 1.2 | 1.1 | 1.0 | 1.0 | 1.3 | 1.3 | 1.2 | 1.2 | 1.6 | 1.6 | 1.9 | 2.5 | 11.1 | 11.3 | 8.9 | 8.9 | 7.5 | 7.5 | 7.0 | 6.9 | 5.4 | 4.9 |
| 1996 | 2.0 | 1.9 | 2.0 | 2.0 | 2.0 | 2.0 | 2.4 | 2.4 | 2.0 | 1.9 | 2.3 | 2.3 | 3.6 | 3.9 | 10.4 | 10.9 | 8.4 | 8.1 | 6.0 | 5.8 | 4.7 | 4.6 | 4.4 | 4.1 |
| 1997 | 2.3 | 2.1 | 2.2 | 2.2 | 2.4 | 2.3 | 2.8 | 2.3 | 2.3 | 2.2 | 2.5 | 2.6 | 3.7 | 4.4 | 10.0 | 9.7 | 7.1 | 6.6 | 5.8 | 5.7 | 5.3 | 5.1 | 4.3 | 4.0 |
| AVG | 1.8 | 1.6 | 1.5 | 1.7 | 1.5 | 1.8 | 1.8 | 1.6 | 1.5 | 1.4 | 1.5 | 1.6 | 2.1 | 4.5 | 10.3 | 10.8 | 9.5 | 9.4 | 9.1 | 8.9 | 9.0 | 8.5 | 5.8 | 3.1 |
| MIN | 0.8 | 0.6 | 0.8 | 0.7 | 0.8 | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 1.0 | 2.5 | 5.8 | 6.7 | 6.8 | 6.6 | 5.8 | 5.7 | 4.7 | 4.6 | 3.2 | 0.8 |
| MAX | 2.3 | 2.1 | 2.2 | 2.6 | 2.7 | 2.9 | 2.8 | 2.5 | 2.3 | 2.2 | 2.5 | 2.6 | 3.7 | 5.7 | 12.0 | 13.3 | 10.8 | 9.8 | 10.5 | 11.1 | 11.3 | 10.8 | 8.0 | 4.9 |

Table C-4. Descaling and mortality data from John Day Dam, 1985-1999.

| | YEARLING CHINOOK | | | | | SUBYEARLING CHINOOK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | SAMPLE | DESC | %DESC | MORT | %MORT | SAMPLE | DESC | %DESC | MORT | %MORT |
| 1985 | 62,790 | 3,846 | 6.2 | 809 | 1.3 | 228,211 | 4,567 | 2.0 | 5,425 | 2.4 |
| 1986 | 92,856 | 4,630 | 5.0 | 547 | 0.6 | 181,857 | 4,135 | 2.3 | 1,231 | 0.7 |
| 1987 | 84,312 | 5,617 | 6.8 | 1,505 | 1.8 | 95,693 | 2,290 | 2.5 | 2,313 | 2.4 |
| 1988 | 34,071 | 2,470 | 7.5 | 1,292 | 3.8 | 109,435 | 2,186 | 2.1 | 3,050 | 2.8 |
| 1989 | 34,935 | 3,749 | 10.9 | 694 | 2.0 | 129,957 | 5,922 | 4.7 | 3,273 | 2.5 |
| 1990 | 26,907 | 2,968 | 11.3 | 541 | 2.0 | 39,280 | 2,316 | 6.2 | 2,009 | 5.1 |
| 1991 | 26,879 | 4,487 | 16.9 | 320 | 1.2 | 46,785 | 2,696 | 5.9 | 775 | 1.7 |
| 1992 | 42,231 | 4,256 | 10.5 | 1,823 | 4.3 | 59,783 | 1,216 | 2.1 | 3,096 | 5.2 |
| 1993 | 52,821 | 5,342 | 10.6 | 2,464 | 4.7 | 116,804 | 3,954 | 3.6 | 6,413 | 5.5 |
| 1994 | 34,071 | 2,219 | 6.8 | 1,606 | 4.7 | 75,164 | 2,309 | 3.3 | 5,004 | 6.7 |
| 1995 | 34,308 | 3,361 | 10.1 | 1,032 | 3.0 | 48,896 | 3,325 | 7.1 | 2,029 | 4.2 |
| 1996 | 14,560 | 2,001 | 13.9 | 158 | 1.1 | 31,157 | 1,119 | 3.7 | 692 | 2.2 |
| 1997 | 4,586 | 859 | 19.1 | 84 | 1.8 | 20,487 | 1,133 | 5.6 | 322 | 1.6 |
| 1998 | 27,732 | 1,675 | 6.1 | 133 | 0.5 | 31,178 | 678 | 2.2 | 70 | 0.2 |
| 1999 | 160,378 | 9,952 | 6.2 | 882 | 0.5 | 232,131 | 2,094 | 0.9 | 282 | 0.1 |
| **TOTAL** | 733,437 | 57,432 | 8.0 | 13,890 | 1.9 | 1,446,818 | 39,940 | 2.8 | 35,984 | 2.5 |

| | WILD STEELHEAD | | | | | HATCHERY STEELHEAD | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | SAMPLE | DESC | %DESC | MORT | %MORT | SAMPLE | DESC | %DESC | MORT | %MORT |
| 1985 | 36,355 | 1,292 | 3.6 | 320 | 0.9 | | | | | |
| 1986 | 37,858 | 962 | 2.6 | 156 | 0.4 | | | | | |
| 1987 | 12,374 | 447 | 3.6 | 41 | 0.3 | 11,622 | 634 | 5.5 | 94 | 0.8 |
| 1988 | 6,810 | 335 | 5.0 | 56 | 0.8 | 8,227 | 1,012 | 12.7 | 268 | 3.3 |
| 1989 | 8,585 | 348 | 4.1 | 53 | 0.6 | 11,229 | 1,225 | 11.0 | 84 | 0.7 |
| 1990 | 6,104 | 303 | 5.0 | 76 | 1.2 | 4,867 | 665 | 13.9 | 90 | 1.8 |
| 1991 | 5,455 | 287 | 5.3 | 10 | 0.2 | 11,171 | 1,593 | 14.3 | 30 | 0.3 |
| 1992 | 5,141 | 332 | 6.5 | 54 | 1.1 | 11,970 | 1,663 | 14.4 | 389 | 3.2 |
| 1993 | 16,042 | 530 | 3.4 | 294 | 1.8 | 52,936 | 6,562 | 12.6 | 1,049 | 2.0 |
| 1994 | 7,604 | 290 | 3.9 | 85 | 1.1 | 14,454 | 1,761 | 12.7 | 554 | 3.8 |
| 1995 | 4,043 | 166 | 4.1 | 26 | 0.6 | 18,915 | 2,236 | 12.0 | 325 | 1.7 |
| 1996 | 3,973 | 134 | 3.4 | 3 | 0.1 | 11,171 | 1,310 | 11.8 | 30 | 0.3 |
| 1997 | 4,011 | 130 | 3.3 | 11 | 0.3 | 13,645 | 1,279 | 9.4 | 24 | 0.2 |
| 1998 | 8,378 | 132 | 1.6 | 4 | 0.0 | 6,214 | 444 | 7.2 | 16 | 0.3 |
| 1999 | 33,545 | 649 | 1.9 | 36 | 0.1 | 42,003 | 2,537 | 6.1 | 83 | 0.2 |
| **TOTAL** | 196,278 | 6,337 | 3.2 | 1,225 | 0.6 | 218,424 | 22,921 | 10.6 | 3,036 | 1.4 |

| | COHO | | | | | SOCKEYE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | SAMPLE | DESC | %DESC | MORT | %MORT | SAMPLE | DESC | %DESC | MORT | %MORT |
| 1985 | 598 | 44 | 7.4 | 7 | 1.2 | 17,246 | 1,258 | 7.4 | 157 | 0.9 |
| 1986 | 1,990 | 62 | 3.1 | 4 | 0.2 | 17,539 | 1,688 | 9.7 | 151 | 0.9 |
| 1987 | 13,213 | 741 | 5.6 | 36 | 0.3 | 11,923 | 624 | 5.3 | 48 | 0.4 |
| 1988 | 8,680 | 363 | 4.3 | 153 | 1.8 | 6,336 | 320 | 5.1 | 45 | 0.7 |
| 1989 | 6,934 | 431 | 6.2 | 12 | 0.2 | 5,497 | 672 | 12.3 | 41 | 0.7 |
| 1990 | 6,261 | 418 | 6.7 | 7 | 0.1 | 1,769 | 144 | 8.3 | 41 | 2.3 |
| 1991 | 5,104 | 437 | 8.6 | 3 | 0.1 | 3,447 | 604 | 17.5 | 4 | 0.1 |
| 1992 | 9,804 | 636 | 6.6 | 158 | 1.6 | 2,608 | 183 | 7.1 | 39 | 1.5 |
| 1993 | 13,164 | 669 | 5.1 | 110 | 0.8 | 14,885 | 1,630 | 11.3 | 397 | 2.7 |
| 1994 | 11,385 | 446 | 4.0 | 281 | 2.5 | 7,270 | 719 | 10.1 | 155 | 2.1 |
| 1995 | 5,908 | 244 | 4.1 | 8 | 0.1 | 5,625 | 807 | 14.6 | 112 | 2.0 |
| 1996 | 8,551 | 579 | 6.8 | 13 | 0.2 | 1,147 | 84 | 7.4 | 9 | 0.8 |
| 1997 | 3,409 | 361 | 10.6 | 16 | 0.5 | 738 | 152 | 21.0 | 13 | 1.8 |
| 1998 | 5,330 | 297 | 5.6 | 9 | 0.2 | 4,479 | 726 | 16.3 | 17 | 0.4 |
| 1999 | 37,941 | 1,397 | 3.7 | 78 | 0.2 | 54,710 | 4,331 | 8.0 | 619 | 1.1 |
| **TOTAL** | 138,272 | 7,125 | 5.2 | 895 | 0.6 | 96,030 | 13,942 | 14.8 | 1,848 | 1.9 |

Table C-5. Condition subsampling data, expressed as a percent of sample, from John Day Dam, 1985-1999.

| YEAR | NO. | INJURY | | | DISEASE | | | | BIRD | 3-19% |
|---|---|---|---|---|---|---|---|---|---|---|
| | SMPLD | HEAD | OPERC. | BODY | PAR. | COL. | FUN. | BKD | PRED | DESC |
| **Yearling Chinook** | | | | | | | | | | |
| 1985 | 981 | 0.92 | N/A | 1.94 | N/A | N/A | N/A | N/A | N/A | 10.19 |
| 1986 | 950 | 1.37 | N/A | 2.11 | N/A | N/A | N/A | N/A | N/A | 20.11 |
| 1987 | 1,957 | 0.36 | N/A | 1.07 | N/A | N/A | N/A | N/A | N/A | 15.94 |
| 1988 | 1,870 | 0.75 | 0.48 | 1.34 | 0.11 | N/A | 0.8 | N/A | 0.37 | 12.03 |
| 1989 | 1,313 | 1.68 | 1.07 | 3.12 | 0.53 | N/A | 0.76 | 0.38 | 0.53 | 13.02 |
| 1990 | 1,143 | 0.26 | 1.05 | 0.7 | 0.09 | N/A | 0.96 | 0.61 | 0.35 | 20.65 |
| 1991 | 1,959 | 0.71 | 0.26 | 0.46 | 0.2 | N/A | 0.56 | 0.71 | 1.58 | 14.34 |
| 1992 | 1,507 | 0.6 | 0.13 | 0.33 | 0.07 | N/A | 1.33 | 0.86 | 1.39 | 10.95 |
| 1993 | 3,995 | N/A | 0.8 | 2.95 | 0.35 | 0.33 | 0.38 | N/A | 1.05 | 15.52 |
| 1994 | 3,879 | N/A | 0.18 | 6.21 | 0.03 | 0.75 | 0.85 | N/A | 1.47 | 14.54 |
| 1995 | 2,573 | 2.18 | 1.63 | 2.91 | 1.52 | 0.31 | 1.67 | 2.64 | 2.37 | 21.45 |
| 1996 | 2,596 | 0.58 | 0.58 | 1.5 | 0.5 | 0.04 | 0.15 | 0.39 | 1.16 | 28.58 |
| 1997 | 1,509 | 0.40 | 0.40 | 2.32 | 1.19 | 0.00 | 0.27 | 0.73 | 1.59 | 17.30 |
| 1998 | 2,606 | 0.27 | 0.58 | 0.54 | 0.12 | 0.08 | 0.69 | 0.88 | 1.07 | 11.24 |
| 1999 | 2,753 | 0.33 | 0.73 | 1.60 | 0.44 | 0.00 | 0.80 | 0.65 | 1.16 | 15.73 |
| **Wild Steelhead** | | | | | | | | | | |
| 1985 | 96 | 2.08 | N/A | 2.08 | N/A | N/A | N/A | N/A | N/A | 7.29 |
| 1986 | 230 | 1.3 | N/A | 3.48 | N/A | N/A | N/A | N/A | N/A | 8.26 |
| 1987 | 750 | 0.13 | N/A | 0.93 | N/A | N/A | N/A | N/A | N/A | 11.87 |
| 1988 | 1,080 | 0.09 | N/A | 0.28 | 0.09 | N/A | 0.46 | N/A | 0.37 | 5.93 |
| 1989 | 1,159 | 0.09 | 0.26 | 1.04 | 0.17 | N/A | 0.17 | N/A | 0.69 | 6.47 |
| 1990 | 476 | 0.42 | 0.84 | 0.21 | 2.1 | N/A | 1.47 | N/A | 1.26 | 14.71 |
| 1991 | 899 | 0.44 | 1 | 0.67 | 7.45 | N/A | N/A | 0.33 | 1.67 | 7.56 |
| 1992 | 863 | 0.12 | 0.58 | 1.16 | 3.01 | N/A | 0.58 | 0.23 | 1.74 | 6.6 |
| 1993 | 2,265 | N/A | 0.75 | 1.41 | 2.65 | 0.49 | 0.26 | N/A | 1.81 | 10.95 |
| 1994 | 1,605 | N/A | 0.19 | 2.87 | 2.24 | N/A | 1.43 | N/A | 2.55 | 8.66 |
| 1995 | 1,131 | 2.48 | 1.33 | 1.86 | 15.21 | 0.18 | 2.21 | 0.18 | 3.45 | 11.41 |
| 1996 | 1,126 | 0.89 | 1.15 | 1.78 | 3.46 | 0 | 0.27 | 0 | 2.49 | 18.12 |
| 1997 | 1,035 | 0.40 | 0.40 | 2.32 | 2.22 | 0.00 | 0.58 | 0.10 | 2.42 | 9.76 |
| 1998 | 1,707 | 0.18 | 0.12 | 0.06 | 2.40 | 0.06 | 0.23 | 0.00 | 1.82 | 3.57 |
| 1999 | 2,334 | 0.26 | 0.73 | 2.57 | 5.01 | 0.00 | 1.03 | 0.09 | 4.88 | 9.34 |
| **Coho** | | | | | | | | | | |
| 1985 | 96 | 2.08 | N/A | 2.08 | N/A | N/A | N/A | N/A | N/A | 7.29 |
| 1986 | 230 | 1.3 | N/A | 3.48 | N/A | N/A | N/A | N/A | N/A | 8.26 |
| 1987 | 750 | 0.13 | N/A | 0.93 | N/A | N/A | N/A | N/A | N/A | 11.87 |
| 1988 | 1,080 | 0.09 | N/A | 0.28 | 0.09 | N/A | 0.46 | N/A | 0.37 | 5.93 |
| 1989 | 1,159 | 0.09 | 0.26 | 1.04 | 0.17 | N/A | 0.17 | N/A | 0.69 | 6.47 |
| 1990 | 849 | N/A | N/A | 1.3 | N/A | N/A | 1.18 | N/A | 1.06 | 13.43 |
| 1991 | 844 | N/A | 0.24 | 0.36 | 0.12 | N/A | 0.12 | 0.12 | 0.47 | 14.34 |
| 1992 | 834 | 0.36 | N/A | 0.48 | N/A | N/A | 0.72 | N/A | 0.96 | 9.11 |
| 1993 | 2,166 | N/A | 0.51 | 0.88 | 0.14 | 0.18 | 0.05 | N/A | 1.39 | 8.36 |
| 1994 | 1,450 | N/A | 0.07 | 2.69 | 0.14 | 0.14 | 0.28 | N/A | 2.69 | 9.66 |
| 1995 | 1,026 | 0.39 | 0.1 | 0.39 | 0.29 | N/A | 0.19 | N/A | 3.8 | 10.23 |
| 1996 | 1,738 | 1.09 | 0.69 | 1.38 | 0.46 | 0 | 0.23 | 0 | 1.55 | 21.52 |
| 1997 | 1,070 | 0.65 | 0.37 | 0.93 | 0.65 | 0.00 | 0.65 | 0.19 | 2.99 | 14.95 |
| 1998 | 1,374 | 0.15 | 0.51 | 0.36 | 0.00 | 0.07 | 0.29 | 0.07 | 1.82 | 5.90 |
| 1999 | 2,767 | 0.18 | 0.51 | 1.34 | 0.43 | 0.00 | 0.40 | 0.18 | 1.52 | 11.67 |

| YEAR | NO. | INJURY | | | DISEASE | | | | BIRD | 3-19% |
|---|---|---|---|---|---|---|---|---|---|---|
| | SMPLD | HEAD | OPERC. | BODY | PAR. | COL. | FUN. | BKD | PRED | DESC |
| **Subyearling Chinook** | | | | | | | | | | |
| 1985 | 2,707 | 1.81 | N/A | 1.55 | 0.04 | N/A | 0.92 | N/A | N/A | 7.35 |
| 1986 | 3,517 | 0.65 | N/A | 3.18 | N/A | N/A | 0.77 | N/A | N/A | 9.01 |
| 1987 | 4,407 | 0.34 | N/A | 3.36 | N/A | N/A | N/A | N/A | N/A | 11.64 |
| 1988 | 4,710 | 0.25 | 0.23 | 0.98 | N/A | N/A | 12.85 | N/A | 0.08 | 8.79 |
| 1989 | 2,997 | 0.17 | 0.2 | 0.33 | 0.23 | N/A | 3.77 | 0.13 | 0.3 | 9.68 |
| 1990 | 2,340 | 0.26 | 0.38 | 0.81 | 0.26 | N/A | 4.32 | 0.68 | N/A | 14.96 |
| 1991 | 3,106 | 0.35 | 0.06 | 0.58 | 0.19 | N/A | 4.15 | 0.06 | 0.03 | 9.01 |
| 1992 | 2,520 | 0.04 | 0.08 | 0.75 | 0.56 | N/A | 10.79 | 0.36 | 0.36 | 4.09 |
| 1993 | 5,869 | N/A | 0.15 | 3.14 | 0.34 | 8.62 | 2.25 | N/A | 0.12 | 10.36 |
| 1994 | 4,579 | N/A | 0.07 | 3.78 | 0.31 | 8.69 | 1.53 | N/A | 0.15 | 8.08 |
| 1995 | 4,392 | 0.3 | 0.3 | 2.44 | 0.84 | 2.87 | 0.34 | 0.93 | 0.43 | 8.06 |
| 1996 | 3,840 | 0.44 | 0.73 | 2.42 | 1.98 | 3.78 | 0.42 | 0.08 | 0.26 | 11.98 |
| 1997 | 5,380 | 0.69 | 0.20 | 1.58 | 0.22 | 0.86 | 0.09 | 0.11 | 0.26 | 8.10 |
| 1998 | 5,169 | 0.15 | 0.25 | 0.00 | 0.19 | 0.06 | 0.21 | 0.14 | 0.19 | 7.70 |
| 1999 | 8,941 | 0.09 | 0.38 | 1.45 | 0.06 | 0.10 | 0.13 | 0.00 | 0.34 | 4.79 |
| **Hatchery Steelhead** | | | | | | | | | | |
| 1985 | | | | | | | | | | |
| 1986 | | | | | | | | | | |
| 1987 | | | | | | | | | | |
| 1988 | | | | | | | | | | |
| 1989 | | | | | | | | | | |
| 1990 | 507 | 0.99 | 1.18 | 3.55 | 1.18 | N/A | 1.78 | N/A | 3.16 | 24.46 |
| 1991 | 1,063 | 1.03 | 1.22 | 1.51 | 0.38 | N/A | 0.47 | 0.09 | 4.61 | 25.68 |
| 1992 | 938 | 0.32 | 1.71 | 3.62 | 0.32 | N/A | 2.99 | N/A | 6.08 | 14.61 |
| 1993 | 2,371 | N/A | 3.58 | 5.65 | 0.89 | 0.55 | 1.98 | N/A | 6.45 | 36.95 |
| 1994 | 1,812 | N/A | 1.88 | 9.93 | 0.06 | 0.06 | 3.92 | N/A | 15.07 | 24.17 |
| 1995 | 2,243 | 4.55 | 6.55 | 4.9 | 7.13 | 0.13 | 4.5 | 0.13 | 15.07 | 30.58 |
| 1996 | 2,185 | 0.87 | 2.24 | 4.3 | 0.64 | 0.09 | 0.96 | 0 | 9.61 | 41.05 |
| 1997 | 2,049 | 1.17 | 2.54 | 2.83 | 0.54 | 0.05 | 0.68 | 0.00 | 7.22 | 18.94 |
| 1998 | 1,510 | 0.73 | 2.32 | 0.46 | 0.40 | 0.07 | 1.19 | 0.13 | 7.62 | 12.78 |
| 1999 | 2,716 | 0.63 | 2.36 | 4.31 | 0.15 | 0.04 | 1.25 | 0.04 | 8.43 | 19.33 |
| **Sockeye** | | | | | | | | | | |
| 1985 | 553 | 0.18 | N/A | 0.18 | N/A | N/A | N/A | N/A | N/A | 9.4 |
| 1986 | 588 | 1.02 | N/A | 2.55 | N/A | N/A | N/A | N/A | N/A | 17.18 |
| 1987 | 740 | 0.41 | N/A | 0.81 | N/A | N/A | N/A | N/A | N/A | 17.3 |
| 1988 | 1,004 | 0.2 | 0.4 | 0.1 | N/A | N/A | 0.4 | N/A | N/A | 6.08 |
| 1989 | 1,013 | 0.59 | 0.59 | 0.39 | N/A | N/A | 0.39 | 0.2 | N/A | 10.37 |
| 1990 | 361 | N/A | 0.28 | N/A | N/A | N/A | 0.83 | N/A | N/A | 10.25 |
| 1991 | 549 | 1.46 | 0.91 | 0.18 | N/A | N/A | 0.18 | 0.18 | 0.55 | 9.47 |
| 1992 | 291 | 1.03 | 0.34 | 0.69 | N/A | N/A | N/A | N/A | N/A | 12.71 |
| 1993 | 1,765 | N/A | 1.42 | 2.1 | 0.06 | N/A | 0.45 | N/A | 0.17 | 14.84 |
| 1994 | 1,656 | N/A | 0.48 | 2.05 | N/A | 0.06 | 0.18 | N/A | 0.54 | 16 |
| 1995 | 1,103 | 0.91 | 1.9 | 1.18 | N/A | N/A | 0.27 | 0.27 | 1.0 | 16.41 |
| 1996 | 399 | 0 | 1.25 | 0.25 | 0.25 | 0 | 0.25 | 0 | 0.5 | 20.3 |
| 1997 | 219 | 0.40 | 3.20 | 2.32 | 1.19 | 0.00 | 0.27 | 0.73 | 1.59 | 17.30 |
| 1998 | 1,268 | 0.08 | 1.42 | 0.16 | 0.00 | 0.00 | 0.16 | 0.08 | 0.08 | 15.54 |
| 1999 | 1,864 | 0.16 | 1.88 | 1.61 | 0.00 | 0.00 | 0.80 | 0.05 | 0.75 | 19.05 |

Table C-6. PIT tag detections from John Day Dam, 1993-1999.

| Species | Run | Rearing Type | 1993 (3B & 3C) | 1994 (3B) | 1995 (3B) | 1996 (3B & 3C) | 1997 (3B) | 1998 Full Bypass | 1999 Full Bypass |
|---|---|---|---|---|---|---|---|---|---|
| Chinook | Spring | Hatchery | 199 | 205 | 267 | 677 | 66 | 8,528 | 21,928 |
| | | Wild | 23 | 10 | 101 | 37 | 8 | 1,242 | 3,804 |
| | Summer | Hatchery | 24 | 16 | 52 | 145 | 57 | 3,656 | 2,502 |
| | | Wild | 4 | | 20 | 40 | 4 | 832 | 3,024 |
| | | Unknown | | | | 1 | | 1 | |
| | Fall | Hatchery | 4 | 3 | 52 | 187 | 38 | 12,174 | 7,046 |
| | | Wild | 9 | 4 | 13 | 10 | 2 | 282 | 552 |
| | | Unknown | | | | | | 3 | 7,205 |
| | Unknown | Hatchery | 44 | 19 | 915 | 795 | 9 | 5,964 | 17,649 |
| | | Wild | 17 | 4 | 253 | 182 | 1 | 1,190 | 3,948 |
| | | Unknown | 15 | 14 | 28 | 215 | 5 | 3,340 | 5,748 |
| Chinook Total | | | 339 | 275 | 1,701 | 2,289 | 190 | 37,212 | 73,406 |
| Steelhead | Spring | Hatchery | | | | 5 | | | |
| | | Wild | | | | | | | 327 |
| | Summer | Hatchery | 195 | 210 | 1,068 | 1,321 | 663 | 8,109 | 55,135 |
| | | Wild | 62 | 26 | 115 | 141 | 61 | 2,510 | 4,106 |
| | | Unknown | | | | 1 | | 10 | 18 |
| | Unknown | Hatchery | | | | | | 63 | |
| Steelhead Total | | | 257 | 236 | 1,183 | 1,468 | 724 | 10,692 | 59,586 |
| Coho | Fall | Hatchery | | | | 5 | 9 | 652 | 4,433 |
| | | Unknown | | | | | | 484 | 562 |
| | Spring | Hatchery | | | | | 3 | | 1 |
| | Unknown | Hatchery | | | | | | | 1 |
| Coho Total | | | | | | 5 | 12 | 1,136 | 4,997 |
| Sockeye | Spring | Hatchery | 17 | | 3 | | | | |
| | Summer | Hatchery | | | | 8 | | 186 | 207 |
| | | Wild | | 5 | 1 | | | 16 | 30 |
| | Unknown | Hatchery | | | | 12 | 1 | 13 | 37 |
| | | Wild | 19 | | 9 | 2 | 1 | 355 | 442 |
| | | Unknown | | | | | | 4 | |
| Sockeye Total | | | 36 | 5 | 13 | 22 | 2 | 574 | 716 |
| Unknown | Unknown | Wild | | | | | | 1 | |
| Unknown Total | | | | | | | | 1 | |
| TOTALS (all species combined) = | | | **632** | **516** | **2,897** | **3,784** | **928** | **49,615** | **138,705** |

Table C-7. External mark recaptures at John Day Dam, 1985-1999.

| Year | Yearling Chinook | Subyearling Chinook | Wild Steelhead[1] | Hatchery Steelhead | Coho | Sockeye | Total |
|---|---|---|---|---|---|---|---|
| **Brands** | | | | | | | |
| 1985 | 1,960 | 80 | | 2,113 | 3 | 334 | 4,490 |
| 1986 | 6,084 | 1,927 | | 4,324 | 2 | 304 | 12,641 |
| 1987 | 1,890 | 1,024 | | 1,608 | 4 | 107 | 4,633 |
| 1988 | 2,262 | 1,797 | | 895 | 3 | 80 | 5,037 |
| 1989 | 2,207 | 1,585 | | 2,150 | 1 | 36 | 5,979 |
| 1990 | 732 | 337 | | 599 | 1 | 9 | 1,678 |
| 1991 | 576 | 773 | | 1,134 | | 85 | 2,568 |
| 1992[2] | 1,420 | 945 | 66 | 546 | | | 2,977 |
| 1993[2] | 1,069 | 1,920 | 24 | 1,463 | | 39 | 4,515 |
| 1994 | 265 | 830 | | 416 | | | 1,511 |
| 1995 | 560 | 317 | | 183 | | | 1,060 |
| 1996 | 255 | 130 | | 75 | 2 | | 462 |
| 1997 | | | | 16 | | | 16 |
| 1998 | | | | 84 | | | 84 |
| 1999 | | | | 55 | | | 55 |
| **Elastomer** | | | | | | | |
| 1996 | 628 | | | | | | 628 |
| 1997 | 201 | | | 135 | | | 336 |
| 1998 | 432 | | | 417 | | | 849 |
| 1999 | 5,280 | | | 777 | | | 6,057 |

1. Wild and hatchery steelhead were not differentiated before 1992.
2. Samples from gatewells 3B and 3C combined.

Table C-8. Adult salmonid fallbacks at John Day Dam, 1985-1998.

| Year | Dates | # of Gatewells | Chinook | | Steelhead | | Coho | Sockeye | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | Adults | Jacks | Wild[1] | Hatchery | | | |
| 1985 | 4/27-10/29 | 1 | 28 | 85 | | 50 | 1 | 12 | 176 |
| 1986 | 3/28-10/30 | 1 | 78 | 80 | | 134 | 3 | 4 | 299 |
| 1987 | 4/1-11/30 | 1 | 25 | 4 | | 58 | | 1 | 88 |
| 1988 | 3/30-10/31 | 1 | 7 | 2 | | 47 | 2 | | 58 |
| 1989 | 3/28-10/31 | 1 | 18 | 7 | | 80 | 1 | 22 | 128 |
| 1990 | 3/27-10/31 | 1 | 14 | 6 | | 35 | | 3 | 58 |
| 1991 | 4/7-10/31 | 1 | 10 | | | 34 | | 6 | 50 |
| 1992 | 3/25-10/13 | 2 | 12 | | | 42 | 1 | 4 | 59 |
| 1993 | 4/6-10/29 | 2 | 12 | 2 | | 145 | 1 | 8 | 168 |
| 1994 | 4/5-9/30 | 1 | 5 | 10 | | 52 | 2 | 5 | 74 |
| 1995 | 4/6-9/29 | 1 | 11 | 12 | 40 | 71 | 1 | 2 | 137 |
| 1996 | 4/8-9/9 | 1 | 15 | 9 | 21 | 63 | | 7 | 115 |
| 1997[2] | 4/8-9/8 | 1 | | | | | | | 0 |
| See Adult Catch Section for Details | | | | | | | | | |
| 1998 | 4/9-10/31 | up to 48 | | | | | | | 642 |
| 1999 | 4/1-10/31 | up to 48 | | | | | | | 9,725 |

1. Fallbacks were not consistently differentiated as wild or hatchery prior to 1995.
2. An adult excluder was installed on the sample collection tank in 1997.

Table C-9. Summary of collection estimates for chinook fry at John Day dam, 1987-1999.

| Year | Sample | Collection |
|---|---|---|
| 1987 | 780 | 780 |
| 1988 | 3,800 | 3,800 |
| 1989 | 3,922 | 3,922 |
| 1990 | 30 | 30 |
| 1991 | 513 | 513 |
| 1992 | 141 | 141 |
| 1993 | 1,317 | 1,317 |
| 1994 | 47 | 47 |
| 1995 | 507 | 1,350 |
| 1996 | 105 | 217 |
| 1997 | 1,305 | 2,342 |
| 1998 | 159 | 4,229 |
| 1999 | 675 | 7,012 |

Table C-10. Summary of species composition during dewaterings at John Day SMF, 1998-99.

| Date | Purpose/details | Adult Salmonids | P. Lamprey | Juvenile salmonids | Shad, cat-fish, other | Total |
|---|---|---|---|---|---|---|
| **1998** | | | | | | |
| 27-Jul-98 | Scheduled inspection, Crest gate evaluation | 69 | 100 | 30-50 | 138-258 | 337-477 |
| 23-Sep-98 | PDS Adult holding investigation | 130-140 | 50-100 | 200 | 22 | 402 |
| 29-Oct-98 | End of season dewatering | 164 | | | | 164 |
| **1999** | | | | | | |
| 2-Apr-99 | PDS screen cleaner failure, switch gate repairs | 2 | 20-30 | 50-60 | | 72-92 |
| 9-Jun-99 | Scheduled inspection, Crest gate malfunction | 30-50 | | | | 30-50 |
| 21-Sep-99 | PDS Adult holding investigation | 150-250 | 50-60 | | 112 | 312-424 |
| 27-Oct-99 | End of season dewatering | 182 | 41 | | 28 | 251 |

Table C-11. Collection numbers for the most numerous incidental species sampled at John Day Dam, 1985 - 1999.

| Year | American Shad | | Pacific Lamprey | | Crappie | Sculpin | Mountain | Sucker | Walleye | S-Mouth | Bluegill[1] | Northern | Peamouth | Chisel- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Juvenile | Adult | Juvenile | Adult | Species | Species | Whitefish | Species | | Bass | | Squawfish | | mouth |
| 1985[2] | 90,904 | 233 | 35 | 15 | 6,174 | 675 | 236 | 571 | 161 | 789 | 18 | 89 | 24 | 195 |
| 1986 | 49,916 | 516 | 890 | 24 | 279 | 201 | 675 | 501 | 308 | 191 | 35 | 250 | 42 | 137 |
| 1987 | 18,606 | 176 | 229 | 58 | 1,016 | 581 | 499 | 372 | 677 | 283 | 22 | 63 | 27 | 86 |
| 1988 | 39,474 | 312 | 629 | 52 | 293 | 481 | 236 | 178 | 70 | 163 | 16 | 37 | 65 | 27 |
| 1989 | 61,832 | 451 | 1,928 | 7 | 87 | 113 | 269 | 222 | 101 | 74 | 14 | 53 | 108 | 40 |
| 1990[3] | 330,177 | 213 | 923 | 4 | 96 | 48 | 253 | 92 | 24 | 60 | 1,054 | 17 | 25 | 25 |
| 1991 | 168,602 | 179 | 9,337 | 44 | 99 | 59 | 383 | 162 | 12 | 79 | 159 | 646 | 14 | 16 |
| 1992 | 203,782 | 175 | 178 | 6 | 38 | 4,827 | 444 | 64 | 813 | 119 | 44 | 9 | 32 | 14 |
| 1993 | 180,088 | 615 | 4,348 | 7 | 58 | 256 | 582 | 295 | 133 | 93 | 237 | 56 | 26 | 11 |
| 1994 | 111,418 | 460 | 3,250 | 28 | 28 | 479 | 353 | 234 | 167 | 68 | 8 | 16 | 104 | 25 |
| 1995[4] | 202,375 | 772 | 1,143 | 36 | 81 | 29 | 294 | 142 | 84 | 115 | 102 | 41 | 200 | 34 |
| 1996 | 56,245 | 657 | 481 | 10 | 8 | 23 | 303 | 137 | 28 | 38 | 27 | 18 | 28 | 14 |
| 1997 | 108,961 | 50 | 486 | 3 | 20 | 11 | 79 | 291 | 4 | 16 | 18 | 3 | 6 | 8 |
| 1998 | 1,281,697 | 276 | 149,483 | 1,012 | 1,802 | 2,682 | 17,725 | 34,583 | 628 | 7,554 | 4,359 | 187 | 310 | 196 |
| 1999 | 5,234,523 | 939 | 167,856 | 493 | 281 | 1,050 | 8,294 | 6,761 | 1,347 | 1,586 | 2,320 | 236 | 117 | 2,050 |

[1] Bluegill and Pumpkinseeds are not differentiated.
[2] Unit 3B was out of service from April 2-26 for STS installations and testing in 1985.
[3] Sampling was done in Gatewell 5B during the 1990 season, and an electrical fire shut down the unit from 29 May to 10 June.
[4] Starting in 1995, subsampling was implemented and collection estimates were calculated. Prior to 1995, all sampling was at 100%.

Table C-12. Summary of sampling effort at John Day Dam, 1985-1999.

| | | | | | Yearling Chinook | | | | | Subyearling Chinook | | | | | Coho | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ~~Collection~~ | | ~~Index~~ | | | ~~Collection~~ | | ~~Index~~ | | | ~~Collection~~ | | ~~Index~~ | |
| Year | Dates | Sampling Effort | Sub-Sampling | Sample Rate | Sample # | Hourly | Daily | Hourly | Daily | Sample # | Hourly | Daily | Hourly | Daily | Sample # | Hourly | Daily | Hourly | Daily |
| 1985 | 4/27-10/29 | 24/day | NO | 1 | 63,578 | NA | 63,578 | NA | - | 226,577 | NA | 226,577 | NA | - | 600 | NA | 600 | NA | - |
| 1986 | 3/28-10/30 | 24/day | NO | 1 | 92,591 | NA | 92,951 | NA | - | 182,117 | NA | 182,117 | NA | - | 1,994 | NA | 1,994 | NA | - |
| 1987 | 4/1-11/30 | 24/day | NO | 1 | 84,455 | NA | 84,455 | NA | 1,020,768 | 95,505 | NA | 95,505 | NA | 760,605 | 13,200 | NA | 13,200 | NA | 170,353 |
| 1988 | 3/30-10/31 | 24/day | NO | 1 | 34,045 | NA | 34,045 | NA | 408,675 | 109,448 | NA | 109,448 | NA | 363,101 | 8,650 | NA | 8,650 | NA | 109,325 |
| 1989 | 3/28-10/31 | 24/day | NO | 1 | 34,930 | NA | 34,930 | NA | 502,642 | 129,870 | NA | 129,870 | NA | 1,017,342 | 6,930 | NA | 6,930 | NA | 99,811 |
| 1990 | 3/27-10/31 | 24/day | NO | 1 | 26,992 | NA | 26,992 | NA | 361,968 | 39,602 | NA | 39,602 | NA | 513,669 | 6,261 | NA | 6,261 | NA | 84,342 |
| 1991 | 4/7-10/31 | 24/day | NO | 1 | 26,878 | NA | 26,878 | NA | 374,387 | 46,785 | NA | 46,785 | NA | 568,206 | 5,106 | NA | 5,106 | NA | 72,725 |
| 1992(3c)* | 3/25-10/13 | 24/day | NO | 1 | 23,052 | NA | 23,052 | NA | NA | 27,407 | NA | 27,407 | NA | NA | 5,887 | NA | 5,887 | NA | NA |
| 1992(3b) | 3/25-10/13 | 24/day | NO | 1 | 19,179 | NA | 19,179 | - | 237,172 | 32,376 | NA | 32,376 | - | 294,861 | 3,917 | NA | 3,917 | - | 48,898 |
| 1993(3c) | 4/6-10/29 | 24/day | NO | 1 | 11,054 | 11,054 | 11,054 | NA | NA | 50,243 | 50,243 | 50,243 | NA | NA | 3,437 | 3,437 | 3,437 | NA | NA |
| 1993(3b) | 4/6-10/29 | 24/day | NO | 1 | 41,767 | 41,767 | 41,767 | 715,853 | 720,361 | 66,561 | 66,561 | 66,561 | 671,625 | 717,434 | 9,727 | 9,727 | 9,727 | 170,849 | 173,193 |
| 1994 | 4/5-9/30 | 24/day | NO | 1 | 34,071 | 34,199 | 34,199 | 455,553 | 446,854 | 75,164 | 121,272 | 121,272 | 1,150,694 | 1,207,368 | 11,385 | 11,413 | 11,413 | 159,173 | 151,135 |
| 1995 | 4/6-9/29 | 24/day | YES | .25-1 | 34,308 | 90,704 | 90,348 | 1,344,193 | 1,329,229 | 48,896 | 89,790 | 90,350 | 1,237,324 | 1,240,260 | 5,908 | 22,341 | 22,135 | 343,606 | 335,902 |
| 1996 | 4/8-9/9 | 24/day | YES | .25-1 | 14,560 | 38,995 | 38,975 | 737,815 | 738,311 | 31,157 | 46,238 | 46,232 | 747,428 | 737,841 | 8,551 | 27,021 | 27,043 | 511,251 | 504,863 |
| 1997 | 4/8-9/8 | 24/day | YES | .25-1 | 4,586 | 7,646 | 7,646 | 148,993 | 154,026 | 20,487 | 24,290 | 24,333 | 422,730 | 448,328 | 3,409 | 6,556 | 6,615 | 143,291 | 147,267 |
| 1998 | 4/9-10/31 | 24/day | YES | .0067-.25 | 27,732 | NA | 758,689 | NA | 1,147,861 | 31,178 | NA | 1,584,083 | NA | 2,155,479 | 5,330 | NA | 370,277 | NA | 572,762 |
| 1999 | 4/1-10/31 | 24/day | YES | .0067-.5 | 160,378 | NA | 1,597,819 | NA | 2,193,904 | 232,131 | NA | 3,090,201 | NA | 3,962,632 | 37,941 | NA | 388,932 | NA | 543,318 |

| | | Wild Steelhead | | | | Hatchery Steelhead | | | | | Sockeye | | | | | Total | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ~~Collection~~ | | ~~Index~~ | | | ~~Collection~~ | | ~~Index~~ | | | ~~Collection~~ | | ~~Index~~ | | | ~~Collection~~ | | ~~Index~~ | |
| Sample # | Hourly | Daily | Hourly | Daily | Sample # | Hourly | Daily | Hourly | Daily | Sample # | Hourly | Daily | Hourly | Daily | Sample # | Hourly | Daily | Hourly | Daily |
| ** | NA | ** | NA | NA | 36,616 | NA | 36,616 | NA | - | 17,235 | NA | 17,235 | NA | - | 344,606 | NA | 344,606 | NA | - |
| ** | NA | ** | NA | NA | 37,822 | NA | 37,822 | NA | - | 17,505 | NA | 17,505 | NA | - | 332,029 | NA | 332,389 | NA | - |
| ** | NA | ** | NA | NA | 23,988 | NA | 23,988 | NA | 300,410 | 11,911 | NA | 11,911 | NA | 145,232 | 229,059 | NA | 229,059 | NA | 2,397,368 |
| ** | NA | ** | NA | NA | 14,985 | NA | 14,985 | NA | 179,089 | 6,333 | NA | 6,333 | NA | 80,406 | 173,461 | NA | 173,461 | NA | 1,140,596 |
| ** | NA | ** | NA | NA | 19,818 | NA | 19,818 | NA | 281,685 | 5,496 | NA | 5,496 | NA | 78,190 | 197,044 | NA | 197,044 | NA | 1,979,670 |
| 5,028 | NA | 5,028 | NA | 68,428 | 4,921 | NA | 4,921 | NA | 6,349 | 1,755 | NA | 1,755 | NA | 23,592 | 84,559 | NA | 84,559 | NA | 1,058,348 |
| 5,456 | NA | 5,456 | NA | 75,687 | 11,166 | NA | 11,166 | NA | 158,305 | 3,450 | NA | 3,450 | NA | 52,203 | 98,841 | NA | 98,841 | NA | 1,301,513 |
| 2,770 | NA | 2,770 | NA | NA | 6,917 | NA | 6,917 | NA | NA | 1,647 | NA | 1,647 | NA | NA | 67,680 | NA | 67,680 | NA | NA |
| 2,371 | NA | 2,371 | - | 28,712 | 5,053 | NA | 5,053 | - | 63,494 | 961 | NA | 961 | - | 12,051 | 63,857 | NA | 63,857 | NA | 685,188 |
| 4,668 | 4,668 | 4,668 | NA | NA | 7,416 | 7,416 | 7,416 | NA | NA | 813 | 813 | 813 | NA | NA | 77,631 | 77,631 | 77,631 | NA | NA |
| 11,374 | 11,374 | 11,374 | 186,696 | 189,400 | 45,520 | 45,520 | 45,520 | 879,844 | 882,474 | 14,072 | 14,072 | 14,072 | 267,763 | 272,869 | 189,021 | 189,021 | 189,021 | 2,892,630 | 2,955,731 |
| 7,604 | 7,604 | 7,604 | 99,845 | 96,800 | 14,454 | 14,457 | 14,457 | 196,281 | 189,420 | 7,260 | 7,270 | 7,270 | 101,105 | 96,621 | 149,938 | 196,215 | 196,215 | 2,162,651 | 2,188,198 |
| 4,043 | 11,799 | 11,584 | 176,102 | 170,993 | 18,915 | 61,865 | 61,385 | 930,405 | 919,021 | 5,625 | 18,982 | 19,526 | 287,626 | 293,065 | 117,695 | 295,481 | 295,328 | 4,319,256 | 4,288,470 |
| 3,973 | 11,875 | 11,903 | 229,600 | 228,911 | 11,171 | 36,202 | 36,174 | 705,551 | 701,899 | 1,147 | 3,367 | 3,373 | 64,122 | 64,584 | 70,559 | 163,698 | 163,700 | 2,995,767 | 2,976,409 |
| 4,011 | 7,328 | 7,337 | 145,192 | 151,061 | 13,645 | 28,504 | 28,547 | 598,959 | 614,087 | 738 | 1,171 | 1,184 | 25,441 | 26,519 | 46,876 | 75,495 | 75,662 | 1,484,606 | 1,541,288 |
| 8,378 | NA | 296,969 | NA | 455,339 | 6,214 | NA | 408,195 | NA | 634,446 | 4,479 | NA | 338,099 | NA | 523,866 | 83,311 | NA | 3,756,312 | NA | 5,489,754 |
| 33,545 | NA | 299,072 | NA | 418,515 | 42,003 | NA | 586,952 | NA | 820,431 | 54,710 | NA | 407,398 | NA | 574,062 | 560,708 | NA | 6,370,374 | NA | 8,512,862 |

*3C airlift inoperational 5/13-6/18

**Wild and hatchery steelhead were not differentiated prior to 1990.

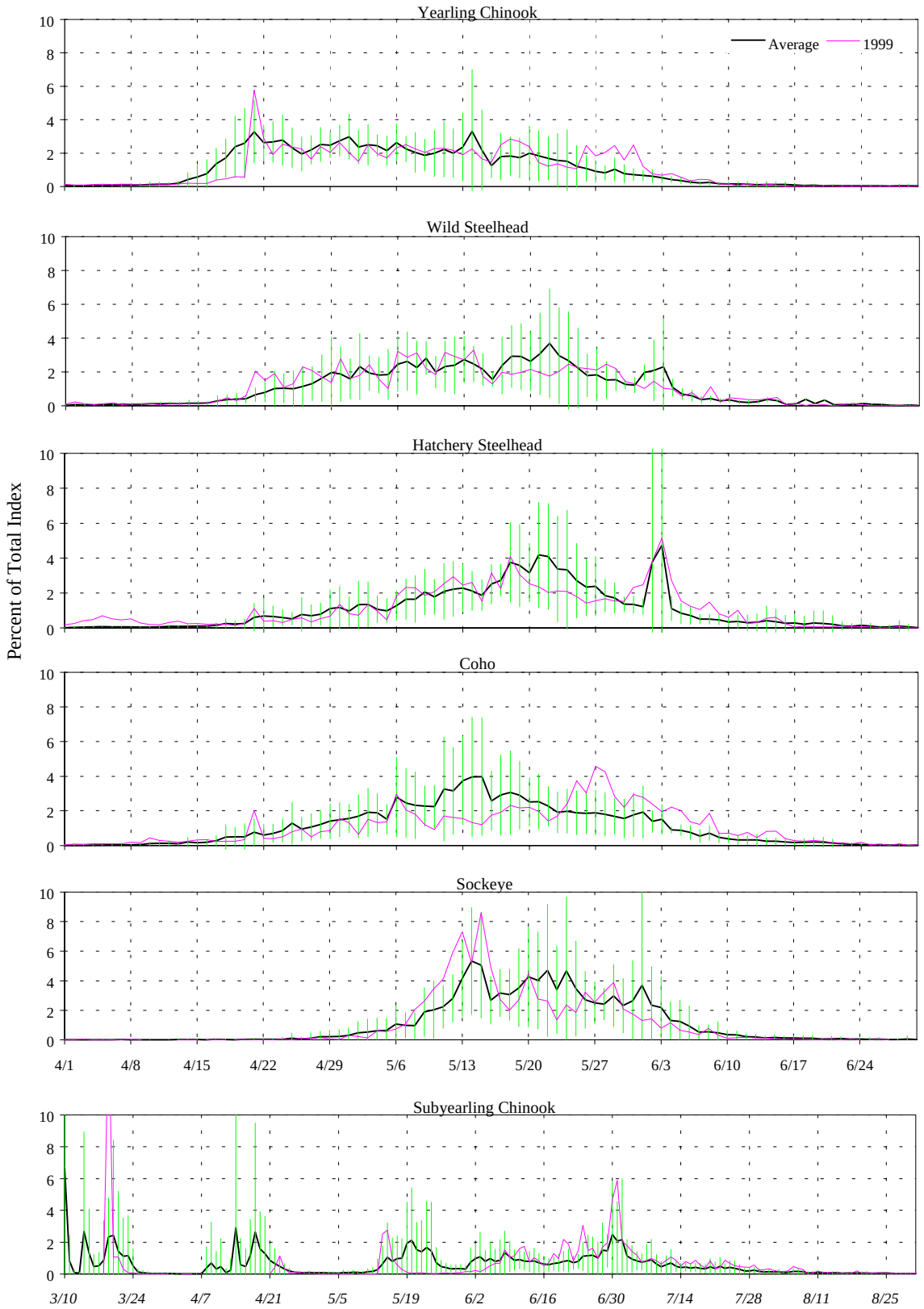


Figure D-1. Historical average passage pattern with standard deviation and the 1999 passage pattern, Bonneville Dam, 1985 - 1999.

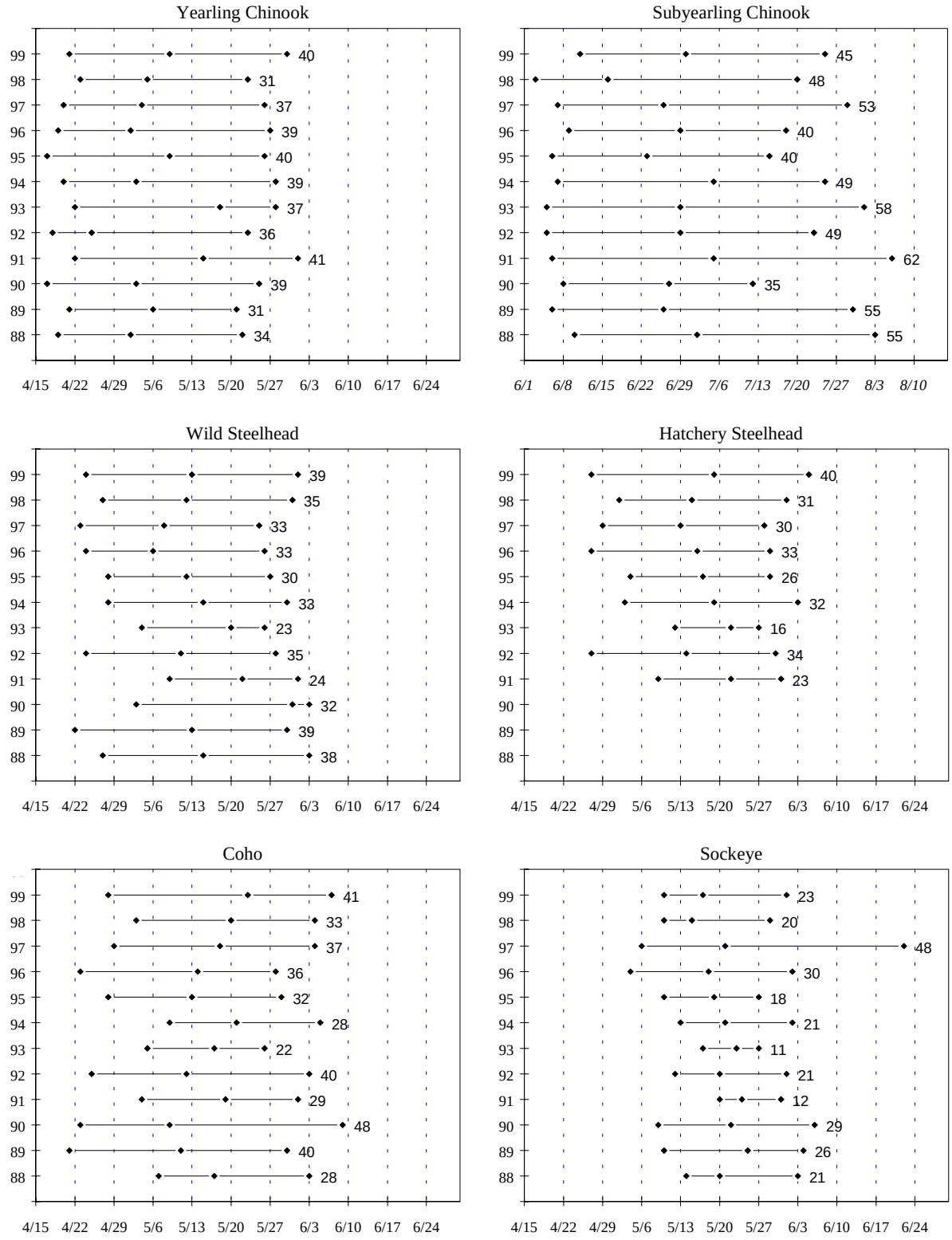


Figure D-2. 10%, 50%, and 90% passage dates for each season at Bonneville Dam, by species, 1988-1999. The duration between 10-90% dates (in days) is indicated for each year. Hatchery and wild steelhead were not differentiated before 1991.

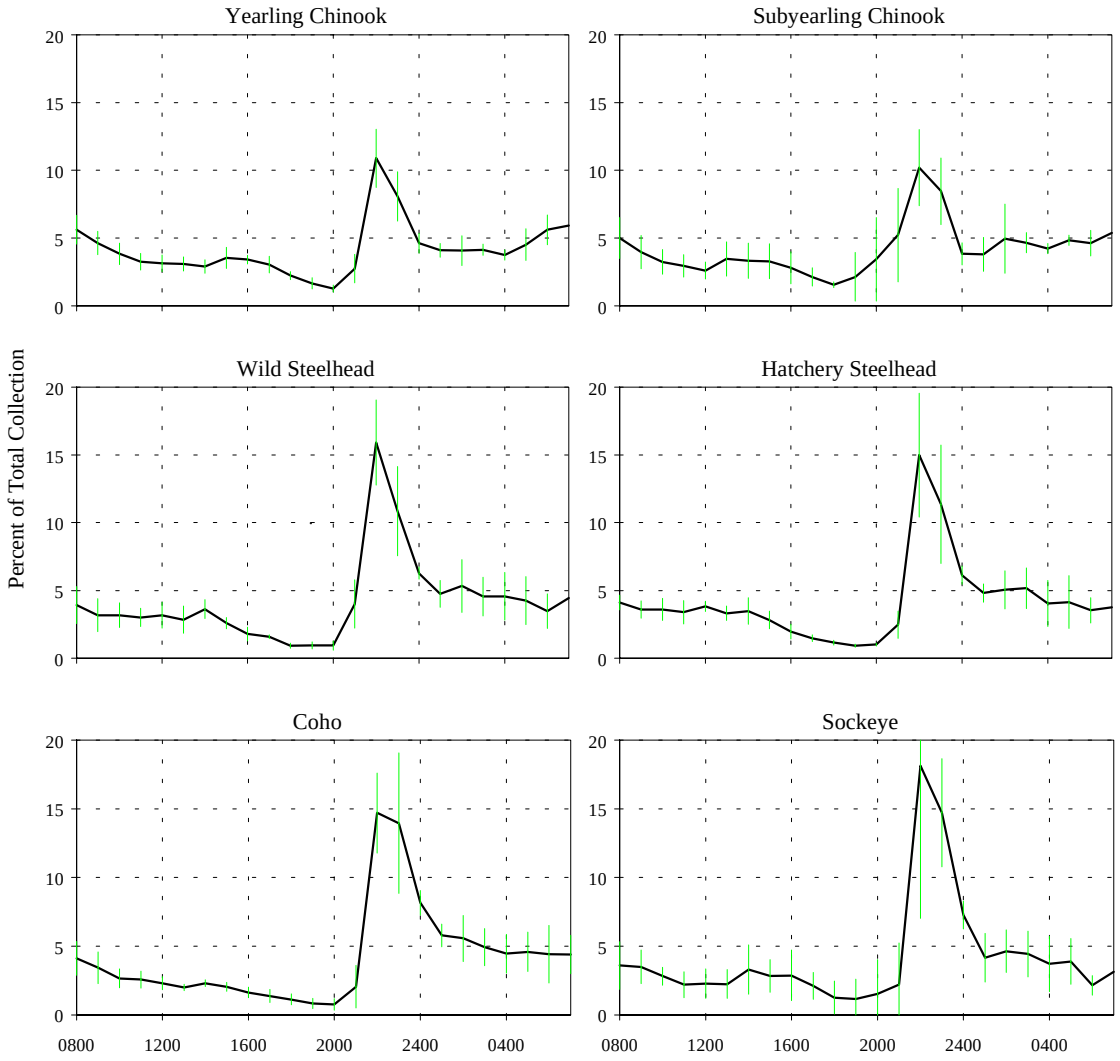


Figure D-3. Historical average diel passage with standard deviation, Bonneville Dam, 1992-1995.

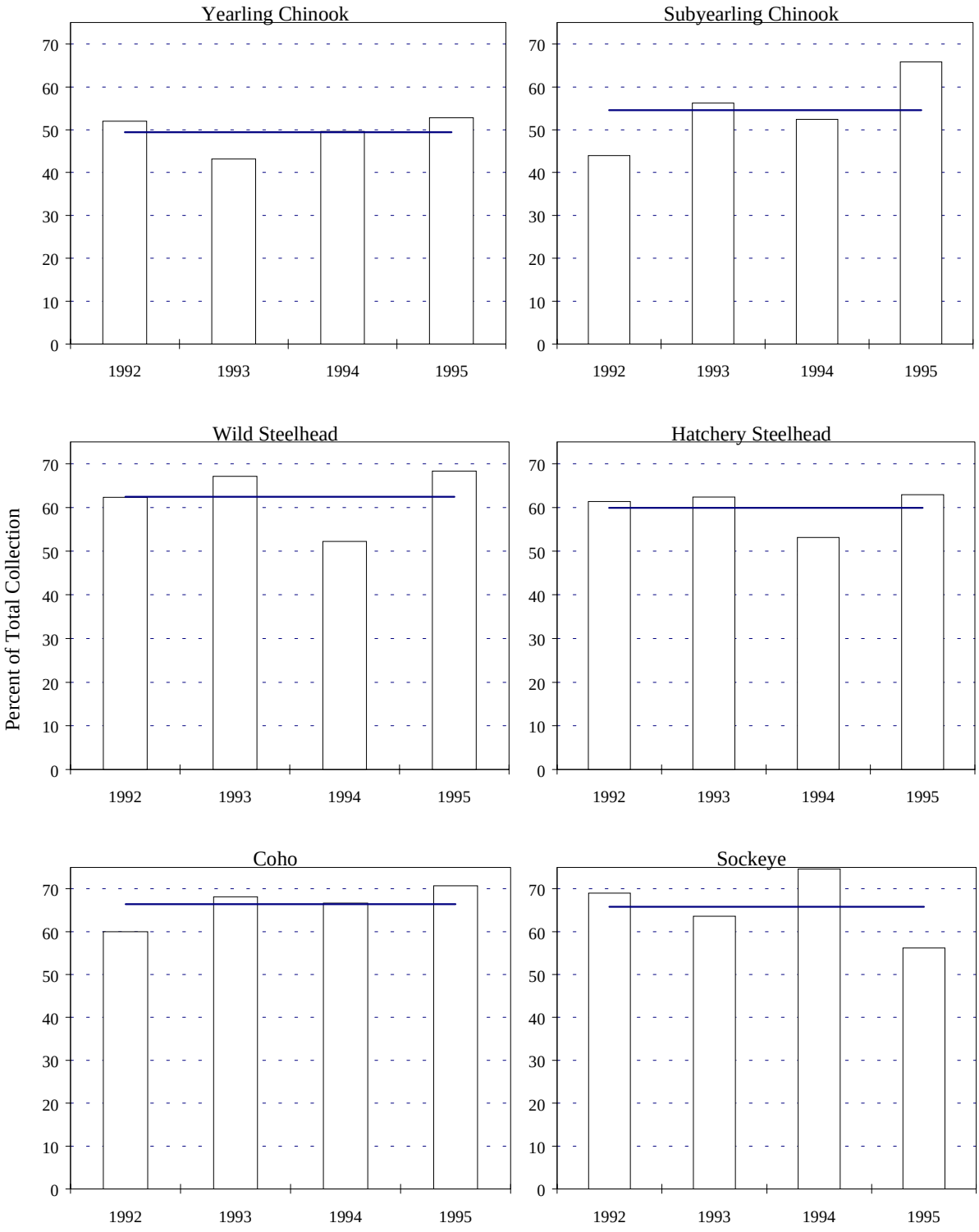


Figure D-4. Percent night passage (2000-0500) for each season of 24 hour monitoring at Bonneville Dam, by species, including the average, 1992-1995.

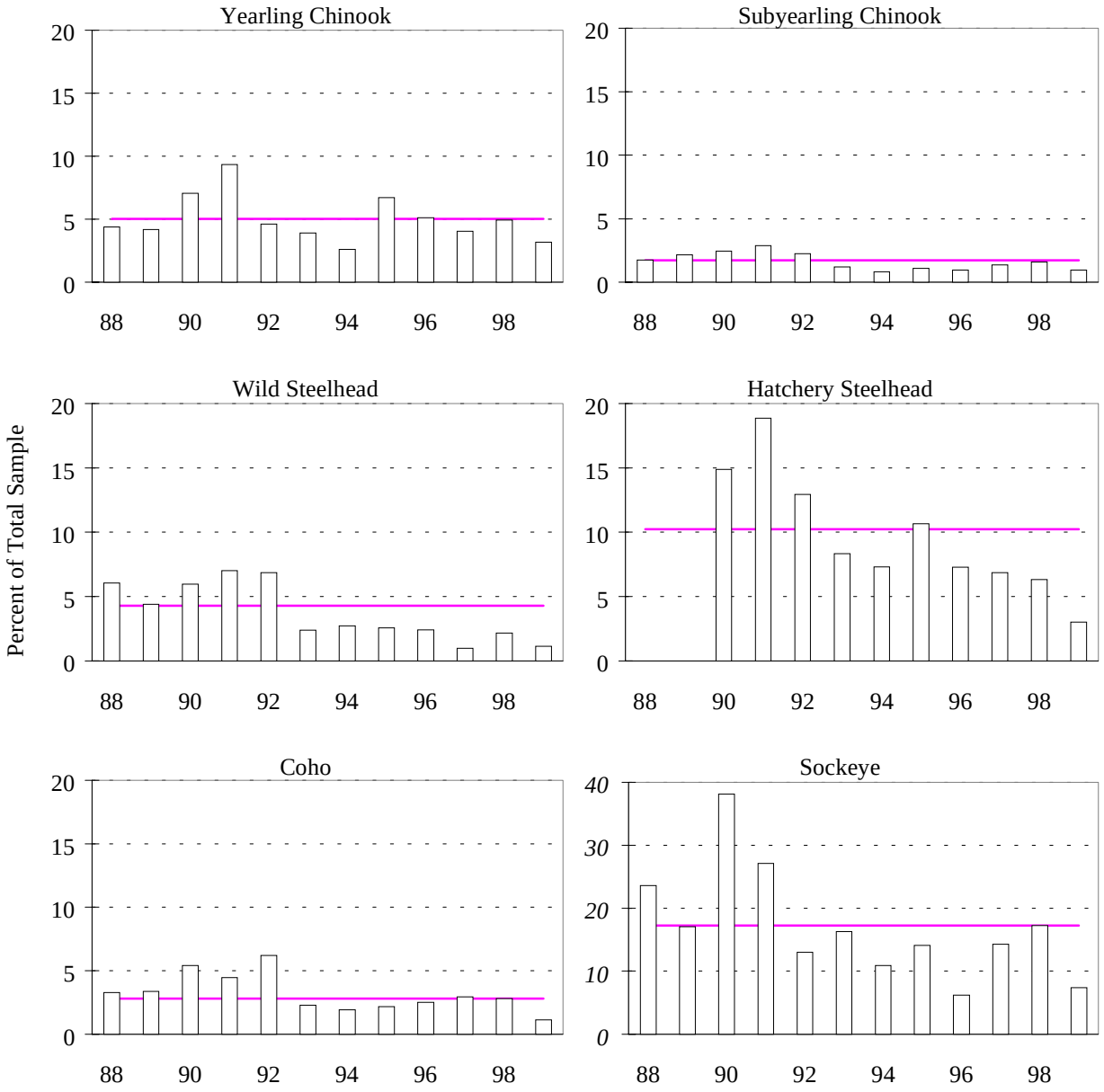


Figure D-5. Historical descaling percentages with the average at Bonneville Dam, PH1, 1988-1999. Hatchery and wild steelhead were not differentiated before 1990.

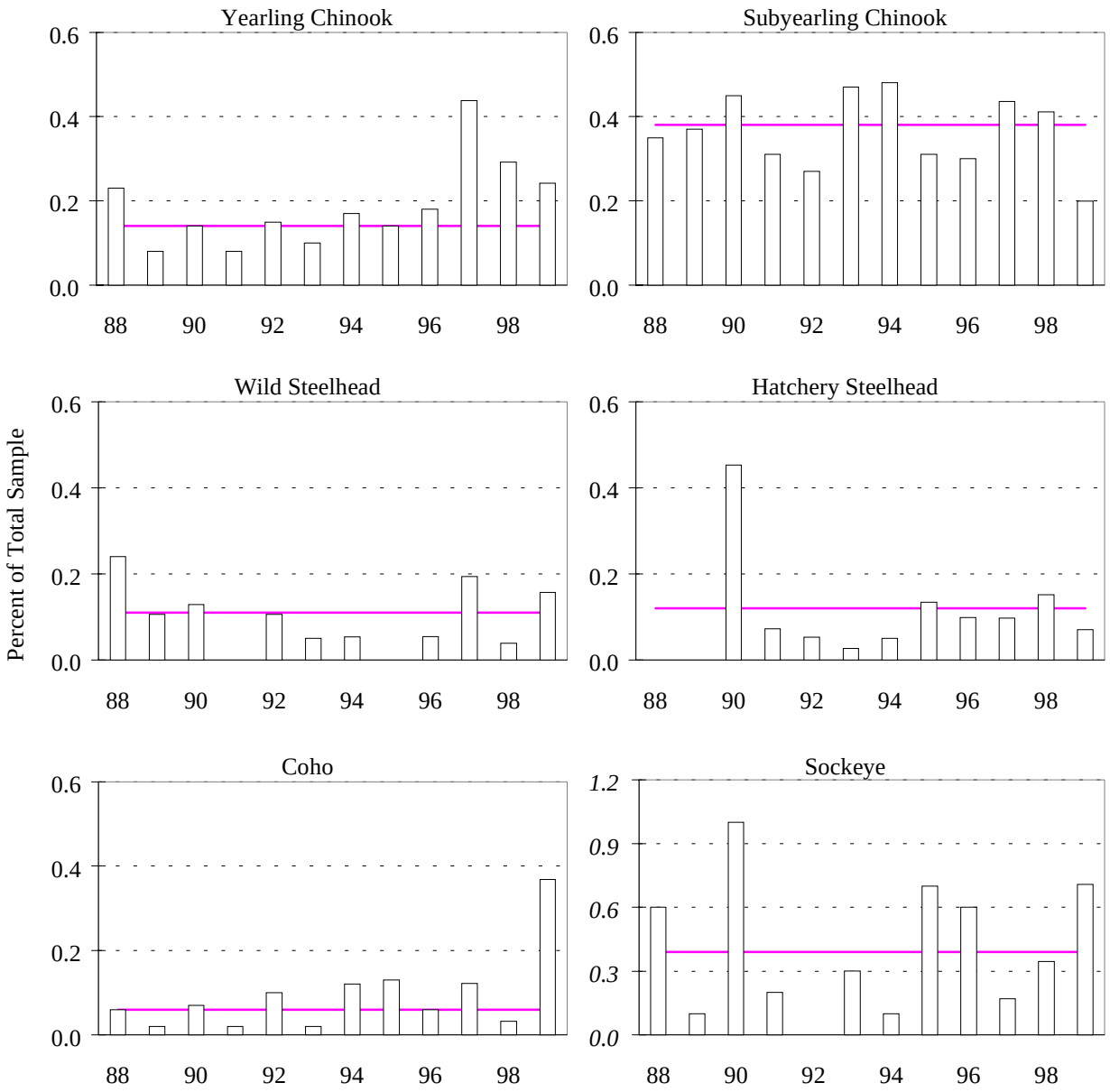


Figure D-6. Historical mortality percentages with the average at Bonneville Dam PH1, 1988-1999. Hatchery and wild steelhead were not differentiated before 1990.

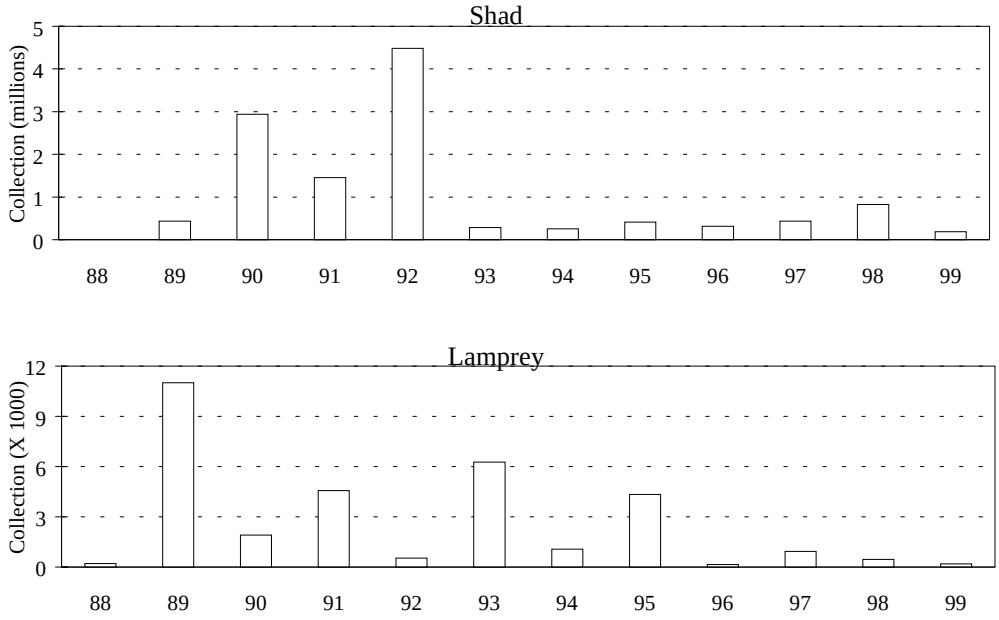


Figure D-7. Historical juvenile shad and lamprey counts at Bonneville Dam, 1988-1999.

Table D-1. Percent night passage (1800-0600) for 1992-95 at Bonneville Dam, PH1.

| YEAR | Yearling Chinook | Subyearling Chinook | Wild Steelhead | Hatchery Steelhead | Coho | Sockeye |
|---|---|---|---|---|---|---|
| 1992 | 52.0 | 44.0 | 62.3 | 61.3 | 60.0 | 69.0 |
| 1993 | 43.2 | 56.2 | 67.1 | 62.4 | 68.1 | 63.6 |
| 1994 | 49.6 | 52.4 | 52.2 | 53.1 | 66.7 | 74.6 |
| 1995 | 52.8 | 65.8 | 68.3 | 62.9 | 70.7 | 56.2 |
| MEDIAN | 50.8 | 54.3 | 64.7 | 61.9 | 67.4 | 66.3 |
| MIN | 43.2 | 44.0 | 52.2 | 53.1 | 60.0 | 56.2 |
| MAX | 52.8 | 65.8 | 68.3 | 62.9 | 70.7 | 74.6 |

Table D-2. 10%, 50%, and 90% passage dates at Bonneville Dam, PH1, 1988-1999.

| Yearling Chinook | | | | |
|---|---|---|---|---|
| | 10 % | 50% | 90 % | # of Days |
| 1988 | 19-Apr | 02-May | 22-May | 34 |
| 1989 | 21-Apr | 06-May | 21-May | 31 |
| 1990 | 17-Apr | 03-May | 25-May | 39 |
| 1991 | 22-Apr | 15-May | 01-Jun | 41 |
| 1992 | 18-Apr | 25-Apr | 23-May | 36 |
| 1993 | 22-Apr | 18-May | 28-May | 37 |
| 1994 | 20-Apr | 03-May | 28-May | 39 |
| 1995 | 17-Apr | 09-May | 26-May | 40 |
| 1996 | 19-Apr | 02-May | 27-May | 39 |
| 1997 | 20-Apr | 4-May | 26-May | 37 |
| 1998 | 23-Apr | 5-May | 23-May | 31 |
| 1999 | 21-Apr | 9-May | 30-May | 40 |
| **MEDIAN** | 20-Apr | 04-May | 26-May | 37 |
| **MIN** | 17-Apr | 25-Apr | 21-May | 31 |
| **MAX** | 23-Apr | 18-May | 01-Jun | 41 |

| Subyearling Chinook - "Brights" Only | | | | |
|---|---|---|---|---|
| | 10 % | 50% | 90 % | # of Days |
| 1988 | 10-Jun | 02-Jul | 03-Aug | 55 |
| 1989 | 06-Jun | 26-Jun | 30-Jul | 55 |
| 1990 | 08-Jun | 27-Jun | 12-Jul | 35 |
| 1991 | 06-Jun | 05-Jul | 06-Aug | 62 |
| 1992 | 05-Jun | 29-Jun | 23-Jul | 49 |
| 1993 | 05-Jun | 29-Jun | 01-Aug | 58 |
| 1994 | 07-Jun | 05-Jul | 25-Jul | 49 |
| 1995 | 6-Jun | 23-Jun | 15-Jul | 40 |
| 1996 | 9-Jun | 29-Jun | 18-Jul | 40 |
| 1997 | 7-Jun | 26-Jun | 29-Jul | 53 |
| 1998 | 3-Jun | 16-Jun | 20-Jul | 48 |
| 1999 | 11-Jun | 30-Jun | 25-Jul | 45 |
| **MEDIAN** | 06-Jun | 29-Jun | 25-Jul | 50 |
| **MIN** | 03-Jun | 16-Jun | 12-Jul | 35 |
| **MAX** | 11-Jun | 05-Jul | 06-Aug | 62 |

| Wild Steelhead | | | | |
|---|---|---|---|---|
| | 10 % | 50% | 90 % | # of Days |
| 1988* | 27-Apr | 15-May | 03-Jun | 38 |
| 1989* | 22-Apr | 13-May | 30-May | 39 |
| 1990* | 03-May | 31-May | 03-Jun | 32 |
| 1991 | 09-May | 22-May | 01-Jun | 24 |
| 1992 | 24-Apr | 11-May | 28-May | 35 |
| 1993 | 04-May | 20-May | 26-May | 23 |
| 1994 | 28-Apr | 15-May | 30-May | 33 |
| 1995 | 28-Apr | 12-May | 27-May | 30 |
| 1996 | 24-Apr | 6-May | 26-May | 33 |
| 1997 | 23-Apr | 8-May | 25-May | 33 |
| 1998 | 27-Apr | 12-May | 31-May | 35 |
| 1999 | 24-Apr | 13-May | 1-Jun | 39 |
| **MEDIAN** | 27-Apr | 12-May | 28-May | 32 |
| **MIN** | 23-Apr | 06-May | 25-May | 23 |
| **MAX** | 09-May | 22-May | 01-Jun | 35 |

| Hatchery Steelhead | | | | |
|---|---|---|---|---|
| | 10 % | 50% | 90 % | # of Days |
| 1988* | | | | |
| 1989* | | | | |
| 1990* | | | | |
| 1991 | 09-May | 22-May | 31-May | 23 |
| 1992 | 27-Apr | 14-May | 30-May | 34 |
| 1993 | 12-May | 22-May | 27-May | 16 |
| 1994 | 03-May | 19-May | 03-Jun | 32 |
| 1995 | 04-May | 17-May | 29-May | 26 |
| 1996 | 27-Apr | 16-May | 29-May | 33 |
| 1997 | 29-Apr | 13-May | 28-May | 30 |
| 1998 | 2-May | 15-May | 1-Jun | 31 |
| 1999 | 27-Apr | 19-May | 5-Jun | 40 |
| **MEDIAN** | 02-May | 16-May | 29-May | 28 |
| **MIN** | 27-Apr | 13-May | 27-May | 16 |
| **MAX** | 12-May | 22-May | 03-Jun | 34 |

| Coho | | | | |
|---|---|---|---|---|
| | 10 % | 50% | 90 % | # of Days |
| 1988 | 07-May | 17-May | 03-Jun | 28 |
| 1989 | 21-Apr | 11-May | 30-May | 40 |
| 1990 | 23-Apr | 09-May | 09-Jun | 48 |
| 1991 | 04-May | 19-May | 01-Jun | 29 |
| 1992 | 25-Apr | 12-May | 03-Jun | 40 |
| 1993 | 05-May | 17-May | 26-May | 22 |
| 1994 | 09-May | 21-May | 05-Jun | 28 |
| 1995 | 28-Apr | 13-May | 29-May | 32 |
| 1996 | 23-Apr | 14-May | 28-May | 36 |
| 1997 | 29-Apr | 18-May | 4-Jun | 37 |
| 1998 | 3-May | 20-May | 4-Jun | 33 |
| 1999 | 28-Apr | 23-May | 7-Jun | 41 |
| **MEDIAN** | 01-May | 17-May | 02-Jun | 33 |
| **MIN** | 23-Apr | 12-May | 26-May | 22 |
| **MAX** | 09-May | 21-May | 05-Jun | 40 |

| Sockeye (Wild + Hatchery) | | | | |
|---|---|---|---|---|
| | 10 % | 50% | 90 % | # of Days |
| 1988 | 14-May | 20-May | 3-Jun | 21 |
| 1989 | 10-May | 25-May | 4-Jun | 26 |
| 1990 | 9-May | 22-May | 6-Jun | 29 |
| 1991 | 20-May | 24-May | 31-May | 12 |
| 1992 | 12-May | 20-May | 1-Jun | 21 |
| 1993 | 17-May | 23-May | 27-May | 11 |
| 1994 | 13-May | 21-May | 2-Jun | 21 |
| 1995 | 10-May | 19-May | 27-May | 18 |
| 1996 | 4-May | 18-May | 2-Jun | 30 |
| 1997 | 6-May | 21-May | 22-Jun | 48 |
| 1998 | 10-May | 15-May | 29-May | 20 |
| 1999 | 10-May | 17-May | 1-Jun | 23 |
| **MEDIAN** | 11-May | 20-May | 31-May | 22 |
| **MIN** | 04-May | 15-May | 27-May | 11 |
| **MAX** | 20-May | 24-May | 22-Jun | 48 |

* Years in which no differentiation was made between wild and hatchery steelhead for index purposes.

Table D-3. Percent of total passage per hour at Bonneville Dam, 1992-1995.

**Yearling Chinook**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 5.1 | 5.4 | 4.1 | 3.6 | 3.2 | 2.9 | 2.6 | 2.8 | 3.1 | 2.5 | 1.9 | 1.4 | 1.5 | 3.9 | 11.8 | 10.5 | 4.9 | 4.2 | 3.8 | 4.3 | 3.6 | 3.6 | 5.2 | 3.8 |
| 1993 | 6.7 | 5.0 | 4.8 | 4.0 | 4.0 | 3.4 | 2.9 | 4.3 | 3.8 | 3.9 | 2.6 | 2.2 | 1.4 | 1.5 | 7.9 | 6.8 | 3.5 | 3.5 | 3.1 | 3.5 | 3.4 | 3.8 | 6.2 | 7.7 |
| 1994 | 6.2 | 4.5 | 3.2 | 2.7 | 2.5 | 2.4 | 2.4 | 2.9 | 3.2 | 2.7 | 2.2 | 1.6 | 1.0 | 2.4 | 11.0 | 8.5 | 4.9 | 4.1 | 3.7 | 4.3 | 3.8 | 6.2 | 6.8 | 6.9 |
| 1995 | 4.4 | 3.4 | 3.1 | 2.8 | 2.9 | 3.6 | 3.6 | 4.0 | 3.4 | 3.0 | 2.1 | 1.4 | 1.1 | 3.2 | 12.9 | 6.6 | 5.2 | 4.7 | 5.7 | 4.5 | 4.3 | 4.6 | 4.3 | 5.1 |
| AVG | 5.8 | 4.5 | 3.8 | 3.2 | 3.1 | 3.0 | 2.9 | 3.6 | 3.4 | 3.1 | 2.3 | 1.7 | 1.2 | 2.5 | 10.5 | 7.8 | 4.5 | 4.1 | 4.0 | 4.1 | 3.8 | 4.7 | 5.8 | 6.4 |
| MIN | 4.4 | 3.4 | 3.1 | 2.7 | 2.5 | 2.4 | 2.4 | 2.8 | 3.1 | 2.5 | 1.9 | 1.4 | 1.0 | 1.5 | 7.9 | 6.6 | 3.5 | 3.5 | 3.1 | 3.5 | 3.4 | 3.6 | 4.3 | 3.8 |
| MAX | 6.7 | 5.4 | 4.8 | 4.0 | 4.0 | 3.6 | 3.6 | 4.3 | 3.8 | 3.9 | 2.6 | 2.2 | 1.5 | 3.9 | 12.9 | 10.5 | 5.2 | 4.7 | 5.7 | 4.5 | 4.3 | 6.2 | 6.8 | 7.7 |

**Subyearling Chinook**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 6.5 | 4.6 | 4.1 | 4.0 | 3.3 | 5.1 | 4.4 | 4.2 | 4.1 | 3.0 | 1.8 | 1.0 | 0.6 | 4.3 | 9.4 | 7.9 | 3.1 | 2.6 | 3.1 | 4.5 | 4.0 | 4.5 | 4.0 | 5.8 |
| 1993 | 4.5 | 3.2 | 2.8 | 2.3 | 2.1 | 2.0 | 1.9 | 2.1 | 1.8 | 1.6 | 1.6 | 4.8 | 7.7 | 10.2 | 7.4 | 6.1 | 4.5 | 5.0 | 3.8 | 3.9 | 4.1 | 5.0 | 6.0 | 5.5 |
| 1994 | 5.8 | 5.1 | 3.8 | 3.2 | 2.9 | 3.2 | 4.2 | 4.5 | 3.6 | 2.2 | 1.6 | 0.9 | 2.0 | 4.0 | 9.9 | 7.7 | 3.2 | 2.9 | 4.3 | 4.5 | 4.1 | 4.7 | 4.4 | 7.1 |
| 1995 | 3.2 | 2.7 | 2.2 | 2.4 | 2.1 | 3.5 | 2.6 | 2.2 | 1.8 | 1.7 | 1.3 | 1.8 | 3.5 | 2.4 | 14.0 | 11.9 | 4.6 | 4.7 | 8.7 | 5.7 | 4.7 | 5.2 | 4.1 | 3.0 |
| AVG | 5.2 | 4.3 | 3.4 | 3.0 | 2.7 | 3.3 | 3.5 | 3.6 | 3.0 | 2.1 | 1.6 | 1.8 | 3.1 | 5.0 | 10.1 | 8.1 | 3.6 | 3.5 | 4.7 | 4.6 | 4.2 | 4.8 | 4.6 | 6.0 |
| MIN | 3.2 | 2.7 | 2.2 | 2.3 | 2.1 | 2.0 | 1.9 | 2.1 | 1.8 | 1.6 | 1.3 | 0.9 | 0.6 | 2.4 | 7.4 | 6.1 | 3.1 | 2.6 | 3.1 | 3.9 | 4.0 | 4.5 | 4.0 | 3.0 |
| MAX | 6.5 | 5.1 | 4.1 | 4.0 | 3.3 | 5.1 | 4.4 | 4.5 | 4.1 | 3.0 | 1.8 | 4.8 | 7.7 | 10.2 | 14.0 | 11.9 | 4.6 | 5.0 | 8.7 | 5.7 | 4.7 | 5.2 | 6.0 | 7.1 |

**Wild Steelhead**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 3.8 | 3.7 | 3.2 | 3.7 | 3.9 | 2.6 | 3.4 | 2.2 | 1.1 | 1.6 | 0.7 | 0.7 | 0.7 | 4.1 | 16.9 | 15.3 | 6.3 | 4.1 | 4.3 | 4.4 | 3.2 | 2.8 | 3.0 | 4.2 |
| 1993 | 4.0 | 2.3 | 2.4 | 2.8 | 2.8 | 1.9 | 2.7 | 2.4 | 1.8 | 1.8 | 1.2 | 1.0 | 0.8 | 2.8 | 11.9 | 8.1 | 6.3 | 6.2 | 6.9 | 6.4 | 6.7 | 6.5 | 5.4 | 4.9 |
| 1994 | 5.5 | 4.7 | 4.4 | 3.6 | 4.1 | 4.4 | 4.4 | 3.3 | 2.4 | 1.6 | 1.0 | 0.8 | 0.7 | 2.6 | 15.5 | 11.1 | 5.5 | 4.1 | 3.0 | 2.8 | 3.0 | 2.8 | 3.0 | 5.5 |
| 1995 | 2.2 | 2.0 | 2.6 | 2.1 | 2.0 | 2.7 | 4.1 | 2.7 | 1.9 | 1.5 | 0.8 | 1.3 | 1.4 | 6.5 | 19.4 | 8.7 | 6.8 | 4.3 | 7.0 | 4.5 | 5.3 | 4.8 | 2.4 | 2.8 |
| AVG | 4.4 | 3.4 | 3.3 | 3.1 | 3.3 | 3.1 | 3.7 | 2.8 | 2.0 | 1.7 | 1.0 | 0.9 | 0.9 | 3.3 | 14.8 | 10.0 | 6.0 | 4.9 | 5.1 | 4.5 | 4.7 | 4.5 | 3.8 | 4.8 |
| MIN | 2.2 | 2.0 | 2.4 | 2.1 | 2.0 | 1.9 | 2.7 | 2.2 | 1.1 | 1.5 | 0.7 | 0.7 | 0.7 | 2.6 | 11.9 | 8.1 | 5.5 | 4.1 | 3.0 | 2.8 | 3.0 | 2.8 | 2.4 | 2.8 |
| MAX | 5.5 | 4.7 | 4.4 | 3.7 | 4.1 | 4.4 | 4.4 | 3.3 | 2.4 | 1.8 | 1.2 | 1.3 | 1.4 | 6.5 | 19.4 | 15.3 | 6.8 | 6.2 | 7.0 | 6.4 | 6.7 | 6.5 | 5.4 | 5.5 |

**Hatchery Steelhead**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 3.8 | 3.3 | 3.2 | 3.5 | 4.0 | 3.3 | 3.1 | 2.5 | 1.3 | 1.3 | 1.3 | 1.1 | 0.9 | 3.2 | 16.5 | 16.1 | 6.9 | 4.3 | 3.6 | 3.9 | 2.7 | 3.0 | 3.4 | 3.6 |
| 1993 | 4.6 | 3.8 | 3.3 | 3.0 | 4.0 | 2.6 | 2.3 | 2.6 | 1.9 | 1.8 | 1.1 | 0.9 | 1.0 | 1.8 | 11.0 | 6.5 | 5.5 | 5.7 | 6.6 | 7.1 | 6.4 | 7.1 | 4.6 | 4.6 |
| 1994 | 4.4 | 4.4 | 4.7 | 4.4 | 3.2 | 3.5 | 4.3 | 3.7 | 2.6 | 1.3 | 1.0 | 0.9 | 0.9 | 1.5 | 12.1 | 14.0 | 6.5 | 4.4 | 4.2 | 4.1 | 2.8 | 3.3 | 3.7 | 4.3 |
| 1995 | 3.5 | 2.8 | 3.1 | 2.5 | 4.0 | 3.9 | 3.9 | 2.3 | 2.0 | 1.5 | 1.3 | 0.8 | 1.2 | 3.4 | 20.8 | 8.9 | 5.7 | 4.8 | 5.8 | 5.6 | 4.1 | 3.3 | 2.4 | 2.4 |
| AVG | 4.2 | 3.7 | 3.6 | 3.3 | 3.8 | 3.2 | 3.2 | 2.8 | 2.1 | 1.6 | 1.1 | 0.9 | 1.0 | 2.2 | 14.0 | 9.4 | 5.8 | 5.1 | 5.7 | 5.9 | 4.8 | 5.0 | 3.8 | 3.9 |
| MIN | 3.5 | 2.8 | 3.1 | 2.5 | 3.2 | 2.6 | 2.3 | 2.3 | 1.3 | 1.3 | 1.0 | 0.8 | 0.9 | 1.5 | 11.0 | 6.5 | 5.5 | 4.3 | 3.6 | 3.9 | 2.7 | 3.0 | 2.4 | 2.4 |
| MAX | 4.6 | 4.4 | 4.7 | 4.4 | 4.0 | 3.9 | 4.3 | 3.7 | 2.6 | 1.8 | 1.3 | 1.1 | 1.2 | 3.4 | 20.8 | 16.1 | 6.9 | 5.7 | 6.6 | 7.1 | 6.4 | 7.1 | 4.6 | 4.6 |

**Coho**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 5.5 | 4.9 | 3.6 | 3.4 | 2.9 | 2.1 | 2.2 | 1.7 | 1.4 | 1.4 | 0.9 | 0.5 | 0.4 | 1.4 | 14.1 | 18.5 | 9.2 | 4.8 | 3.5 | 3.2 | 2.7 | 2.7 | 4.4 | 4.6 |
| 1993 | 3.5 | 3.0 | 2.3 | 2.1 | 2.5 | 1.7 | 2.2 | 2.4 | 2.0 | 2.0 | 1.7 | 1.2 | 1.1 | 2.6 | 11.1 | 8.1 | 7.2 | 6.7 | 6.4 | 6.4 | 6.1 | 6.1 | 7.4 | 4.2 |
| 1994 | 4.6 | 3.7 | 2.6 | 2.1 | 1.9 | 2.0 | 2.1 | 1.9 | 1.2 | 0.8 | 0.9 | 0.5 | 0.4 | 0.3 | 15.3 | 18.1 | 8.5 | 5.6 | 5.1 | 4.6 | 4.4 | 4.7 | 3.0 | 5.8 |
| 1995 | 2.7 | 2.1 | 2.1 | 2.5 | 1.9 | 2.2 | 2.6 | 2.2 | 1.8 | 1.4 | 1.0 | 1.1 | 1.1 | 3.9 | 18.1 | 11.2 | 7.7 | 6.1 | 7.4 | 5.5 | 4.8 | 4.8 | 2.9 | 2.7 |
| AVG | 3.9 | 3.3 | 2.5 | 2.3 | 2.2 | 2.0 | 2.3 | 2.1 | 1.6 | 1.3 | 1.1 | 0.8 | 0.8 | 1.8 | 14.5 | 13.8 | 8.0 | 6.0 | 5.8 | 5.2 | 4.8 | 5.0 | 4.4 | 4.6 |
| MIN | 2.7 | 2.1 | 2.1 | 2.1 | 1.9 | 1.7 | 2.1 | 1.7 | 1.2 | 0.8 | 0.9 | 0.5 | 0.4 | 0.3 | 11.1 | 8.1 | 7.2 | 4.8 | 3.5 | 3.2 | 2.7 | 2.7 | 2.9 | 2.7 |
| MAX | 5.5 | 4.9 | 3.6 | 3.4 | 2.9 | 2.2 | 2.6 | 2.4 | 2.0 | 2.0 | 1.7 | 1.2 | 1.1 | 3.9 | 18.1 | 18.5 | 9.2 | 6.7 | 7.4 | 6.4 | 6.1 | 6.1 | 7.4 | 5.8 |

**Sockeye**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 3.8 | 5.8 | 4.5 | 1.7 | 2.0 | 1.8 | 2.9 | 1.6 | 2.6 | 0.4 | 0.4 | 0.1 | 0.7 | 0.4 | 21.0 | 22.4 | 11.5 | 3.7 | 2.9 | 2.9 | 1.8 | 1.9 | 0.4 | 2.9 |
| 1993 | 5.0 | 2.8 | 2.9 | 2.7 | 2.0 | 1.8 | 2.7 | 2.7 | 2.2 | 2.2 | 1.7 | 1.6 | 1.9 | 2.9 | 17.0 | 5.1 | 4.7 | 5.4 | 7.0 | 6.1 | 5.5 | 5.7 | 4.3 | 3.9 |
| 1994 | 3.4 | 3.6 | 1.9 | 1.6 | 1.3 | 1.3 | 2.5 | 1.6 | 2.1 | 1.1 | 0.5 | 0.3 | 0.1 | 0.1 | 20.2 | 26.1 | 9.8 | 4.5 | 4.1 | 3.4 | 3.0 | 2.4 | 1.6 | 3.6 |
| 1995 | 1.7 | 1.6 | 2.1 | 2.8 | 3.5 | 3.9 | 4.9 | 5.4 | 4.7 | 4.6 | 2.5 | 2.7 | 3.4 | 5.4 | 14.4 | 5.2 | 3.3 | 3.1 | 4.8 | 5.3 | 4.7 | 5.6 | 2.3 | 2.2 |
| AVG | 3.9 | 2.8 | 2.5 | 2.5 | 2.1 | 2.1 | 3.1 | 2.9 | 2.7 | 2.4 | 1.6 | 1.5 | 1.7 | 2.7 | 17.3 | 10.6 | 5.8 | 4.7 | 5.8 | 5.2 | 4.7 | 4.8 | 3.2 | 3.5 |
| MIN | 1.7 | 1.6 | 1.9 | 1.6 | 1.3 | 1.3 | 2.5 | 1.6 | 2.1 | 0.4 | 0.4 | 0.1 | 0.1 | 0.1 | 14.4 | 5.1 | 3.3 | 3.1 | 2.9 | 2.9 | 1.8 | 1.9 | 0.4 | 2.2 |
| MAX | 5.0 | 5.8 | 4.5 | 2.8 | 3.5 | 3.9 | 4.9 | 5.4 | 4.7 | 4.6 | 2.5 | 2.7 | 3.4 | 5.4 | 21.0 | 26.1 | 11.5 | 5.4 | 7.0 | 6.1 | 5.5 | 5.7 | 4.3 | 3.9 |

**All species combined**

| | 0800 | 0900 | 1000 | 1100 | Noon | 1300 | 1400 | 1500 | 1600 | 1700 | 1800 | 1900 | 2000 | 2100 | 2200 | 2300 | MID | 0100 | 0200 | 0300 | 0400 | 0500 | 0600 | 0700 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1992 | 6.0 | 4.8 | 4.0 | 3.8 | 3.2 | 4.2 | 3.7 | 3.6 | 3.5 | 2.7 | 1.7 | 1.0 | 0.8 | 3.9 | 10.6 | 9.8 | 4.3 | 3.2 | 3.3 | 4.3 | 3.7 | 4.1 | 4.3 | 5.2 |
| 1993 | 4.9 | 3.6 | 3.3 | 2.8 | 2.8 | 2.3 | 2.3 | 2.8 | 2.4 | 2.3 | 1.8 | 3.0 | 4.1 | 5.6 | 9.1 | 6.6 | 4.8 | 5.0 | 4.5 | 4.6 | 4.6 | 5.1 | 6.1 | 5.7 |
| 1994 | 5.7 | 4.8 | 3.6 | 3.0 | 2.7 | 2.9 | 3.7 | 3.8 | 3.2 | 2.1 | 1.6 | 0.9 | 1.5 | 3.2 | 11.1 | 9.7 | 4.3 | 3.5 | 4.3 | 4.5 | 4.0 | 4.8 | 4.5 | 6.8 |
| 1995 | 3.3 | 2.7 | 2.5 | 2.5 | 2.4 | 3.3 | 3.0 | 2.8 | 2.3 | 2.1 | 1.5 | 1.6 | 2.4 | 3.0 | 14.8 | 10.0 | 5.3 | 4.9 | 7.4 | 5.3 | 4.6 | 4.9 | 3.8 | 3.4 |
| AVG | 5.1 | 4.1 | 3.3 | 2.9 | 2.7 | 3.0 | 3.2 | 3.3 | 2.9 | 2.2 | 1.6 | 1.6 | 2.3 | 3.8 | 11.2 | 9.0 | 4.6 | 4.1 | 4.8 | 4.7 | 4.2 | 4.8 | 4.7 | 5.7 |
| MIN | 3.3 | 2.7 | 2.5 | 2.5 | 2.4 | 2.3 | 2.3 | 2.8 | 2.3 | 2.1 | 1.5 | 0.9 | 0.8 | 3.0 | 9.1 | 6.6 | 4.3 | 3.2 | 3.3 | 4.3 | 3.7 | 4.1 | 3.8 | 3.4 |
| MAX | 6.0 | 4.8 | 4.0 | 3.8 | 3.2 | 4.2 | 3.7 | 3.8 | 3.5 | 2.7 | 1.8 | 3.0 | 4.1 | 5.6 | 14.8 | 10.0 | 5.3 | 5.0 | 7.4 | 5.3 | 4.6 | 5.1 | 6.1 | 6.8 |

Table D-4. Descaling and mortality data from Bonneville Dam, PH1, 1988 – 1999.

| | YEARLING CHINOOK | | | | | SUBYEARLING CHINOOK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | SAMPLE | DESC | %DESC | MORT | %MORT | SAMPLE | DESC | %DESC | MORT | %MORT |
| 1988 | 28,958 | 1,265 | 4.4 | 67 | 0.2 | 96,415 | 1,659 | 1.7 | 337 | 0.4 |
| 1989 | 27,934 | 1,164 | 4.2 | 22 | 0.1 | 98,571 | 2,119 | 2.2 | 361 | 0.4 |
| 1990 | 23,821 | 1,675 | 7.0 | 34 | 0.1 | 80,446 | 1,956 | 2.4 | 358 | 0.5 |
| 1991 | 29,409 | 2,741 | 9.3 | 24 | 0.1 | 83,240 | 2,383 | 2.9 | 257 | 0.3 |
| 1992 | 42,523 | 1,952 | 4.6 | 62 | 0.2 | 112,037 | 2,517 | 2.3 | 301 | 0.3 |
| 1993 | 52,623 | 2,050 | 3.9 | 51 | 0.1 | 130,615 | 1,557 | 1.2 | 611 | 0.5 |
| 1994 | 34,361 | 896 | 2.6 | 58 | 0.2 | 125,967 | 999 | 0.8 | 600 | 0.5 |
| 1995 | 19,557 | 1,310 | 6.7 | 27 | 0.1 | 60,356 | 651 | 1.1 | 189 | 0.3 |
| 1996 | 7,246 | 370 | 5.1 | 13 | 0.2 | 27,113 | 254 | 0.9 | 82 | 0.3 |
| 1997 | 5,938 | 239 | 4.0 | 26 | 0.4 | 44,024 | 595 | 1.4 | 192 | 0.4 |
| 1998 | 6,850 | 337 | 4.9 | 20 | 0.3 | 30,835 | 485 | 1.6 | 127 | 0.4 |
| 1999 | 15,279 | 482 | 3.2 | 37 | 0.2 | 35,637 | 339 | 1.0 | 71 | 0.2 |
| **TOTAL** | 294,499 | 14,481 | 4.9 | 441 | 0.2 | 925,256 | 15,514 | 1.7 | 3,486 | 0.4 |

| | WILD STEELHEAD | | | | | HATCHERY STEELHEAD | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | SAMPLE | DESC | %DESC | MORT | %MORT | SAMPLE | DESC | %DESC | MORT | %MORT |
| 1988* | 7,478 | 452 | 6.1 | 18 | 0.2 | | | | | |
| 1989* | 12,240 | 536 | 4.4 | 13 | 0.1 | | | | | |
| 1990 | 3,894 | 232 | 6.0 | 5 | 0.1 | 5,521 | 818 | 14.9 | 25 | 0.5 |
| 1991 | 2,772 | 194 | 7.0 | 0 | 0.0 | 5,502 | 1,036 | 18.8 | 4 | 0.1 |
| 1992 | 2,837 | 194 | 6.8 | 3 | 0.1 | 3,767 | 487 | 12.9 | 2 | 0.1 |
| 1993 | 4,025 | 96 | 2.4 | 2 | 0.0 | 7,456 | 622 | 8.3 | 2 | 0.0 |
| 1994 | 3,730 | 102 | 2.7 | 2 | 0.1 | 3,981 | 290 | 7.3 | 2 | 0.1 |
| 1995 | 1,240 | 32 | 2.6 | 0 | 0.0 | 3,737 | 397 | 10.6 | 5 | 0.1 |
| 1996 | 1,821 | 44 | 2.4 | 1 | 0.1 | 5,075 | 369 | 7.3 | 5 | 0.1 |
| 1997 | 3,615 | 35 | 1.0 | 7 | 0.2 | 9,285 | 635 | 6.8 | 9 | 0.1 |
| 1998 | 2,587 | 56 | 2.2 | 1 | 0.0 | 3,294 | 208 | 6.3 | 5 | 0.2 |
| 1999 | 2,549 | 29 | 1.1 | 4 | 0.2 | 5,647 | 170 | 3.0 | 4 | 0.1 |
| **TOTAL** | 48,788 | 2,002 | 4.1 | 56 | 0.1 | 53,265 | 5,032 | 9.5 | 63 | 0.1 |

| | COHO | | | | | SOCKEYE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DATE | SAMPLE | DESC | %DESC | MORT | %MORT | SAMPLE | DESC | %DESC | MORT | %MORT |
| 1988 | 40,776 | 1,340 | 3.3 | 24 | 0.1 | 4,588 | 1,077 | 23.6 | 28 | 0.6 |
| 1989 | 29,747 | 998 | 3.4 | 5 | 0.0 | 7,723 | 1,319 | 17.1 | 11 | 0.1 |
| 1990 | 43,032 | 2,325 | 5.4 | 30 | 0.1 | 4,537 | 1,710 | 38.1 | 45 | 1.0 |
| 1991 | 23,842 | 1,059 | 4.4 | 5 | 0.0 | 4,462 | 1,205 | 27.1 | 9 | 0.2 |
| 1992 | 23,971 | 1,485 | 6.2 | 24 | 0.1 | 638 | 83 | 13.0 | 0 | 0.0 |
| 1993 | 28,243 | 649 | 2.3 | 6 | 0.0 | 4,939 | 803 | 16.3 | 15 | 0.3 |
| 1994 | 22,378 | 430 | 1.9 | 27 | 0.1 | 2,965 | 322 | 10.9 | 2 | 0.1 |
| 1995 | 11,868 | 258 | 2.2 | 16 | 0.1 | 2,184 | 305 | 14.1 | 15 | 0.7 |
| 1996 | 12,689 | 320 | 2.5 | 8 | 0.1 | 694 | 43 | 6.2 | 4 | 0.6 |
| 1997 | 12,346 | 363 | 2.9 | 15 | 0.1 | 589 | 84 | 14.3 | 1 | 0.2 |
| 1998 | 6,272 | 176 | 2.8 | 2 | 0.0 | 1,737 | 299 | 17.3 | 6 | 0.3 |
| 1999 | 8,411 | 94 | 1.1 | 31 | 0.4 | 2,118 | 155 | 7.4 | 15 | 0.7 |
| **TOTAL** | 263,575 | 9,497 | 3.6 | 193 | 0.1 | 37,174 | 7,405 | 20.0 | 151 | 0.4 |

* Wild and hatchery steelhead numbers are combined for 1988-89.

Table D-5. Descaling and mortality data from Bonneville Dam, PH2, 1988-1998. No condition data was available in 1999 at PH2.

| | YEARLING CHINOOK | | | | | SUBYEARLING CHINOOK | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | SAMPLE | DESC | %DESC | MORT | %MORT | SAMPLE | DESC | %DESC | MORT | %MORT |
| 1988 | 7,076 | 361 | 5.2 | 147 | 2.1 | 9,711 | 185 | 2.0 | 390 | 4.0 |
| 1989 | 15,579 | 671 | 4.4 | 478 | 3.1 | 12,144 | 74 | 0.6 | 176 | 1.5 |
| 1990 | 5,267 | 278 | 5.3 | 36 | 0.7 | 2,669 | 8 | 0.3 | 10 | 0.4 |
| 1991 | 17,943 | 1,780 | 10.0 | 143 | 0.8 | 7,846 | 140 | 1.8 | 39 | 0.5 |
| 1992 | 358 | 36 | 10.2 | 5 | 1.4 | 1,452 | 42 | 2.9 | 6 | 0.4 |
| 1993 | 5,468 | 393 | 7.2 | 36 | 0.7 | 5,545 | 65 | 1.2 | 36 | 0.7 |
| 1994 | 4,172 | 208 | 5.1 | 54 | 1.3 | 5,703 | 80 | 1.4 | 138 | 2.4 |
| 1995 | 2,709 | 180 | 6.7 | 16 | 0.6 | 4,696 | 108 | 2.3 | 31 | 0.7 |
| 1996 | 3,059 | 304 | 10.0 | 16 | 0.5 | 8,662 | 176 | 2.0 | 29 | 0.3 |
| 1997 | 1,311 | 72 | 5.5 | 2 | 0.2 | 7,415 | 138 | 1.9 | 52 | 0.7 |
| 1998 | 3,355 | 146 | 4.4 | 9 | 0.3 | 5,519 | 57 | 1.0 | 24 | 0.4 |
| **TOTAL** | 66,297 | 4,429 | 6.8 | 942 | 1.4 | 71,362 | 1,073 | 1.5 | 931 | 1.3 |

| | WILD STEELHEAD | | | | | HATCHERY STEELHEAD | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | SAMPLE | DESC | %DESC | MORT | %MORT | SAMPLE | DESC | %DESC | MORT | %MORT |
| 1988* | 762 | 43 | 5.7 | 12 | 1.6 | | | | | |
| 1989* | 2,049 | 84 | 4.2 | 31 | 1.5 | | | | | |
| 1990 | 206 | 5 | 2.5 | 4 | 1.9 | 176 | 25 | 15.6 | 16 | 9.1 |
| 1991 | 921 | 88 | 9.6 | 6 | 0.7 | 1,614 | 321 | 20.1 | 17 | 1.1 |
| 1992 | 3 | 0 | 0.0 | 0 | 0.0 | 4 | 0 | 0.0 | 0 | 0.0 |
| 1993 | 255 | 16 | 6.3 | 0 | 0.0 | 462 | 79 | 17.1 | 1 | 0.2 |
| 1994 | 279 | 31 | 11.2 | 1 | 0.4 | 218 | 5 | 2.3 | 2 | 0.9 |
| 1995 | 65 | 4 | 6.3 | 1 | 1.5 | 184 | 35 | 19.1 | 1 | 0.5 |
| 1996 | 182 | 1 | 0.6 | 1 | 0.5 | 531 | 48 | 9.1 | 1 | 0.2 |
| 1997 | 461 | 14 | 3.0 | 0 | 0.0 | 1,596 | 134 | 8.4 | 3 | 0.2 |
| 1998 | 695 | 23 | 3.3 | 2 | 0.3 | 720 | 38 | 5.3 | 2 | 0.3 |
| **TOTAL** | 5,878 | 309 | 5.3 | 58 | 1.0 | 5,505 | 685 | 12.5 | 43 | 0.8 |

| | COHO | | | | | SOCKEYE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | SAMPLE | DESC | %DESC | MORT | %MORT | SAMPLE | DESC | %DESC | MORT | %MORT |
| 1988 | 5,556 | 195 | 3.6 | 61 | 1.1 | 237 | 33 | 16.4 | 36 | 15.2 |
| 1989 | 9,192 | 282 | 3.1 | 207 | 2.3 | 2,247 | 343 | 19.1 | 451 | 20.1 |
| 1990 | 5,498 | 204 | 3.7 | 16 | 0.3 | 137 | 25 | 18.5 | 2 | 1.5 |
| 1991 | 7,284 | 448 | 6.2 | 33 | 0.5 | 2,575 | 761 | 30.3 | 61 | 2.4 |
| 1992 | 119 | 9 | 7.6 | 1 | 0.8 | 1 | 1 | 100.0 | 0 | 0.0 |
| 1993 | 3,621 | 162 | 4.5 | 7 | 0.2 | 623 | 126 | 20.4 | 4 | 0.6 |
| 1994 | 2,678 | 69 | 2.6 | 18 | 0.7 | 400 | 75 | 18.9 | 4 | 1.0 |
| 1995 | 1,075 | 29 | 2.7 | 5 | 0.5 | 348 | 61 | 18.0 | 9 | 2.6 |
| 1996 | 4,296 | 113 | 2.6 | 18 | 0.4 | 196 | 33 | 17.2 | 4 | 2.0 |
| 1997 | 2,169 | 54 | 2.5 | 6 | 0.3 | 520 | 118 | 23.0 | 6 | 1.2 |
| 1998 | 1,303 | 75 | 5.8 | 9 | 0.7 | 711 | 80 | 11.3 | 0 | 0.0 |
| **TOTAL** | 42,791 | 1,640 | 3.9 | 381 | 0.9 | 7,995 | 1,656 | 22.3 | 577 | 7.2 |

* Wild and hatchery steelhead numbers are combined for 1988-89.

Table D-6. Condition subsampling data, expressed as a percent of total, from Bonneville Dam, PH1, 1988-1999.

**Yearling Chinook**

| YEAR | NO. | INJURY | | | DISEASE | | | | BIRD | 3-19% |
|---|---|---|---|---|---|---|---|---|---|---|
| | SMPLD | HEAD | OPERC. | BODY | PAR. | COL. | FUN. | BKD | PRED | DESC |
| 1988 | 1856 | 0.27 | 0.05 | 0.59 | 0.05 | N/A | 0.11 | 0.00 | 0.16 | 4.20 |
| 1989 | 2327 | 0.39 | 0.39 | 1.12 | 0.21 | N/A | 0.34 | 0.17 | 0.43 | 8.04 |
| 1990 | 3111 | 0.10 | 0.13 | 0.84 | 0.13 | N/A | 0.51 | 0.23 | 0.58 | 9.64 |
| 1991 | 2158 | 0.42 | 0.32 | 0.65 | 0.00 | N/A | 0.23 | 0.23 | 0.42 | 5.38 |
| 1992 | 2190 | 0.41 | 0.23 | 0.73 | 0.27 | N/A | 0.37 | 0.87 | 0.50 | 6.39 |
| 1993 | 2934 | 0.00 | 0.65 | 3.03 | 0.55 | N/A | 0.85 | 0.00 | 0.55 | 14.25 |
| 1994 | 4018 | 0.00 | 0.37 | 1.84 | 0.20 | N/A | 0.77 | 0.00 | 1.14 | 9.98 |
| 1995 | 2648 | 1.44 | 1.36 | 4.80 | 0.98 | N/A | 0.87 | 1.13 | 0.98 | 14.31 |
| 1996 | 2305 | 0.52 | 0.56 | 1.52 | 0.22 | 0.00 | 0.48 | 0.43 | 1.13 | 12.75 |
| 1997 | 1591 | 0.19 | 0.44 | 1.19 | 0.06 | 0.00 | 0.31 | 0.13 | 0.94 | 9.99 |
| 1998 | 1687 | 0.41 | 0.24 | 0.65 | 0.18 | 0.00 | 1.01 | 0.24 | 0.95 | 13.04 |
| 1999 | 3429 | 0.55 | 0.82 | 0.73 | 0.17 | 0.00 | 0.93 | 0.90 | 1.84 | 14.09 |

**Subyearling Chinook**

| YEAR | NO. | INJURY | | | DISEASE | | | | BIRD | 3-19% |
|---|---|---|---|---|---|---|---|---|---|---|
| | SMPLD | HEAD | OPERC. | BODY | PAR. | COL. | FUN. | BKD | PRED | DESC |
| 1988 | 3451 | 0.09 | 0.03 | 0.67 | 0.03 | N/A | 0.09 | 0.00 | 0.12 | 2.98 |
| 1989 | 8481 | 0.15 | 0.09 | 1.29 | 0.15 | N/A | 0.05 | 0.12 | 0.04 | 4.55 |
| 1990 | 6929 | 0.10 | 0.14 | 0.64 | 0.16 | N/A | 0.07 | 0.32 | 0.27 | 1.93 |
| 1991 | 4404 | 0.23 | 0.11 | 0.43 | 0.30 | N/A | 0.05 | 0.52 | 0.09 | 2.45 |
| 1992 | 4422 | 0.09 | 0.25 | 0.34 | 0.41 | N/A | 0.05 | 0.79 | 0.47 | 3.55 |
| 1993 | 8343 | 0.00 | 0.36 | 3.12 | 0.31 | N/A | 0.08 | 0.00 | 0.11 | 7.76 |
| 1994 | 7149 | 0.00 | 0.29 | 0.92 | 0.10 | N/A | 0.10 | 0.00 | 0.08 | 4.00 |
| 1995 | 5230 | 0.33 | 0.44 | 1.97 | 0.23 | N/A | 0.13 | 0.17 | 0.13 | 5.35 |
| 1996 | 4080 | 0.32 | 0.47 | 0.69 | 0.12 | 0.00 | 0.17 | 0.05 | 0.22 | 4.56 |
| 1997 | 4893 | 0.25 | 0.49 | 0.76 | 0.25 | 0.02 | 0.16 | 0.14 | 0.16 | 5.89 |
| 1998 | 3324 | 0.33 | 0.48 | 1.08 | 0.30 | 0.00 | 0.39 | 0.15 | 0.21 | 8.33 |
| 1999 | 4513 | 0.22 | 0.55 | 0.69 | 0.02 | 0.00 | 0.20 | 0.00 | 0.24 | 6.16 |

**Wild Steelhead**

| YEAR | NO. | INJURY | | | DISEASE | | | | BIRD | 3-19% |
|---|---|---|---|---|---|---|---|---|---|---|
| | SMPLD | HEAD | OPERC. | BODY | PAR. | COL. | FUN. | BKD | PRED | DESC |
| 1988 | 2148 | 0.09 | 0.05 | 0.28 | 0.05 | N/A | 0.61 | 0.00 | 0.05 | 3.17 |
| 1989 | 2626 | 0.42 | 0.23 | 0.42 | 0.19 | N/A | 0.30 | 0.00 | 0.19 | 6.28 |
| 1990 | 3468 | 0.09 | 0.09 | 0.43 | 0.09 | N/A | 0.40 | 0.06 | 0.46 | 7.73 |
| 1991 | 1967 | 0.20 | 0.20 | 0.36 | 0.20 | N/A | 0.15 | 0.10 | 0.31 | 1.83 |
| 1992 | 1883 | 0.27 | 0.37 | 0.32 | 0.16 | N/A | 0.64 | 0.00 | 0.32 | 5.47 |
| 1993 | 2227 | 0.00 | 0.45 | 1.93 | 0.27 | N/A | 0.90 | 0.00 | 0.31 | 5.34 |
| 1994 | 2725 | 0.00 | 0.22 | 1.10 | 0.11 | N/A | 1.10 | 0.00 | 0.33 | 6.68 |
| 1995 | 2574 | 0.62 | 0.35 | 3.11 | 0.85 | N/A | 1.09 | 0.12 | 0.47 | 7.58 |
| 1996 | 2720 | 0.18 | 0.18 | 0.55 | 0.18 | 0.11 | 0.37 | 0.04 | 1.03 | 10.22 |
| 1997 | 2347 | 0.30 | 0.09 | 0.60 | 0.09 | 0.00 | 0.30 | 0.04 | 0.55 | 7.93 |
| 1998 | 768 | 0.65 | 0.52 | 0.91 | 4.56 | 0.00 | 0.39 | 0.00 | 1.95 | 10.94 |
| 1999 | 1067 | 0.28 | 0.47 | 0.47 | 9.75 | 0.00 | 0.84 | 0.00 | 1.78 | 9.37 |

**Hatchery Steelhead**

| YEAR | NO. | INJURY | | | DISEASE | | | | BIRD | 3-19% |
|---|---|---|---|---|---|---|---|---|---|---|
| | SMPLD | HEAD | OPERC. | BODY | PAR. | COL. | FUN. | BKD | PRED | DESC |
| 1988 | | | | | | | | | | |
| 1989 | | | | | | | | | | |
| 1990 | 1042 | 0.38 | 0.19 | 1.44 | 4.03 | N/A | 1.25 | 0.00 | 2.11 | 10.08 |
| 1991 | 706 | 0.85 | 0.71 | 1.56 | 8.22 | N/A | 0.71 | 0.00 | 1.56 | 2.55 |
| 1992 | 590 | 0.17 | 0.17 | 0.68 | 5.59 | N/A | 0.34 | 0.00 | 2.20 | 5.59 |
| 1993 | 1250 | 0.00 | 0.24 | 1.60 | 6.64 | N/A | 0.72 | 0.00 | 5.84 | 6.56 |
| 1994 | 1429 | 0.00 | 0.49 | 2.59 | 8.33 | N/A | 0.49 | 0.00 | 2.80 | 9.24 |
| 1995 | 419 | 1.67 | 1.19 | 2.86 | 19.33 | N/A | 0.24 | 0.00 | 3.10 | 9.79 |
| 1996 | 789 | 0.25 | 0.63 | 0.38 | 8.11 | 0.00 | 0.25 | 0.00 | 1.52 | 9.00 |
| 1997 | 1306 | 0.61 | 0.77 | 1.23 | 4.59 | 0.00 | 0.23 | 0.00 | 2.07 | 6.89 |
| 1998 | 1011 | 0.69 | 2.77 | 2.08 | 0.30 | 0.00 | 1.58 | 0.00 | 7.52 | 25.32 |
| 1999 | 2158 | 0.32 | 3.06 | 0.93 | 0.42 | 0.00 | 1.02 | 0.00 | 5.70 | 19.32 |

**Coho**

| YEAR | NO. | INJURY | | | DISEASE | | | | BIRD | 3-19% |
|---|---|---|---|---|---|---|---|---|---|---|
| | SMPLD | HEAD | OPERC. | BODY | PAR. | COL. | FUN. | BKD | PRED | DESC |
| 1988 | 1403 | 0.78 | 0.29 | 0.78 | 1.50 | 0.50 | 0.00 | 0.00 | 3.85 | 7.48 |
| 1989 | 2319 | 0.43 | 0.73 | 1.21 | 3.32 | N/A | 1.03 | 0.04 | 2.50 | 10.48 |
| 1990 | 1366 | 0.88 | 0.73 | 1.46 | 0.15 | N/A | 3.07 | 0.00 | 6.15 | 21.52 |
| 1991 | 1024 | 0.29 | 4.39 | 0.88 | 0.20 | N/A | 0.78 | 0.20 | 3.81 | 9.67 |
| 1992 | 735 | 0.41 | 2.99 | 1.09 | 0.41 | N/A | 1.22 | 0.00 | 4.76 | 11.02 |
| 1993 | 1669 | 0.00 | 1.86 | 3.18 | 2.22 | N/A | 1.44 | 0.00 | 0.00 | 16.12 |
| 1994 | 1595 | 0.00 | 3.13 | 3.64 | 0.94 | N/A | 0.56 | 0.00 | 8.40 | 21.63 |
| 1995 | 1278 | 1.88 | 3.36 | 5.71 | 2.11 | N/A | 3.05 | 0.08 | 8.29 | 25.67 |
| 1996 | 1789 | 0.28 | 3.47 | 2.12 | 0.11 | 0.00 | 0.78 | 0.06 | 10.01 | 27.56 |
| 1997 | 1978 | 0.01 | 0.03 | 0.02 | 0.05 | 0.15 | 0.40 | 0.00 | 6.77 | 25.28 |
| 1998 | 1960 | 0.41 | 0.31 | 0.36 | 0.15 | 0.00 | 1.12 | 0.05 | 0.36 | 7.60 |
| 1999 | 2643 | 0.30 | 0.38 | 0.19 | 0.15 | 0.00 | 3.67 | 0.08 | 0.72 | 6.36 |

**Sockeye**

| YEAR | NO. | INJURY | | | DISEASE | | | | BIRD | 3-19% |
|---|---|---|---|---|---|---|---|---|---|---|
| | SMPLD | HEAD | OPERC. | BODY | PAR. | COL. | FUN. | BKD | PRED | DESC |
| 1988 | 686 | 0.00 | 0.00 | 0.00 | 0.00 | N/A | 0.00 | 0.00 | 0.00 | 9.62 |
| 1989 | 1397 | 0.50 | 0.50 | 0.36 | 0.00 | N/A | 0.07 | 0.07 | 0.07 | 16.11 |
| 1990 | 1425 | 1.26 | 0.77 | 0.49 | 0.07 | N/A | 0.14 | 0.07 | 0.14 | 14.88 |
| 1991 | 621 | 0.97 | 2.25 | 0.81 | 0.00 | N/A | 0.32 | 0.00 | 0.32 | 11.27 |
| 1992 | 131 | 0.76 | 2.29 | 0.76 | 0.00 | N/A | 0.00 | 0.00 | 0.00 | 17.56 |
| 1993 | 940 | 0.11 | 2.34 | 3.09 | 0.32 | N/A | 0.43 | 0.00 | 0.21 | 23.83 |
| 1994 | 1047 | 0.00 | 1.91 | 1.43 | 0.00 | N/A | 0.29 | 0.00 | 0.19 | 26.65 |
| 1995 | 829 | 0.97 | 2.41 | 1.09 | 0.00 | N/A | 0.72 | 0.00 | 0.24 | 23.88 |
| 1996 | 307 | 0.00 | 1.30 | 1.63 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 13.36 |
| 1997 | 215 | 1.40 | 2.79 | 0.47 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 25.58 |
| 1998 | 595 | 2.02 | 2.86 | 0.34 | 0.00 | 0.00 | 1.18 | 0.00 | 0.00 | 26.55 |
| 1999 | 869 | 1.61 | 3.45 | 0.35 | 0.00 | 0.00 | 0.35 | 0.00 | 0.12 | 31.42 |

Table D-7. Numbers of PIT tagged fish detected at Bonneville Dam, 1992-1999.

| Species | Run | Rearing Type | 1992 | 1993 | 1994 | 1995 | 1996* | 1997^ | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|
| Chinook | Spring | Hatchery | 1 | 70 | 48 | 38 | 831 | 2,323 | 7,563 | 25,971 |
| | | Wild | 1 | 13 | 5 | 13 | 60 | 127 | 832 | 12,860 |
| | | Unknown | 4 | | | | | | | |
| | Summer | Hatchery | | 6 | 6 | 9 | 273 | 1,199 | 2,364 | 3,205 |
| | | Wild | | 1 | 2 | 5 | 43 | 75 | 604 | 2,114 |
| | | Unknown | | | | | | | 1 | |
| | Fall | Hatchery | | 1 | | 20 | 140 | 1,608 | 5,024 | 3,934 |
| | | Wild | | 2 | 3 | 2 | 2 | 117 | 79 | 230 |
| | | Unknown | 2 | | | | | 7,127 | 3,891 | 24,167 |
| | Unknown | Hatchery | 4 | 15 | 7 | 131 | 1,057 | 161 | 5,018 | 14,124 |
| | | Wild | | 6 | 2 | 60 | 180 | 2 | 1,033 | 2,846 |
| | | Unknown | 5 | 9 | 4 | 2 | 223 | 78 | 1,883 | 3,102 |
| Chinook Total | | | 17 | 123 | 77 | 280 | 2,809 | 12,817 | 28,292 | 92,553 |
| Steelhead | Spring | Hatchery | | | | | 18 | | | 1 |
| | | Wild | | | | | | | | 188 |
| | Summer | Hatchery | | 16 | 19 | 46 | 1,454 | 7,242 | 4,747 | 28,118 |
| | | Wild | | 5 | 4 | 3 | 200 | 423 | 1,482 | 3,136 |
| | | Unknown | | 1 | | | 2 | 8 | 5 | 1 |
| | Unknown | Hatchery | | | | | | | 9 | |
| Steelhead Total | | | 0 | 22 | 23 | 49 | 1,674 | 7,673 | 6,243 | 31,444 |
| Coho | Spring | Hatchery | | | | | | 102 | | 1 |
| | | Unknown | | | | | | | | 5,040 |
| | Summer | Unknown | | | | | | | 1 | |
| | Fall | Hatchery | | | | | 13 | 76 | 269 | 1,333 |
| | | Unknown | | | | | | | 68 | 246 |
| | Unknown | Hatchery | | | | | | | 117 | 2 |
| | | Unknown | | | | | | 4,789 | 7,796 | |
| Coho Total | | | | | | | 13 | 4,967 | 8,251 | 6,622 |
| Sockeye | Spring | Hatchery | | 6 | | | | | | |
| | Summer | Hatchery | | | | | 11 | 5 | 161 | 101 |
| | | Wild | | | | | 2 | 1 | 12 | 10 |
| | Unknown | Hatchery | 2 | | 1 | | 23 | 11 | 12 | 20 |
| | | Wild | | 4 | 4 | 1 | 16 | 33 | 158 | 248 |
| | | Unknown | | | | | | | 2 | |
| Sockeye Total | | | 2 | 10 | 5 | 1 | 52 | 50 | 345 | 379 |
| TOTALS (all detections combined) = | | | **25** | **155** | **105** | **330** | **4,548** | **25,507** | **43,131** | **130,998** |

* PH1 flat plate detections added.

^ PH2 full bypass detections added.

Table D-8. External mark recaptures at Bonneville Dam, 1988-1999.

| Year | Yearling Chinook | Subyearling Chinook | Wild Steelhead[1] | Hatchery Steelhead | Coho | Sockeye | Total |
|---|---|---|---|---|---|---|---|
| **Brands** | | | | | | | |
| 1988 | 425 | 165 | | 157 | 2 | 55 | 804 |
| 1989 | 521 | 364 | | 443 | | 16 | 1,344 |
| 1990 | 286 | 189 | | 218 | | 6 | 699 |
| 1991 | 258 | 235 | | 204 | 2 | 48 | 747 |
| 1992 | 220 | 212 | 18 | 40 | | | 490 |
| 1993 | 349 | 360 | 6 | 57 | | 19 | 791 |
| 1994 | 55 | 187 | | 27 | | | 269 |
| 1995 | 181 | 147 | | 77 | | | 405 |
| 1996[2] | 91 | 56 | | 63 | 1 | | 211 |
| 1997[2] | | | | 32 | | | 32 |
| 1998[2] | | | | 8 | | | 8 |
| 1999 | | | | 1 | | | 1 |
| **Elastomer** | | | | | | | |
| 1997[2] | 230 | | | 181 | | | 352 |
| 1998[2] | 96 | | | 165 | | | 219 |
| 1999 | 156 | | | 29 | | | 185 |

1. Wild and hatchery steelhead were not differentiated before 1992.
2. Includes data from PH1 and PH2.

Table D-9. Adult salmonid fallbacks captured at PH1, Bonneville Dam, 1988-1999.

| Year | Chinook | Steelhead | Coho | Sockeye | Total |
|---|---|---|---|---|---|
| 1988 | 1 | 1 | | | 2 |
| 1989 | 4 | 1 | 1 | 1 | 7 |
| 1990 | 1 | | | | 1 |
| 1991 | 3 | 5 | | 7 | 15 |
| 1992 | 1 | | | | 1 |
| 1993 | 4 | | | | 4 |
| 1994 | 2 | 1 | | | 3 |
| 1995 | 1 | 6 | | | 7 |
| 1996 | 1 | 3 | | 1 | 5 |
| 1997 | | 1 | | 1 | 2 |
| 1998 | | | | | 0 |
| 1999 | | | | | 0 |

Table D-10. Collection numbers for the most numerous incidental species sampled at PH1, Bonneville Dam, 1988 - 1999.

| Year | American Shad | | Pacific Lamprey | | Stickleback | Peamouth | Northern Squawfish | Redside Shiner | S-Mouth Bass | Sculpin Species | Mountain Whitefish |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Juvenile | Adult | Juvenile | Adult | | | | | | | |
| 1988 | 2,361 | 17 | 204 | 37 | 1,017 | 754 | 243 | 264 | 228 | 177 | 33 |
| 1989 | 435,653 | 39 | 34,756 | 63 | 2,473 | 1,413 | 698 | 384 | 5 | 193 | 34 |
| 1990 | 2,939,363 | 0 | 1,909 | 0 | 4,527 | 224 | 520 | 56 | 88 | 47 | 58 |
| 1991 | 1,454,524 | 8 | 4,567 | 4 | 1,862 | 849 | 889 | 224 | 31 | 12 | 121 |
| 1992 | 4,479,820 | 46 | 531 | 86 | 6,581 | 1,053 | 672 | 67 | 162 | 136 | 41 |
| 1993 | 288,463 | 148 | 6,269 | 78 | 6,583 | 1,603 | 264 | 377 | 251 | 268 | 75 |
| 1994 | 252,474 | 85 | 1,074 | 47 | 78,799 | 4,669 | 311 | 269 | 122 | 56 | 65 |
| 1995 | 414,487 | 1,130 | 4,335 | 213 | 5,931 | 2,227 | 979 | 677 | 567 | 233 | 665 |
| 1996 | 318,190 | 104 | 146 | 60 | 88 | 823 | 21 | 259 | 59 | 60 | 73 |
| 1997 | 437,715 | 1,097 | 945 | 48 | 175 | 1,175 | 50 | 128 | 805 | 87 | 113 |
| 1998 | 820,864 | 64 | 464 | 26 | 81 | 899 | 124 | 39 | 52 | 4 | 84 |
| 1999 | 187,300 | 75 | 189 | 23 | 91 | 385 | 47 | 85 | 43 | 21 | 10 |

Note: All values are based on 8 hour samples except for the years 1992-1995, which are based on 24 hour sample numbers.

Table D-11. Sample and collection numbers of chinook and coho fry at Bonneville Dam, PH1, 1992-1999.

| YEAR | # of sample hours/day | ~~Chinook~~ | | ~~Coho~~ | |
|---|---|---|---|---|---|
| | | Sampled | Collected | Sampled | Collected |
| 1992 | 24 | 2,742 | 15,165 | | |
| 1993 | 24 | 5,659 | 61,457 | | |
| 1994 | 24 | 1,538 | 14,731 | 72 | 459 |
| 1995 | 24 | 1,917 | 30,440 | 156 | 1,389 |
| 1996 | 8 | 79 | 647 | 9 | 97 |
| 1997 | 8 | 459 | 3,761 | 13 | 105 |
| 1998 | 8 | 510 | 8,116 | 28 | 452 |
| 1999 | 8 | 154 | 1,451 | 10 | 64 |

Table D-12. Summary of smolt monitoring at Bonneville Dam, PH1, 1986-1999.

| | | | | | Yearling Chinook | | | | | Subyearling Chinook | | | | | Coho | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Collection | | Index | | | Collection | | Index | | | Collection | | Index | |
| Year | Dates | Sampling Effort | Sub-Sampling | Sample Rate | Sample # | Hourly | Daily | Hourly | Daily | Sample # | Hourly | Daily | Hourly | Daily | Sample # | Hourly | Daily | Hourly | Daily |
| 1986 | 5/12-11/26 | 8hr, 5 d/wk | YES | - | 9,495 | NA | 48,282 | NA | NA | 23,252 | NA | 86,220 | NA | NA | 11,538 | NA | 54,181 | NA | NA |
| 1987 | 3/13-11/20 | 8hr, 5 d/wk | YES | - | 28,828 | NA | 120,108 | NA | NA | 61,925 | NA | 371,000 | NA | NA | 23,188 | NA | 102,228 | NA | NA |
| 1988 | 3/15-11/30 | 8hr/day | YES | - | 26,955 | NA | 301,479 | NA | 365,812 | 96,413 | NA | 580,644 | NA | 724,102 | 40,750 | NA | 419,286 | NA | 599,194 |
| 1989 | 3/15-11/30 | 8hr/day | YES | .1-.25 | 27,935 | NA | 223,134 | NA | 435,455 | 98,521 | NA | 1,332,736 | NA | 1,756,794 | 29,746 | NA | 257,244 | NA | 491,618 |
| 1990 | 3/12-11/30 | 8hr/day | YES | 1.67-.2 | 23,843 | NA | 196,216 | NA | 332,792 | 80,422 | NA | 658,702 | NA | 1,219,778 | 43,030 | NA | 365,826 | NA | 677,413 |
| 1991 | 3/15-11/30 | 8hr/day | YES | 1.67-.2 | 29,374 | NA | 242,016 | NA | 609,411 | 83,189 | NA | 604,368 | NA | 1,257,388 | 23,842 | NA | 216,330 | NA | 575,098 |
| 1992 | 3/13-11/20 | 24hr/day | YES | 1.67-.2 | 42,523 | NA | 284,983 | 799,800 | 723,655 | 112,037 | NA | 882,211 | 2,433,053 | 2,320,423 | 23,971 | NA | 140,403 | 471,205 | 388,809 |
| 1993 | 3/17-11/24 | 24hr/day | YES | 1.67-.2 | 52,623 | 707,748 | 715,905 | 2,255,149 | 2,168,019 | 130,615 | 1,190,261 | 1,181,615 | 4,872,526 | 4,339,394 | 28,243 | 421,432 | 392,627 | 1,596,578 | 1,250,698 |
| 1994 | 3/10-10/31 | 24hr/day | YES | 1.67-.2 | 34,362 | 242,624 | 248,741 | 789,593 | 779,713 | 125,967 | 1,361,893 | 1,360,832 | 3,810,943 | 3,607,383 | 22,378 | 205,520 | 201,310 | 699,119 | 626,443 |
| 1995 | 3/11-10/31 | 24hr/day | YES | 1.67-.2 | 19,557 | 496,882 | 500,804 | 1,784,311 | 1,776,344 | 60,356 | 1,001,033 | 994,015 | 3,936,028 | 3,406,412 | 11,868 | 303,527 | 301,950 | 1,159,892 | 1,104,471 |
| 1996 | 3/11-10/31 | 8hr/day | YES | 1.67-.2 | 7,825 | 82,434 | 77,780 | 470,119 | 360,961 | 29,556 | 350,426 | 432,364 | 1,921,906 | 1,593,073 | 13,076 | 158,438 | 156,957 | 863,827 | 675,605 |
| 1997 | 3/17-10/30 | 8hr/day | YES | 1.67-.2 | 5,938 | 56,896 | 56,891 | 279,280 | 286,666 | 44,024 | 342,207 | 342,192 | 1,509,895 | 1,501,962 | 12,346 | 128,034 | 128,031 | 681,513 | 706,780 |
| 1998 | 3/9-10/31 | 8hr/day | YES | .0833-.25 | 6,850 | 97,577 | 97,581 | 381,879 | 346,281 | 30,835 | 450,646 | 450,650 | 1,875,090 | 1,591,883 | 6,272 | 121,695 | 121,695 | 582,096 | 513,643 |
| 1999 | 3/13-10/31 | 8hr/day | YES | .0833-.25 | 15,279 | NA | 165,918 | NA | 638,606 | 35,637 | NA | 474,874 | NA | 1,692,665 | 8,411 | NA | 98,370 | NA | 375,644 |

| | Wild Steelhead | | | | Hatchery Steelhead | | | | | Sockeye | | | | | Total | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Collection | | Index | | | Collection | | Index | | | Collection | | Index | | | Collection | | Index | |
| Sample # | Hourly | Daily | Hourly | Daily | Sample # | Hourly | Daily | Hourly | Daily | Sample # | Hourly | Daily | Hourly | Daily | Sample # | Hourly | Daily | Hourly | Daily |
| * | NA | * | NA | NA | 3,753 | NA | 19,181 | NA | NA | 2,883 | NA | 14,350 | NA | NA | 50,921 | NA | 222,214 | NA | NA |
| * | NA | * | NA | NA | 8,760 | NA | 38,306 | NA | NA | 4,079 | NA | 18,733 | NA | NA | 126,780 | NA | 650,375 | NA | NA |
| * | NA | * | NA | * | 7,473 | NA | 75,662 | NA | 103,701 | 4,587 | NA | 52,023 | NA | 77,921 | 176,178 | NA | 1,429,094 | NA | 1,870,730 |
| * | NA | * | NA | * | 12,240 | NA | 106,787 | NA | 206,226 | 7,723 | NA | 72,962 | NA | 138,310 | 176,165 | NA | 1,992,863 | NA | 3,028,403 |
| 3,894 | NA | 36,812 | NA | 62,826 | 5,525 | NA | 64,400 | NA | 65,056 | 4,537 | NA | 42,633 | NA | 81,403 | 161,251 | NA | 1,364,589 | NA | 2,439,268 |
| 2,775 | NA | 26,295 | NA | 74,438 | 5,504 | NA | 54,528 | NA | 155,754 | 4,462 | NA | 47,722 | NA | 147,174 | 149,146 | NA | 1,191,259 | NA | 2,819,263 |
| 2,837 | NA | 16,503 | 60,823 | 46,098 | 3,767 | NA | 21,915 | 81,871 | 62,486 | 638 | NA | 3,872 | 13,196 | 10,835 | 185,773 | NA | 1,349,887 | 3,859,948 | 3,552,306 |
| 4,025 | 77,143 | 74,138 | 258,236 | 226,120 | 7,456 | 190,608 | 185,240 | 618,692 | 563,884 | 4,939 | 184,129 | 178,245 | 575,586 | 538,837 | 227,901 | 2,771,321 | 2,727,770 | 10,176,767 | 9,086,952 |
| 3,730 | 29,422 | 29,796 | 99,490 | 93,520 | 3,981 | 33,233 | 33,827 | 112,506 | 105,693 | 2,965 | 29,845 | 27,945 | 106,584 | 87,146 | 193,383 | 1,902,537 | 1,902,451 | 5,618,235 | 5,299,898 |
| 1,240 | 30,225 | 29,963 | 111,694 | 106,889 | 3,737 | 102,933 | 103,508 | 394,457 | 376,571 | 2,184 | 67,625 | 71,990 | 256,946 | 263,680 | 98,942 | 2,002,225 | 2,002,230 | 7,643,328 | 7,034,367 |
| 1,885 | 22,003 | 22,787 | 121,996 | 101,655 | 5,083 | 58,033 | 58,825 | 314,846 | 254,448 | 703 | 7,271 | 7,239 | 37,409 | 28,513 | 58,128 | 678,605 | 755,952 | 3,730,103 | 3,014,255 |
| 3,615 | 38,830 | 38,829 | 200,764 | 205,873 | 9,285 | 105,517 | 105,516 | 557,832 | 575,077 | 589 | 5,774 | 5,765 | 30,107 | 31,099 | 75,797 | 677,258 | 677,224 | 3,259,391 | 3,307,458 |
| 2,587 | 40,862 | 40,862 | 187,255 | 159,916 | 3,294 | 57,078 | 57,078 | 276,543 | 237,299 | 1,737 | 26,963 | 26,963 | 143,403 | 114,564 | 51,575 | 794,821 | 794,829 | 3,446,265 | 2,963,585 |
| 2549 | NA | 94,322 | NA | 108,164 | 5,647 | NA | 65,488 | NA | 65,488 | 2,118 | NA | 33,100 | NA | 118,203 | 69,641 | NA | 866,584 | NA | 3,176,429 |

*Wild and hatchery steelhead were not differentiated prior to 1990.

Table D-13. Summary of smolt monitoring sample numbers at Bonneville Dam, PH2, 1986-1998.

| Year | Season Dates | Sampling Hours/Frequency | Sample Rate ^ | **Chinook** Yearling | **Chinook** Subyearling | **Steelhead** Wild | **Steelhead** Hatchery | **Coho** | **Sockeye** | **Total Sample** |
|---|---|---|---|---|---|---|---|---|---|---|
| 1986 | 3/4-11/25 | 24 / daily | 0.1 | 10,917 | 16,844 | * | 1,494 | 6,112 | 2,599 | 37,966 |
| 1987 | 3/10-11/20 | 24 / 4 days/wk | 0.1 | 6,461 | 5,438 | * | 823 | 3,940 | 642 | 17,304 |
| 1988 | 3/17-11/30 | 24 / daily | 0.1 | 7,068 | 9,744 | * | 762 | 5,555 | 238 | 23,367 |
| 1989 | 3/17-11/30 | 24 / daily | 0.1 | 15,579 | 12,197 | * | 2,049 | 9,192 | 2,247 | 41,264 |
| 1990 | 3/12-11/30 | 24 / daily | 0.1 | 5,463 | 20,469 | 238 | 205 | 6,300 | 164 | 32,839 |
| 1991 | 3/15-11/30 | 24 / daily | 0.1 | 18,372 | 19,050 | 952 | 1,630 | 8,070 | 2,592 | 50,666 |
| 1992 | 3/13-11/20 | up to 7 / MWF | 0.1 | 358 | 1,461 | 3 | 4 | 119 | 1 | 1,946 |
| 1993 | 3/17-11/24 | up to 24 / MWF | 0.1 | 5,468 | 5,545 | 255 | 462 | 3,621 | 624 | 15,975 |
| 1994 | 3/10-10/31 | up to 24 / MWF | 0.1 | 4,172 | 5,703 | 218 | 279 | 2,678 | 400 | 13,450 |
| 1995 | 3/11-10/31 | up to 24 / MWF | 0.1 | 2,709 | 4,696 | 65 | 183 | 1,075 | 355 | 9,083 |
| 1996 | 3/13-9/13 | up to 24 / MWF | 0.1 | 3,059 | 8,662 | 182 | 531 | 4,296 | 196 | 16,926 |
| 1997 | 4/27-9/5 | up to 24 / MWF | 1 | 1,311 | 7,415 | 461 | 1,596 | 2,169 | 520 | 13,472 |
| 1998 | 4/1-10/2 | up to 24 / MWF | 1 | 3355 | 5519 | 696 | 720 | 1303 | 711 | 12,304 |

^ Refers to sample rate during sample period, not entire day.

*Wild and hatchery steelhead were not differentiated prior to 1990.

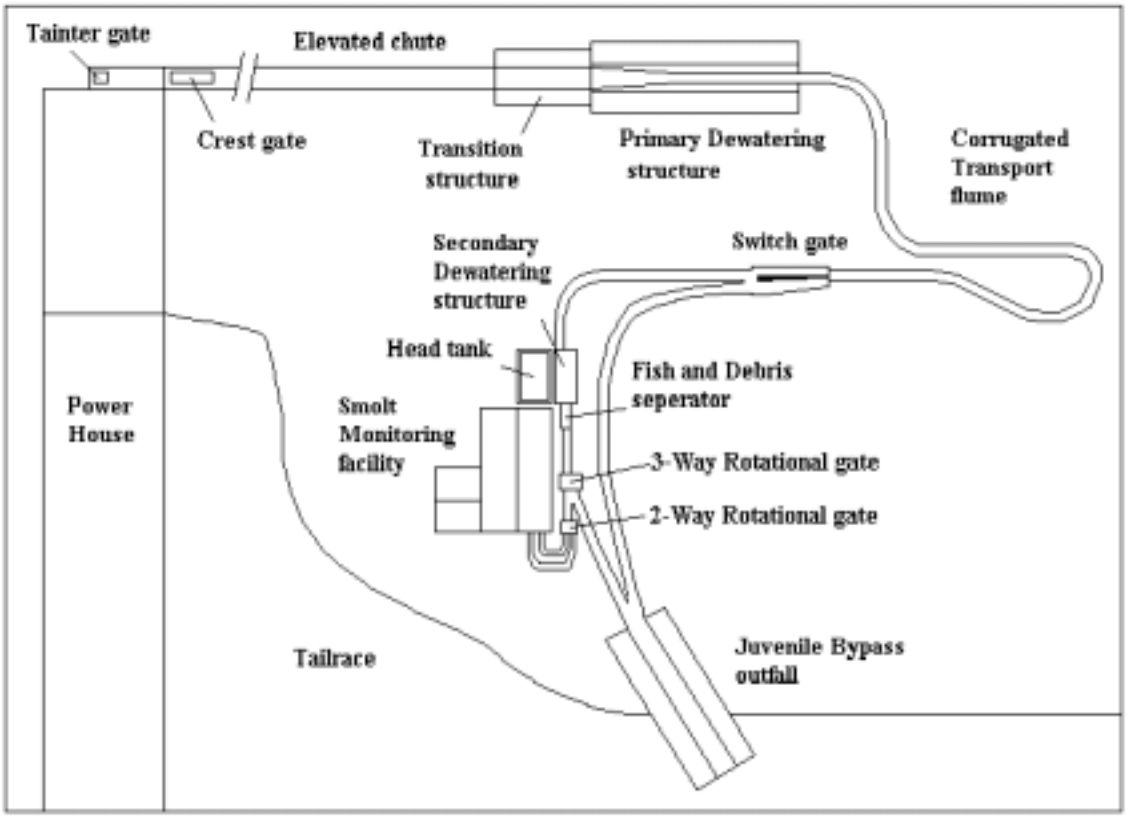


Figure E-1. Diagram of the Smolt Monitoring Facility at John Day Dam, 1998-1999.

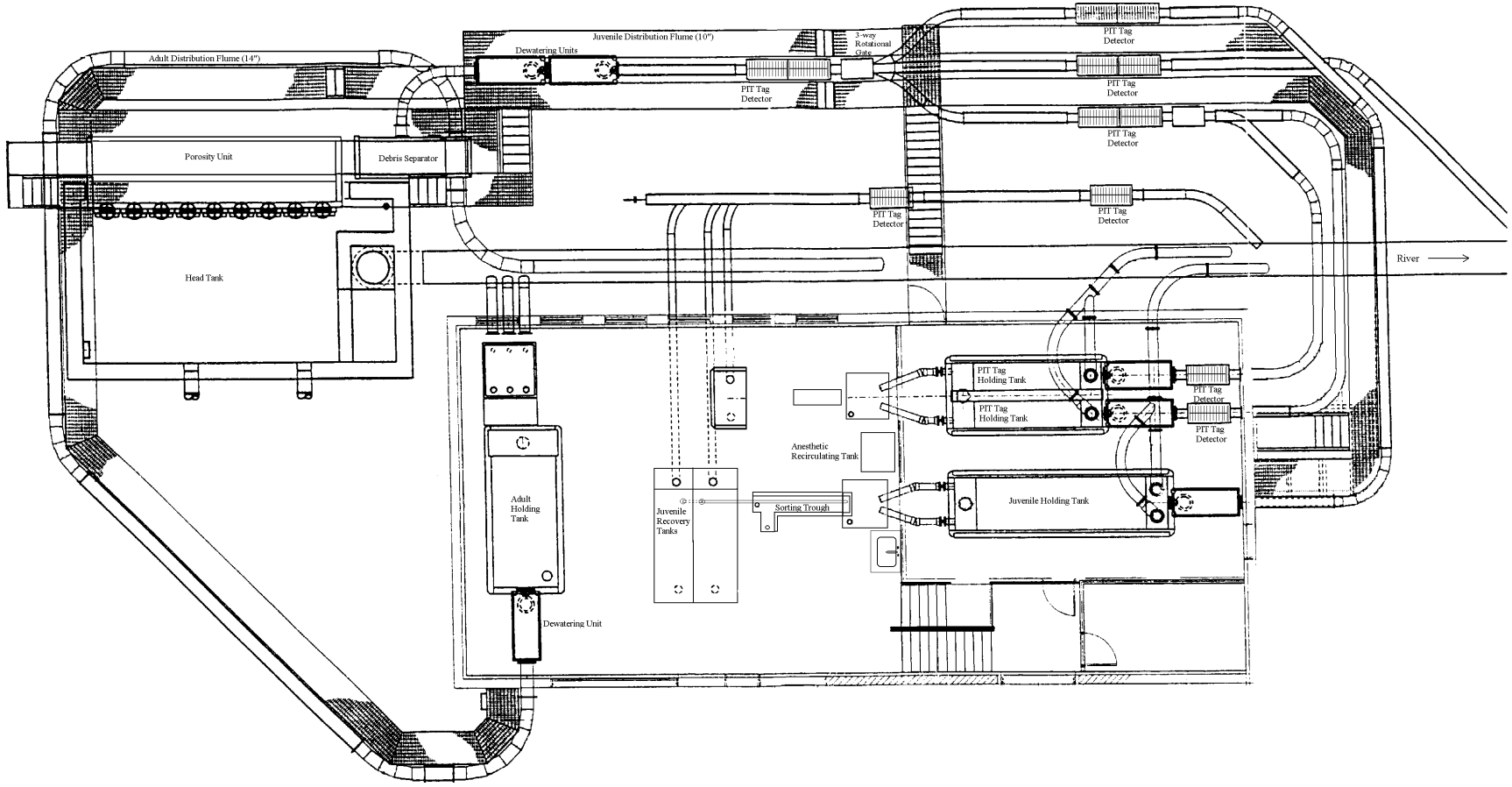


Figure E-2. Smolt Monitoring Facility at John Day Dam, 1999.

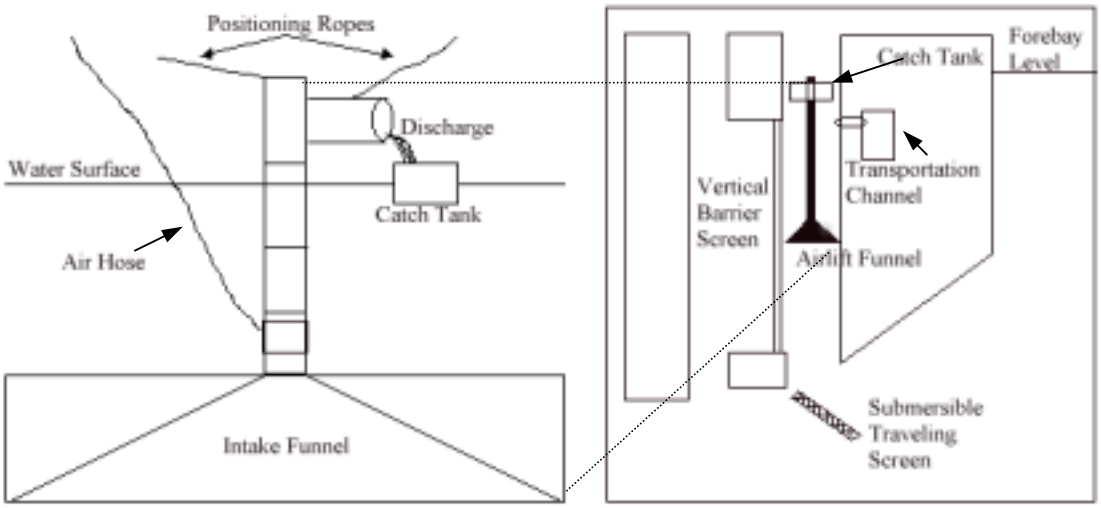


Figure E-3. Airlift sampling system at John Day Dam, 1985-1997.

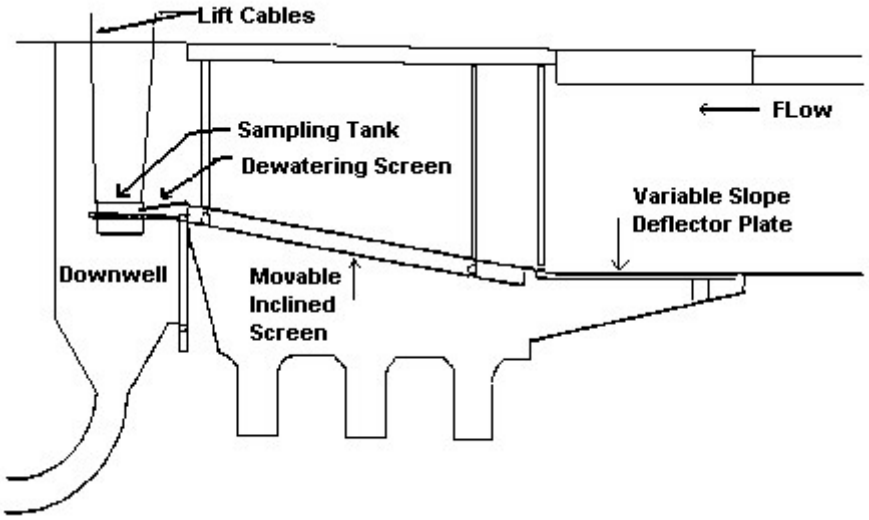


Figure E-4. Inclined screen sampling system in the bypass channel of the first powerhouse at Bonneville Dam.

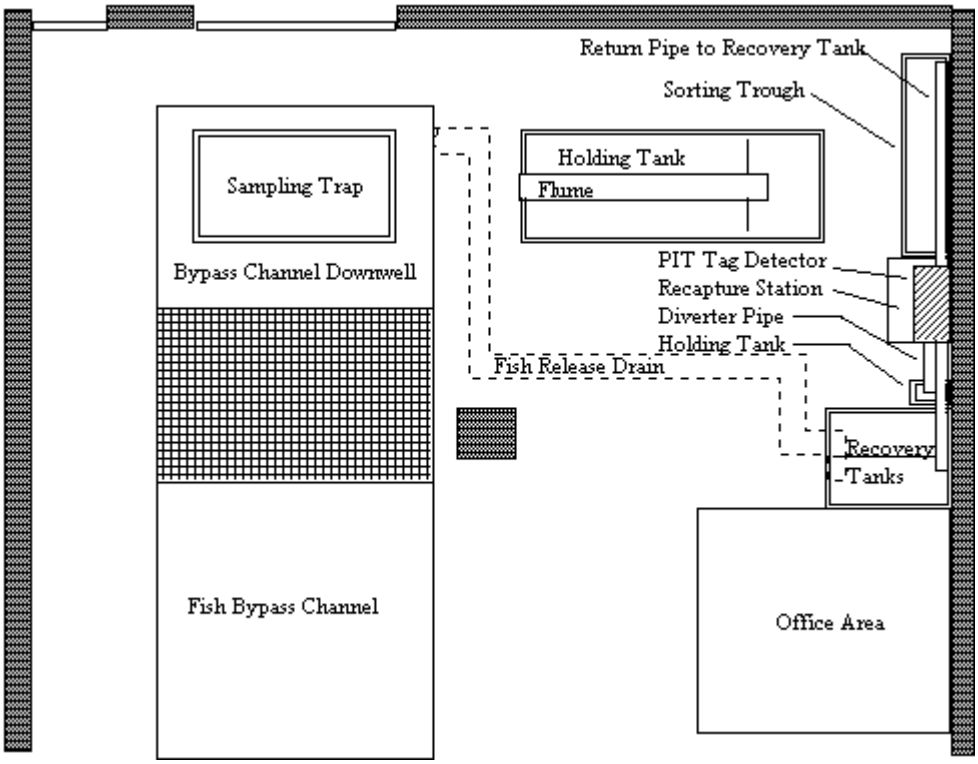


Figure E-5. Smolt monitoring system at Bonneville Dam, PH1, 1999.

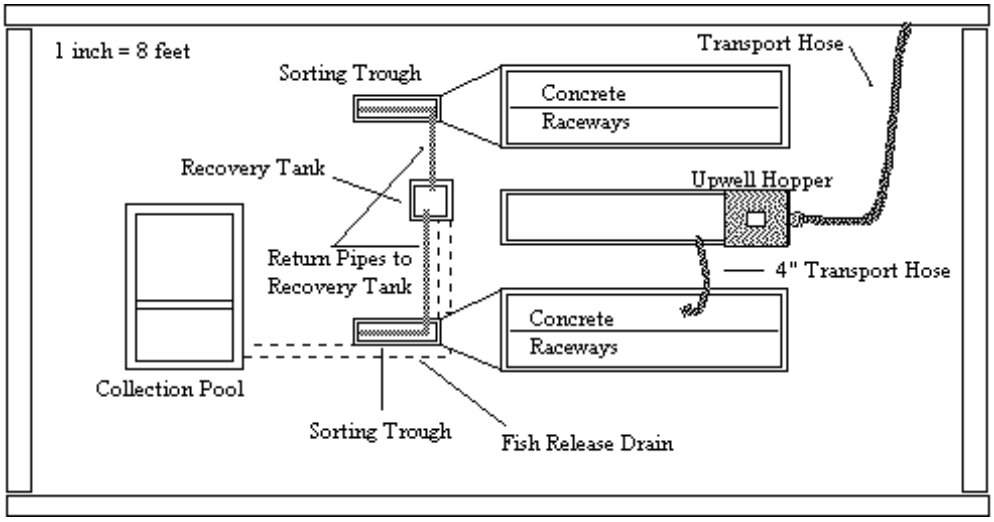


Figure E-6. Smolt monitoring system at Bonneville Dam, PH2, 1998.

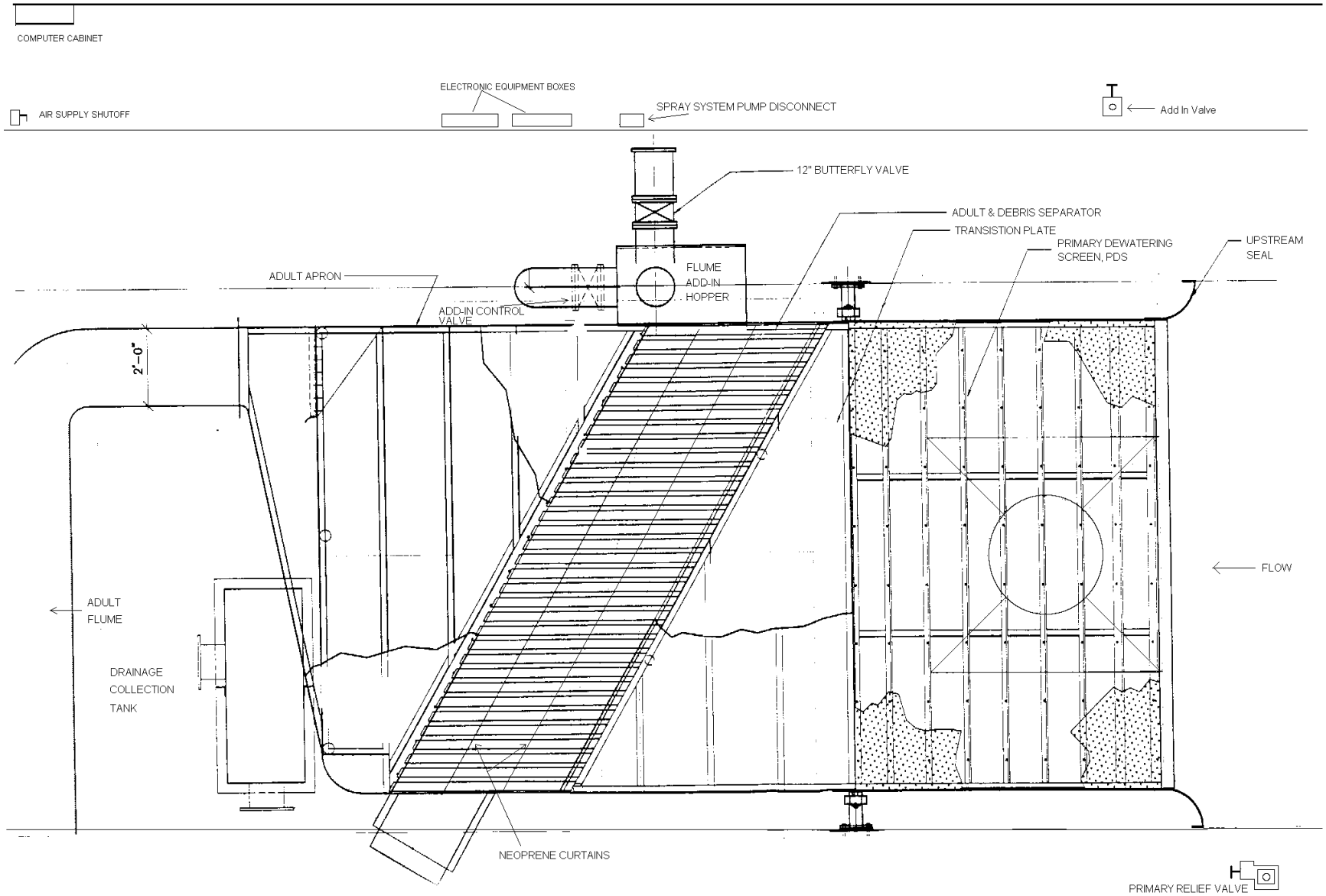


Figure E-7. Top view of PIT tag system, PH2, Bonneville Dam, 1998. This system was dismantled in 1999 to allow construction of new bypass at PH2.

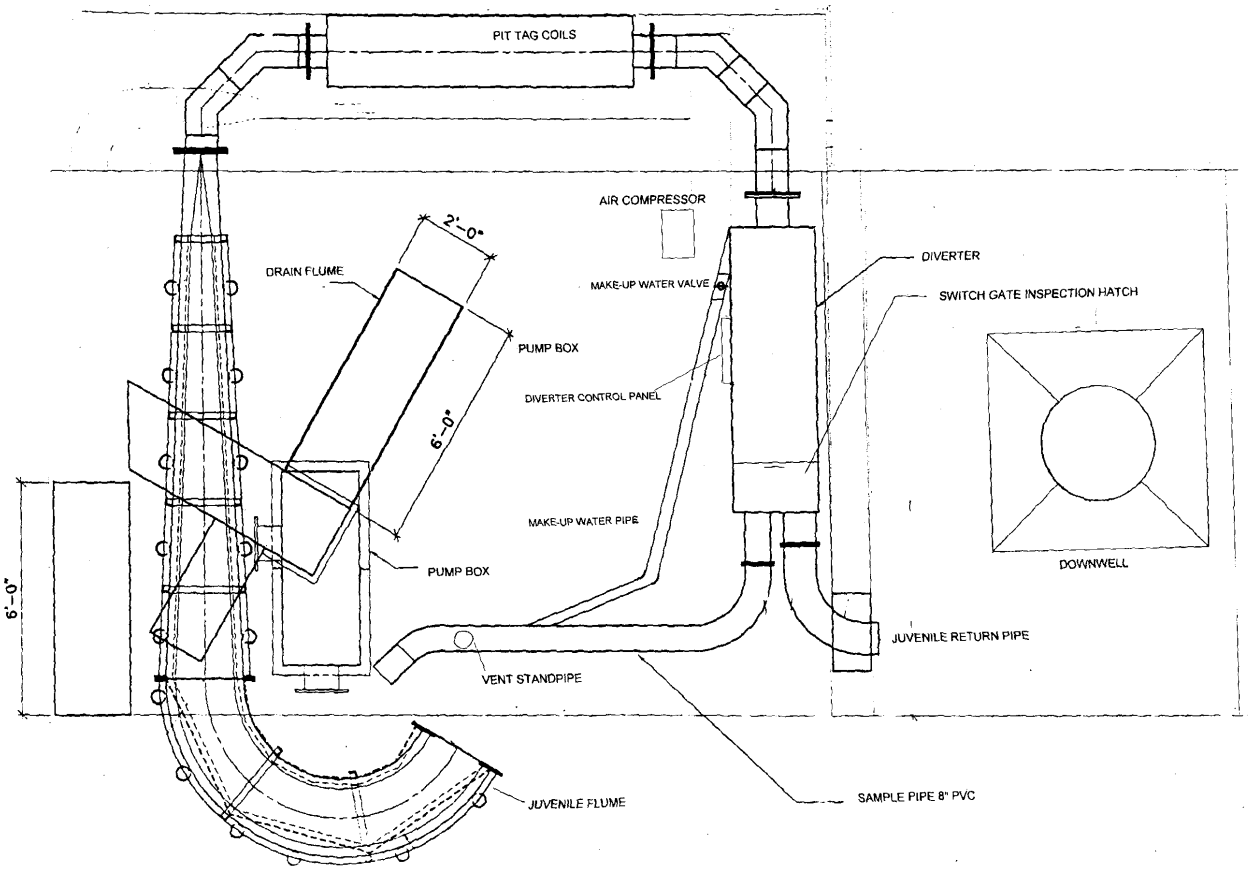


Figure E-8. Lower level or "Sump" area of PIT tag system, PH2, Bonneville Dam, 1998. This system was dismantled in 1999 to allow construction of new bypass at PH2.