MONITORING OF DOWNSTREAM SALMON AND STEELHEAD AT FEDERAL HYDROELECTRIC FACILITIES

ANNUAL REPORT 1992

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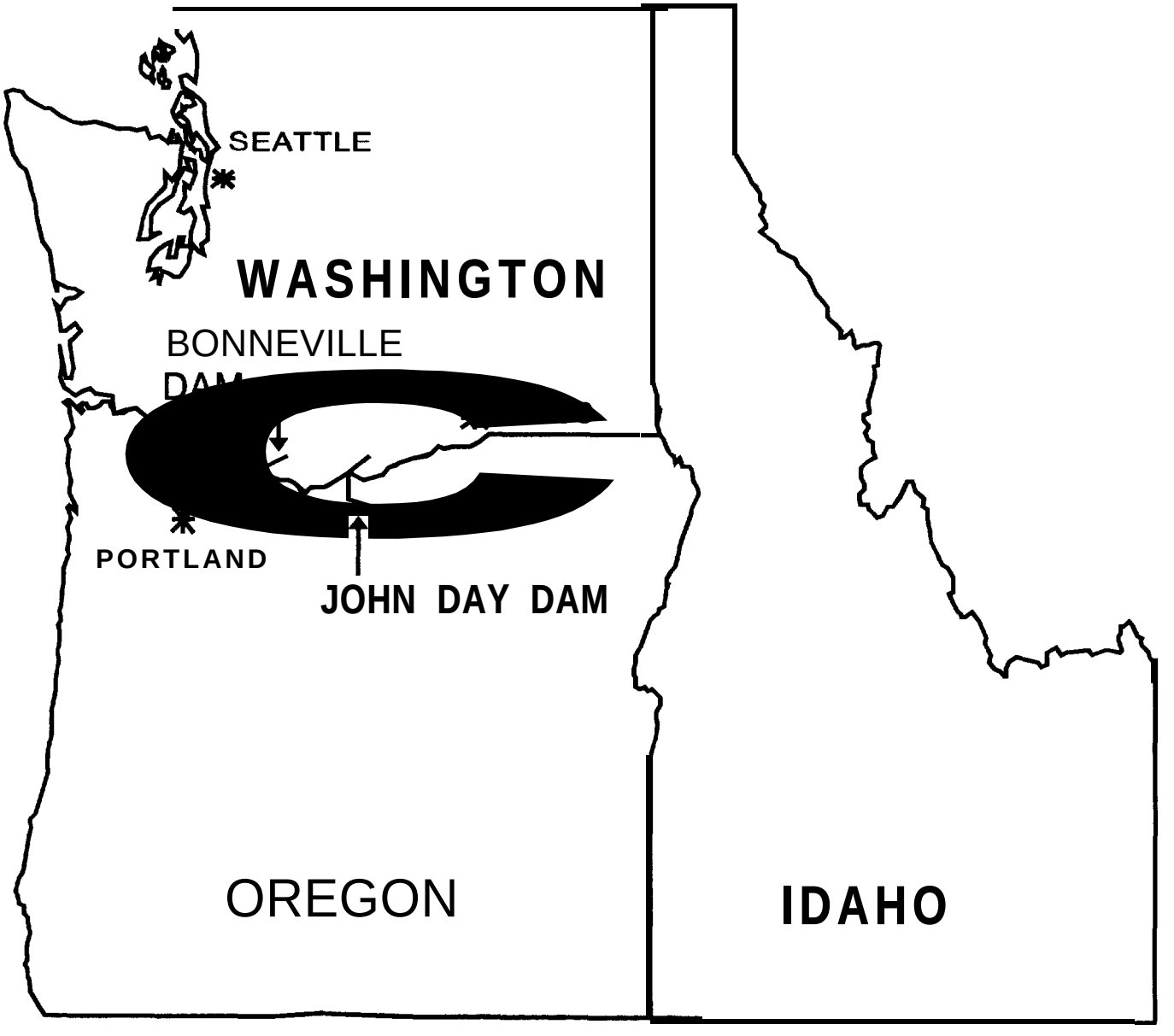

FIGURE 1. National Marine Fisheries Service Smolt Monitoring Sites on the Columbia River

INTRODUCTION

The seaward migration of salmonid smolts was monitored by the National Marine Fisheries Service (NMFS) at two sites on the Columbia River in 1992. The NMFS Smolt Monitoring Project is part of a larger Smolt Monitoring Program to index Columbia Basir juvenile salmonid stocks. It is coordinated by the Fish Passage Center (FPC) for the Columbia Basin Fish and Wildlife Agencies and Tribes. Its purpose is to facilitate fish passage through reservoirs and at dams by providing FPC with timely smolt migration data used for flow and spill management. Data is also used for travel time, migration timing and relative run size magnitude analysis. This program is carried out under the auspices of the Northwest Power Planning Council Fish and Wildlife Program and is funded by the Bonneville Power Administration (BPA).

Sampling sites were John Day and Bonneville Dams under the 1992 Smolt Monitoring Program (Figure 1). All pertinent fish capture, condition, brand recovery, and flow data, were reported daily to FPC. These data were incorporated into the FPC's Fish Passage Data System (FPDS).

METHODS AND MATERIALS

JOHN DAY DAM

To increase the numbers of brands recovered at John Day Dam for travel time analysis, a second airlift pump sampler was installed in gatewell 3C for the 1992 migration season. The two airlift pump systems are of the type described by Brege et al. (1990), and were operated in gatewells B and C of unit number 3. Collected fish were examined hourly over the 24 hour sample day (7AM to 7AM), seven days per week throughout the 1992 sampling season, March 25 - October 13.

Fish were collected in a tank suspended at water level in the gatewell. Each hour this collection tank was raised and fish were gravity fed to holding tanks in a fish handling building via a 6" PVC pipe. Approximately 40 fish at a time were then preanesthetized with about 67 mg/L. of a Benzocaine/Alcohol solution, using the method described by Mathews et al. (1985). Once anesthetized, fish were net-transferred to the examination trough which contained about 13mg/L of Tricaine (MS 222) to keep fish calm during examination. Fish were then placed in a recovery tank and eventually routed back to the bypass system for return to the river. Except for periods of maintenance, unit 3 was in continuous operation, though turbine loading was variable through the sampling season.

BONNEVILLE DAM

At Bonneville Dam, samples were collected in the bypass channels of the first and second powerhouse using the downstream migrant traps (DSM#1 & 2) from March 13 - November 20. The DSM trap operation is described by Gessel (1986) for the first powerhouse, and by McConnell and Muir (1982), and Krcma et al. (1984), for the second powerhouse.

In 1992, to improve diel and passage index data and to increase brand recovery, first powerhouse sampling was expanded from 8 to 24 hours per day. The sampler was manually operated each hour, seven days per week over the sample day which ran from 0700hrs to 0700hrs. The sampling rate was adjusted on a daily basis depending on smolt numbers, and was generally set from 6 to 12 minutes per hour (10 - 20%). Sample time was split into two samples of equal duration per hour. During periods of high smolt passage, the sample rate was adjusted on an hourly basis to a minimum of 1 minute per hour as necessary to avoid overcrowding the trap.

In 1992, second powerhouse sampling was limited to subsampling for fish condition only, due to the restricted operation of the second powerhouse, and the expanded effort at the first powerhouse. The DSM#2 was operated up to 7 hours per day, three days per week, (M,W,F) to obtain a representative sample to monitor fish condition. The DSM#2 sampler operates at a fixed 10% sample rate. These fish were routed to and held in raceways until they were examined.

At both sampling locations, fish were net-transferred directly from the holding tanks to the sorting troughs, which contained about 42mg/L of Tricaine (MS-222). After examination, fish were placed in recovery tanks and eventually routed back to their respective bypass channels.

SAMPLE PERIODS AND DATA COLLECTED

Specific data collected and reported to FPC at the end of the 24 hour sample period at each sample site include:

1) Total daily sample numbers for each salmonid species
2) Hourly diel passage information
3) Recording of all brands and marks
4) Descaling, general fish condition and mortality
5) Length frequencies by species
6) Project, river, turbine and spill flow data

RESULTS AND DISCUSSION

The results of the hands-on assessments of smolt movement into or through the hydroelectric facilities at the listed sites are summarized in Table 1 for the 1992 field season. Three types of fish counts are presented in the table:

1) Total Sample, actual fish counts.

2) Estimated Collection, total sample counts adjusted for sample rate (Bonneville Dam only).

3) Estimated Passage Indices, estimated collection counts divided by the proportion of flow passing through the sampled system to adjust for daily fluctuations in project operations.

As stated in the Fish Passage Center Annual Reports, estimated 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.

Since monitoring at John Day and Bonneville generate diel catch data, fish passage indices can be estimated by two methods;

Hourly Resolution FPI expands hourly collection counts with hourly average flow through the sampled unit, and then sums these hourly passage indexes over the 24 hour day.

Daily Resolution FPI expands daily collection counts with daily average flow through the sampled unit or powerhouse.

Included in the appendices is a graphic coverage of the diel and seasonal passage patterns and flow at John Day and Bonneville Dams. All diel patterns were adjusted to eliminate the effect of the sampled area flow fluctuations on fish passage by multiplying the hourly collection count by the percent hourly deviation from the average flow over the 24 hour period through the sampled area.

TABLE 1. SUMMARY OF 1992 SMOLT MONITORING ACTIVITIES AT JOHN DAY AND BONNEVILLE DAMS.

SPECIES	SITK	TOTAL SAMPLE	TOTAL BRANDS	ESTIMATED COLLECTION[1]	DAILY EST. FPI[2]	HOURLY EST. FPI[3]
YEARLING	JOHN DAY	42,231	1,420	42,231	522,048	519,616
CHINOOK	BONNEVILLE PH#1 DSM	42,523	220	284,983	723,655	799,800
	BONNEVILLE PH#2 DSM[4]	350	---	---	---	---
SUBYEARLING	JOHN DAY	59,783	945	59,783	543,502	550,351
CHINOOK	BONNEVILLE PH#1 DSM	112,037	212	882,211	2,320,423	2,433,053
	BONNEVILLE PH#2 DSM	1,461	---	---	---	---
WILD	JOHN DAY	5,141	66	5,141	62,328	61,711
STEELHEAD	BONNEVILLE PH#1 DSM	2,837	18	16,503	46,098	60,823
(VNCLIPPED)	BONNEVILLE PH#2 DSM	3	---	---	---	---
HATCHERY	JOHN DAY	11,970	546	11,970	149,790	149,764
STEELHEAD	BONNEVILLE PH#1 DSM	3,767	40	21,915	62,486	81,871
(CLIPPED)	BONNEVILLE PH#2 DSM	4	---		---	---
COHO	JOHN DAY	9,804	0	9,804	121,960	122,755
	BONNEVILLE PH#1 DSM	23,971	0	140,403	388,809	471,205
	BONNEVILLE PH#2 DSM	119	---	---	---	---
SOCKEYE	JOHN DAY	2,608	0	2,608	32,494	33,314
	BONNEVILLE PH#1 DSM	638	0	3,872	10,835	13,196
	BONNEVILLE PH#2 DSM	1	---	---	---	---
SEASON	JOHN DAY	131,537	2,977	131,537	1,432,122	1,437,511
TOTALS	BONNEVILLE PH#1 DSM	185,773	490	1,349,887	3,552,306	3,859,948
	BONNEVILLE PH#2 DSM	1,946	---	---	---	---

Data Source: Fish Passage Center.

[1] Daily Est. Collection- Sample # adjusted by sample rate at Bonneville Dam.

[2] Daily Est. FPI= Daily collection counts adjusted by daily ave. flows.

[3] Hourly Est. FPI= Hourly collection counts adjusted by hourly ave. flows.

[4] PH#2 sampled for fish condition only.

JOHN DAY DAM

Airlift Sampling

The two airlifts in gatewells B and C of unit 3 were operated continuously throughout the sampling season except for periods when unit 3 was shut down, or when maintenance was required on the airlift components.

Sampling began as scheduled on March 25 and continued until October 13 when an extended shutdown of unit 3 due to mechanical failure effectively ended the sampling season. Over the normal sampling period (3/25 - 10/31), unit 3 was out of service a total of 501 hours or 10% of the sampling season. The major outage of unit 3 occurred late enough in the season that the juvenile salmonid catch was not greatly affected. Appendix A Table 1 summarizes the sampling down time and relates it to airlift problems or unit 3 shutdowns.

On July 19, one of the large shafts used to raise and lower the 3B airlift basket broke. This also resulted in damage to the airlift basket. Sampling continued with the 3C airlift until repairs could be made to 3B equipment. Sampling resumed with both airlifts at 1800 hours on July 21.

It was noticed during the spring migration that the majority of fish were consistently being caught in the 3C sampler. From the start of the season through May 21, 63% of the catch was from 3C and 37% from 3B. On May 21, after a scheduled traveling screen and gatewell inspection, the funnels were switched in the gatewells. It was found that the funnel now in 3B was still catching more fish compared to the 3C funnel.

After a closer inspection, it was discovered that the airlift funnel that had caught less fish regardless of location was 4" narrower than the gatewell, and that the resulting gap could be allowing fish to escape around the funnel, bypassing our samples. This gap was closed on May 27th, and from then till the end of the season, the catch was more equal between funnels (3B = 55% and 3C = 45%).

Sample Numbers

In 1992, the two airlifts at John Day Dam generated an annual index total of 1,432,122 (daily expansion method), and 1,437,511 (hourly expansion method). Both methods of computing the annual passage index produced results that differed by less than 0.4%.

The 1992 annual index based on the catch from two airlifts is only about 9% more than the 1991 index of 1,301,511 based on the catch from one airlift operated in unit 3. Passage indices were low, despite a doubling of effort, primarily due to maximum transportation of fish past John Day from upriver sites, and poor

river flow conditions. As anticipated, almost twice the amount of branded fish released from McNary dam were recovered at John Day with two airlifts operating.

There were a total of 2,977 brands recovered this season at John Day Dam. Brand quality on McNary releases was recorded and provided every week to the McNary branding crew to improve quality control. A PIT tag detector was installed to scan sampled fish for tags at John Day in 1992. A total of 64 PIT tags were recorded in sampled fish at this site.

Flows and Spill

River flow, Unit 3 discharge, and spill are presented in Appendix A, Figure 1. River flows were low over the spring migration, averaging about 190 kcfs from May 1 through June. Then flows dropped over the summer and fall migrations, averaging about 115 kcfs through the end of August, and 93 kcfs through October. These flows significantly extended travel time and stress for yearling and subyearling chinook and steelhead through the John Day reservoir (Fish Passage Center Annual Report 1992).

The only spill that occurred at John Day in 1992 was that required by The "Fish Spill Memorandum of Agreement". The spill season at John Day Dam runs from June 7 to August 23. Authorized spill for fish at John Day under this agreement is 20% of instantaneous flow for 10 hours per day (2000h - 0600), which equals 8.3% of the daily average flow.

Seasonal Passage Patterns

Seasonal passage patterns for John Day Dam are presented by species in Appendix A, Figures 2 - 4. Peak passage of all spring migrants occurred in May. The majority of subyearling chinook passage occurred from the first of July through mid August.

Estimated dates for the 10 to 90% segment of smolt passage by species are listed below.

Species	10%	90%
Yearling Chinook	5/2	6/10
Subyearling Chinook	6/24	8/15
Steelhead	5/3	5/28
Wild	4/23	5/25
Hatchery	5/8	5/29
Coho	5/2	5/27
Sockeye	5/8	5/27

Diel Patterns

Weekly diel passage patterns are presented for each species in Appendix A, Figures 8 - 48 to show in-season variation. Diel patterns were adjusted to eliminate the effect of unit 3 hourly

fluctuations on fish capture[1/]. Weekly patterns are very consistent over the season and with previous years in that the majority of passage (75 to 95 percent) occurs during night time hours at John Day Dam.

Figure 2 presents the average seasonal diel pattern for each species. Typically, juvenile salmonids move into the forebay during daylight hours, then sound and move through the spillways and powerhouse at dusk reaching a peak during the night and dropping off sharply after sunrise.

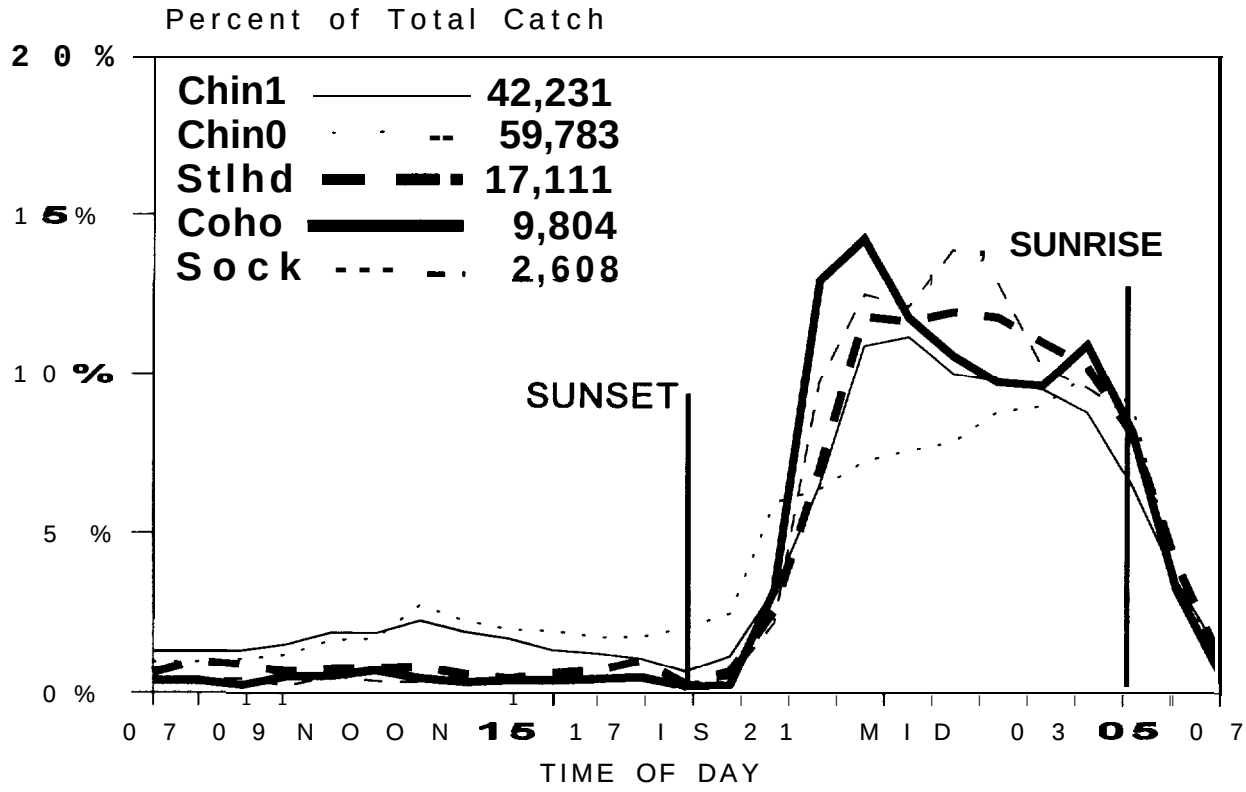

FIGURE 2. Average Diel Passage Patterns at John Day Dam, 1992 Season.

Percent passage over the season for each species during day and nighttime hours are as follows;

Species	Day (0600-1900)	Night (2000-0500)
Yearling Chinook	23%	77%
Subyearling Chinook	26%	74%
Steelhead	13%	87%
Coho	9%	91%
Sockeye	8%	92%
Combined	22%	78%

[1/] Diel passage is shown for a minimum catch of 500 fish per week for all species except Sockeye where a minimum of 400 per week is used.

Fish Condition

The percentages of descaling and mortality in the samples at John Day Dam for the last three years of sampling are listed by species below;

JOHN DAY DAM

YEAR	YEARLING CHINOOK %DESC	YEARLING CHINOOK %MORT	SUBYEARLING CHINOOK %DESC	SUBYEARLING CHINOOK %MORT	STEELHEAD %DESC	STEELHEAD %MORT	COHO %DESC	COHO %MORT	SOCKEYE % DESC	SOCKEYE %MORT
1990	7.8	1.5	5.9	5.1	9.7	1.5	6.5	0.1	a.1	1.8
1991	16.6	1.2	5.8	1.7	11.0	0.2	0.6	0	17.6	1.7
1992	10.1	4.3	2.0	5.2	11.7	2.6	6.5	1.6	7.0	1.5

In 1992, descaling on spring migrants at John Day Dam remained high (Figure 3). Of specific concern are the elevated descaling rates for steelhead, the highest on record since 1985. Hatchery steelhead in particular seemed to be in very poor condition with descaling and mortality rates of 13.9% and 3.2% respectively. This was more than double the rates for wild steelhead (6.5% and 1.1%). Mortality rates in 1992 were some of the highest recorded at John Day for all species.

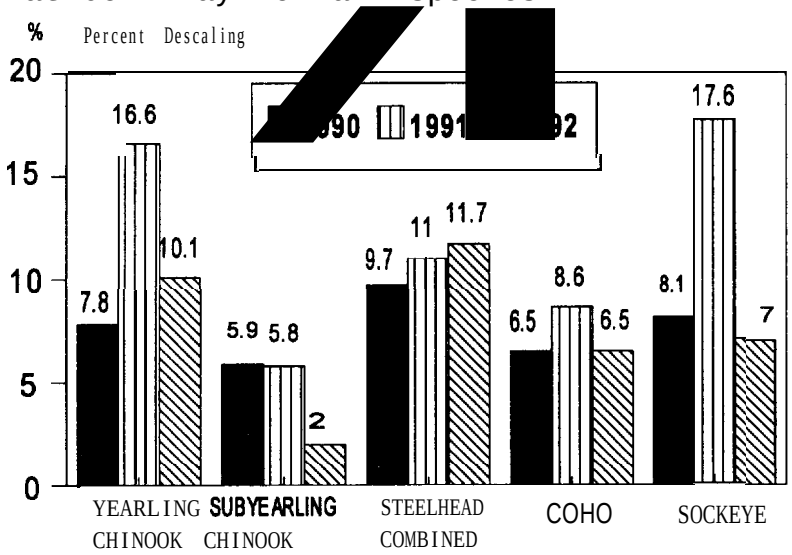

FIGURE 3: Percent Descaling, John Day Dam, 1990 - 1992

Descaling rates increased near the end of April, and stayed high into May. A major debris block in the 3B airlift, and a minor plug in 3C was removed on April 30. The airlift equipment was checked for debris plugs routinely thereafter throughout the spring migration, but no other significant plugs were found. On May 5 the Corps of Engineers raked the trash racks in front of unit 3 and found only a minor amount of debris.

On May 20, smolts were collected from an adjacent gatewell by dipnet to discern if fish that were not exposed to the airlift sampler were similarly descaled. A total of 835 fish were collected from unit 4 and the descaling rate on those fish was 11.1%. This compares to a rate of 12% for airlifted fish from unit 3 on the day ending May 20.

Even though the dipnetting of unit 4 did not reveal a significant difference between the two units, sampling equipment and bypass screens in unit 3 were removed and inspected on May 21. No major problems were found with any of the equipment. The trash racks were again raked at this time and a substantial amount of debris was collected off the 3B rack. Descaling rates did not drop

appreciably after cleaning trash racks.

Sampling equipment was again dismantled and bypass equipment in unit 3 gatewells checked as a part of a routine inspection on June 17 and August 25. No problems were found either time.

During the spring migration McNary Dam was experiencing debris problems and similar descaling and mortality rates (Figure 4). Abnormally high water temperatures in the spring (about 7 degrees above normal during April and May) combined with low flows may have increased stress on spring migrants with a resulting increase in mortality. It is thought that the descaled fish seen at John Day Dam were suffering from cumulative descaling and stress from upriver points. Descaling rates dropped in the middle of June at the end of the spring migration.

Descaling levels for summer migrants averaged less than 2%, but mortality remained high, averaging 5.2%. Water temperatures ranged from 67-71 degrees.

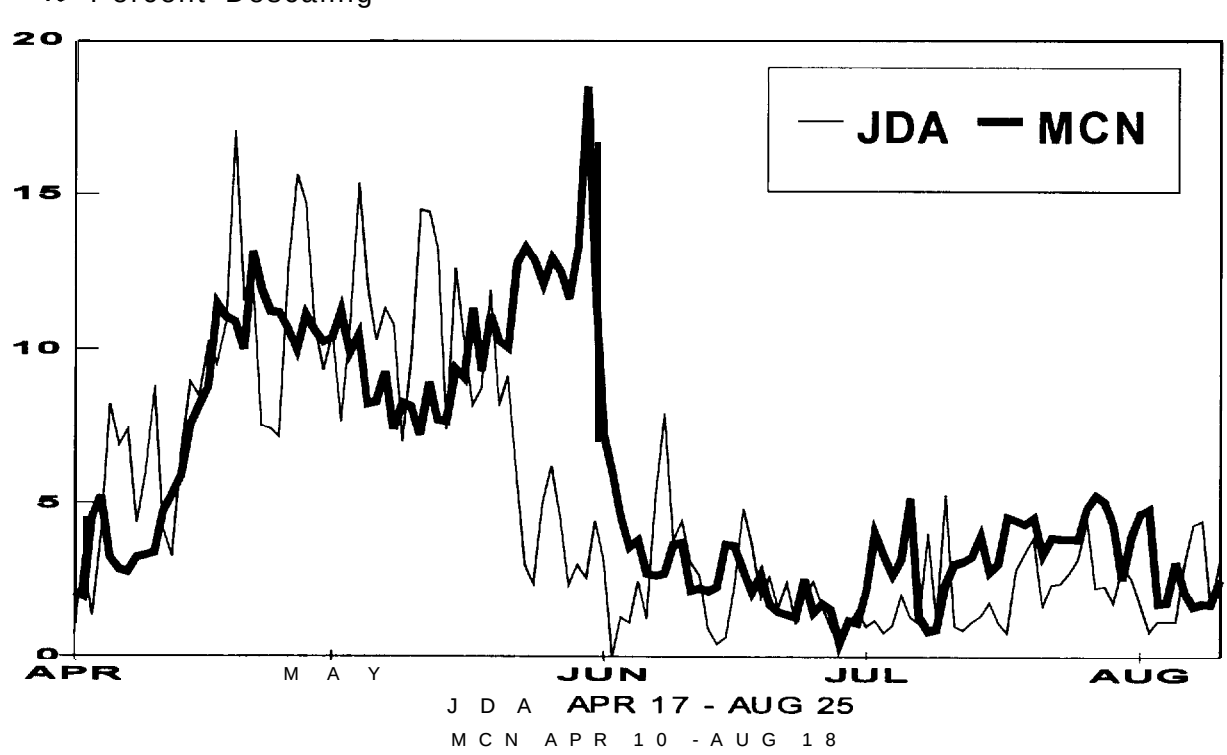

FIGURE **4. Daily descaling rates at John Day and McNary Dams, 1992**

On July 8th seven moribund and seven live subyearling chinook from the airlift samples were examined by a pathologist (Phyllis J. Burney, USFWS Fish Health Center). Both groups of fish were infected with Tricophrya and Columnaris, had abraded nose and fins, low level gas supersaturation symptoms, and had not eaten within 4-7 days even though forage was available. These

conditions have been seen in fish at John Day in past years. The health examination concluded that these conditions are general signs of chronic stress, and though none of the conditions described are fatal in themselves, their combined presence and increasing severity over time can cause mortality.

Delayed Mortality Testing

In a continuing effort to evaluate the impacts of fish handling and anesthetizing procedures on sampled fish at John Day Dam, a series of tests were conducted to measure short term delayed mortality (48 hr. holding) on handled and control groups. Tests were conducted on yearling chinook in May, and on subyearling chinook in July and August. The details and expanded results of these tests are presented in Appendix D.

A summary of the 1992 delayed mortality tests results at John Day Dam are as follows;

SPECIES	water Temp. oF	# of Rep Tests	HANDLED Morts Total	HANDLED % Morts	CONTROL Morts Total	CONTROL % Morts	COMBINED Morts Total	COMBINED % Morts
Yearling Chinook	58-64	23	32/948	3.4	47/973	4.8%	79/1921	4.1%
Subyearling Chinook	67-71	24	154/857	18.0%	198/993	19.95	352/1850	19.0%

For yearling chinook, the mortality in combined handled and control tests were higher (4.1%) than has been seen in previous tests, but reflect the general mortality rate for yearling chinook this spring in the airlift samples (4.3%). Test results showed higher mortality in control groups than handled groups, which may be due to test procedure (see Appendix D).

Each year, subyearling chinook suffer high mortality rates in the samples at John Day during late July to early August, when water temperatures peak. This high background mortality on sampled fish that were not handled prior to holding makes it difficult to obtain clear test results on subyearlings. Combined handled and control test mortality was high (19%) but there was no statistically significant difference between handled (18%) and controls (19.9%).

Brand Recovery Tests

Tests to evaluate brand recognition and recording efficiency of fish handlers at John Day Dam were conducted over the 1992 monitoring season.

Six brand recovery tests were done using yearling chinook and two tests were conducted using subyearling chinook. For each test approximately 20 to 30 fish collected from the hourly sample were branded with a >Y brand using three different locations and rotations on the fish. One test with yearling chinook included several coho as an added variable. The fish were held for 48 hours and then introduced into the airlift trap.

Combined brand detection test results are as follows;

Species	# of Tests	Total # Branded	Total # Recovered	Percent Recovered
Yearling Chinook	6	119	114	96%
Subyearlins Chinook	2	47	47	100%
Total	8	166	161	97%

There were three instances where there was an error reading or recording brands. In those cases the total number of brands found was correct, but a few of the brands were reported incorrectly. This points out the need to carefully check brands as they are entered to ensure accuracy. These types of errors are commonly flagged by the computer's brand interactive program when the brand is processed, allowing them to be corrected while the fish is still in hand. The test >Y brands are not entered on the computer, they are recorded on paper without the automatic check to see if what was reported was a "valid" brand.

Fish handlers at John Day Dam were able to detect a total of 161 out of 166 branded chinook introduced into the sample for a detection rate of 97%, and a brand recording accuracy of 158 out of 161 = 98%. All coho were identified and recorded correctly.

Fry Incidence

The incidence of summer/fall chinook fry (≤ 60mm) in the sample this season was very small (0.2% of all subyearling chinook captured), totalling 141 fry captured from April through the first of June.

Adult Catch

A total of 166 adult salmonids were incidentally captured in the airlifts in 1992; 130 steelhead, 26 chinook, 1 coho, and 9 sockeye. Captured adults were released in the forebay of the dam.

Incidental Catch

Incidental capture of juvenile American shad (Alosa sapidissima) at John Day Dam is presented in Appendix D, Figure 1. Shad capture began to occur regularly in the samples the first of July and peaked through late August. The 1992 sample count for shad from gatewell 3B was about 17% more than the 1991 count (1992-203,780; 1991-169,747). It should be noted that sampling ended 18 days early in 1992 during the latter half of the shad migration and may have significantly affected the total catch of juvenile shad.

Juvenile pacific lamprey (Entosphenus tridentatus) appeared in airlift catches in unusually low numbers sporadically from the start of sampling through July. The 1992 sample count for lamprey was significantly reduced from previous years, totalling only 410 fish from both gatewells compared to 9,338 fish caught in one gatewell in 1991. (see Appendix D, Figure 3).

BONNEVILLE DAM

Sampling

A new single shaft hoist was installed by National Marine Fisheries Service this spring to replace the old dual hoist system on the DSM#1 trap. This made the operation of the trap much easier and safer for the operators, and protected the basket from the stresses produced by the uneven pull of the old dual hoists. With the exception of the west cable breaking on August 30th, the new hoist system performed flawlessly. Five hours of sampling were lost while project maintenance personnel replaced the broken cable. Minor equipment breakdowns caused the loss of only 9 more hours of sampling over the monitoring season.

There were no problems with the DSM#2 sampler this season. In 1992, sampling in the second powerhouse bypass was restricted to monitoring for fish condition only, three times per week. The DSM#2 was taken out of service during large hatchery releases and for NMFS survival tests.

Sample Numbers

Over the 1992 migration, 185,773 juvenile salmon and steelhead were caught in the first powerhouse DSM#1 at Bonneville Dam. This resulted in an expanded (by sample rate) collection estimate of 1,349,887.

The expanded sampling effort from 8 to 24 hours at the first powerhouse generated an annual passage index total of 3,552,306 (daily expansion method), and 3,859,948 (hourly expansion method). Both methods of computing the passage index differed by as much as **31%** for spring migrants and about 5% for summer migrants (see table 1). This difference is primarily due to the high level of spill that occurred during nighttime hours at this project. With these high spill levels, the daily resolution method of calculating the passage index based on daily average powerhouse flow and spill may under-estimate passage. The hourly resolution expansion method based on hourly flow and spill levels may more accurately reflect passage under these conditions.

Using the daily expansion method that has been used in previous years to estimate indices, and the fact that sampling effort was expanded from 8 to 24 hours in 1992, the annual passage index was only 21% higher than the 1991 index (3,552,306 vs. 2,819,263, respectively). Passage indices for 1992 were low despite a tripling of effort at this site, primarily due to;

1) Low flows and maximum transportation of fish past Bonneville Dam; 17,410,355 transported in 1992, 15,474,702 in 1991.

2) High levels of nighttime spill at Bonneville diverting many of the migrants around the powerhouse.

3) Previous years sampling occurred during peak passage hours (1600-2400) so expanding into non-peak hours (2400-1600) should not be expected to generate an equal number of fish.

A total of 490 brands were detected and recorded from the DSM#1 samples with 88% of those found on yearling and subyearling chinook (Table 1). A PIT tag detector was installed to scan sampled fish for tags at the DSM#1 in 1992. A total of 35 PIT tags were recorded in sampled fish.

Second Powerhouse

As in previous years, operation of the second powerhouse was restricted for the middle 80% of the spring and summer migration due to low fish guidance efficiency. During the 1992 water budget period, the second powerhouse was operated in excess of adult attraction water capacity to conduct approved research, avoid excess daytime spill, and meet load requirements.

A total of 1,946 **smolts** were sampled out of the second powerhouse bypass over the 1992 season to assess fish condition. No fish collection or passage index numbers were calculated for this site.

Flows and Spill

Daily river flow, spill and discharge from the first and second powerhouse are presented in Appendix B, Figures l-2. River flows ranged from a high of 227 kcfs on May 22 to a low of 78 kcfs September 1. Spill for the March 5 release of 7,260,000 tule fall chinook from Spring Creek National Fish Hatchery occurred through March 13. Spill resumed on April 16 as part of the juvenile fish passage plan and continued through August 23, averaging 45% of daily average river flow. Spill and river flow peaked on May 22 at 120 kcfs helping to flush the 2,900,000 tule's released on May 21 from Spring Creek down river. First powerhouse discharge ranged from 104 kcfs on March 15 to 25 kcfs on November 14.

Seasonal Passase Patterns

Fish passage patterns for the first powerhouse are presented in Appendix C, Figures 3 - 14. Most spring migrants passed Bonneville from mid April through May.

The spring passage patterns (before June 1) for subyearling chinook mainly represent large releases of Spring Creek N.F.H. "tule" subyearling chinook stock into the Bonneville pool. Releases of tule chinook were as follows;

RELEASE DATE	RELEASE SIZE
2/19-20/92	5,371,000
3/05/92	7,210,680
4/16/92	3,669,334
5/21/92	2,893,740
TOTAL RELEASE	19,144,755

The summer passage pattern for subyearlings (after June 1) mainly represents that portion of the run which is "upriver bright" stock.

Dates for the 10 and 90% segment of smolt passage for each species at the DSM#1 are listed below:

Species	10%	90%
Yearling Chinook	4/17	5/22
Subyearling Chinook	4/19	7/10
"tule stock"	4/19	6/31
"bright stock"	6/14	7/22
Steelhead	4/25	5/29
Wild	4/24	5/28
Hatchery	4/27	5/30
Coho	4/25	6/03
Sockeye	5/11	5/31

Diel Passage

The expansion of sampling effort at the first powerhouse from 8 hours (1600-2400) to 24 hours per day enabled us to develop diel passage patterns for the entire season for the first time. The diel patterns were very similar to patterns generated from isolated diel test dates done in past years.

Weekly diel passage patterns are presented for each species except sockeye in Appendix B, Figures 9-63 to show seasonal variation.[2] Catch numbers were adjusted to eliminate the effect of fluctuations in powerhouse operation, in effect showing passage under flat loading conditions. The average diel passage patterns for the season are shown in Figure 5. Peak passage for all species generally took place after sunset, from 2100 to 2400 hours, then dropped sharply thereafter until sunrise when passage increased during the morning hours.

[2] Diel passage is shown for a minimum collection of 500 fish per week for all species. Maximum collection for sockeye was well below this limit and is therefore not presented.

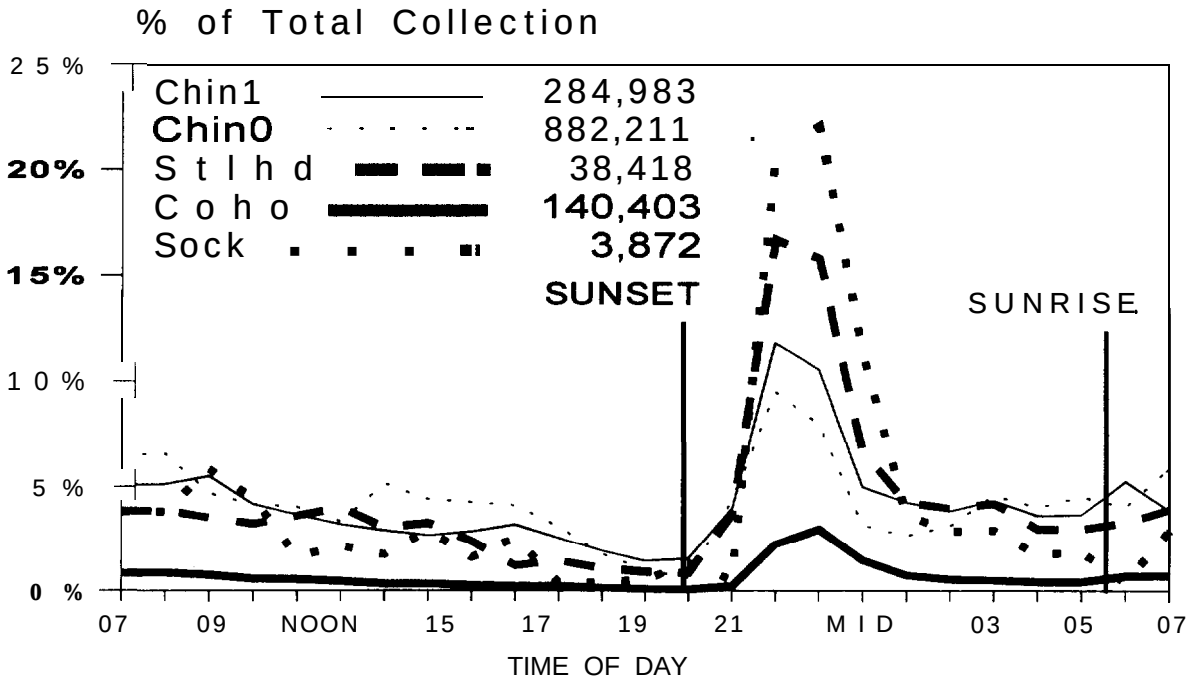

Figure 5. Average Diel Passage Patterns at Bonneville Dam, 1992 season.

The percent passage calculated for each species over the sample season during day and nighttime hours are:

Species	Day (0600-1900)	Night (2000-0500)
Yearling Chinook	48%	52%
Subyearling Chinook	56%	44%
"Tule"	54%	36%
"Brights"	41%	59%
Steelhead	38%	62%
Coho	40%	60%
Sockeye	31%	69%
Combined	52%	48%

Subyearling chinook peaked just after sunset but sustained higher overall daytime passage than any other species. This higher daytime passage was primarily due to the Spring Creek N.F.H. releases of "tule" stock into the Bonneville pool. The March 5 release of 7.2 million tule subyearling chinook produced daytime passage peaks for 2 weeks, (Appendix B, Figures 23-24. Subsequent tule releases produced consistently high daytime passage with nighttime peaks (Appendix B, Figures 25-34).

The "upriver bright" portion of the run (after June 1) consistently produced higher passage peaks just after sunset and minor peaks just after sunrise (Appendix B, Figures 35-45). Figure 6 shows the difference between tule and bright subyearling chinook diel passage at the first powerhouse.

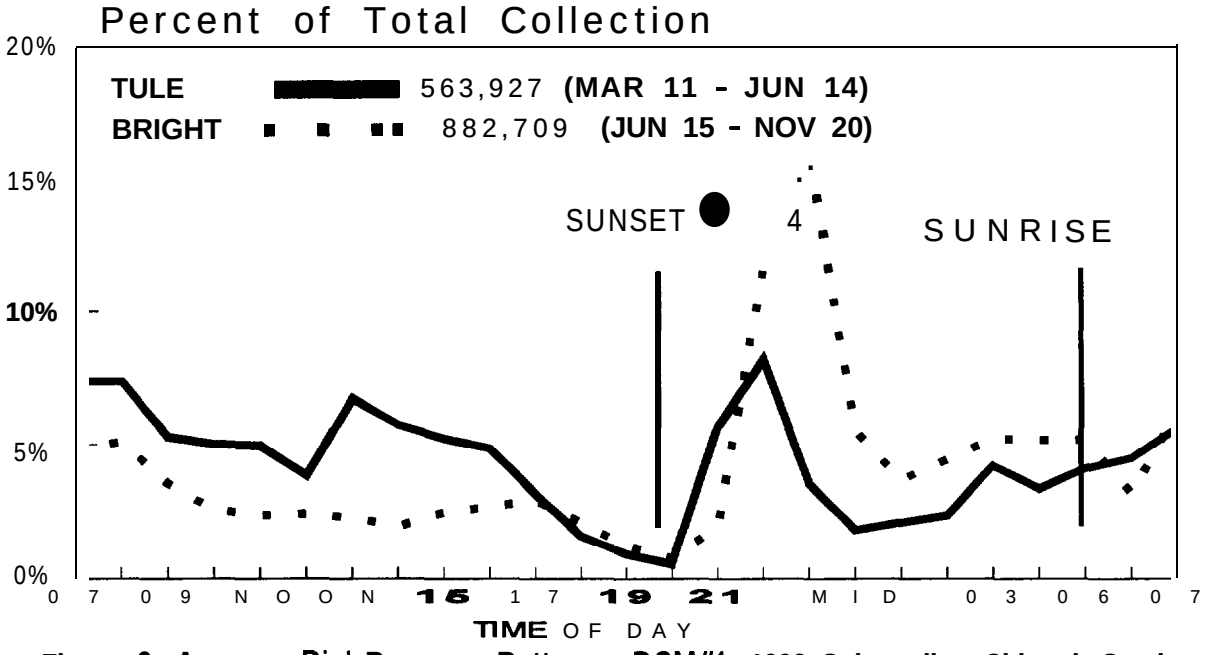

Figure 6. Average Diel Passage Patterns, DSM#1, 1992 Subyearling Chinook Stocks.

These diel passage patterns show when fish are passing through the bypass channel in the first powerhouse. There could be some delay between when fish are guided up into gatewells and when they pass through orifices into and down the bypass channel. In an effort to find out what this delay may be, diel information obtained from concurrent gatewell, orifice, and bypass trapping in the spring of 1985 was graphed in figure 7 (Gessel et al. 1986). This data indicates that fish move through the first powerhouse bypass system without significant delay.

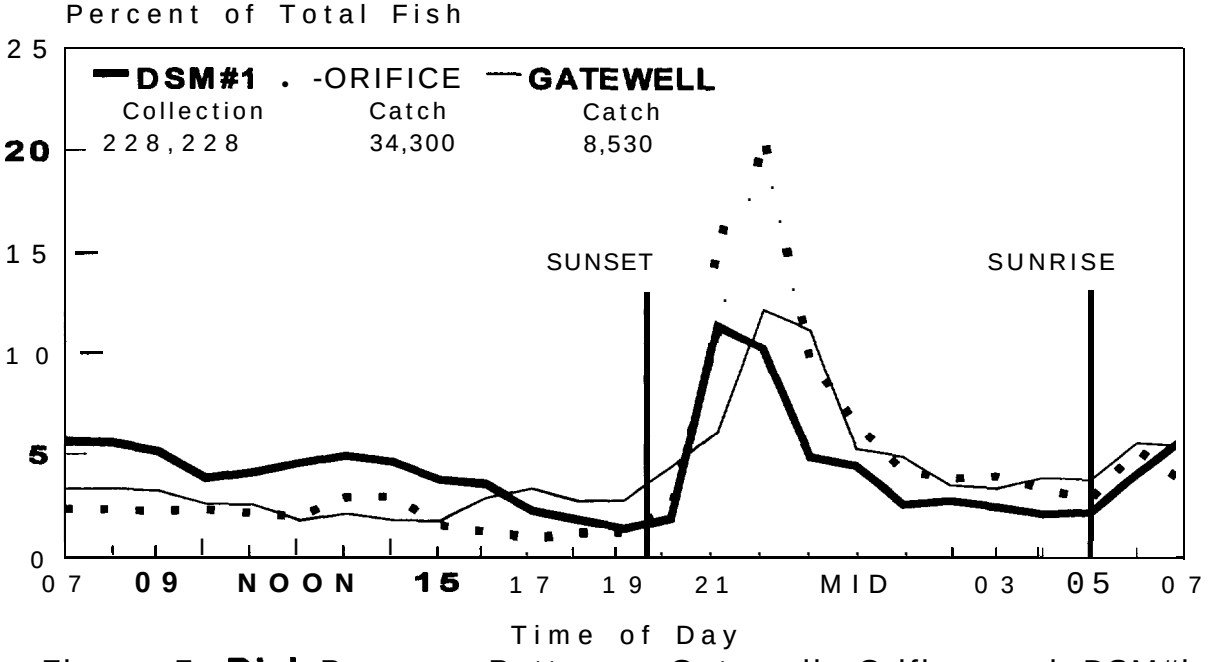

Figure 7. **Diel** Passage Patterns, Gatewell, Orifice and DSM#I **4/20 - 6/1** 1965

Descaling and Mortality

Percent average descaling and mortality in the samples at the first powerhouse for the past three years are listed by species below.

BONNEVILLE DAM DSM#1

YEAR	YEARLING CHINOOK % DESC	% MORT	SUBYEARLING CHINOOK % DESC	% MORT	STEELHEAD % DESC	% MORT	COHO % DESC	% MORT	SOCK % DESC	% MORT
1990	7.1	0.1	2.4	0.5	11.2	0.3	5.4	0.1	37.7	1.0
1991	9.4	0.1	2.8	0.3	15.0	0.0	4.5	0.2	27.7	0.2
1992	4.6	0.1	2.2	0.3	10.3	0.5	6.2	0.3	13.0	0.0

The incidence of descaled fish in the first powerhouse samples over the 1992 season decreased somewhat compared to the last several years of sampling for all species except coho (Figure 8).

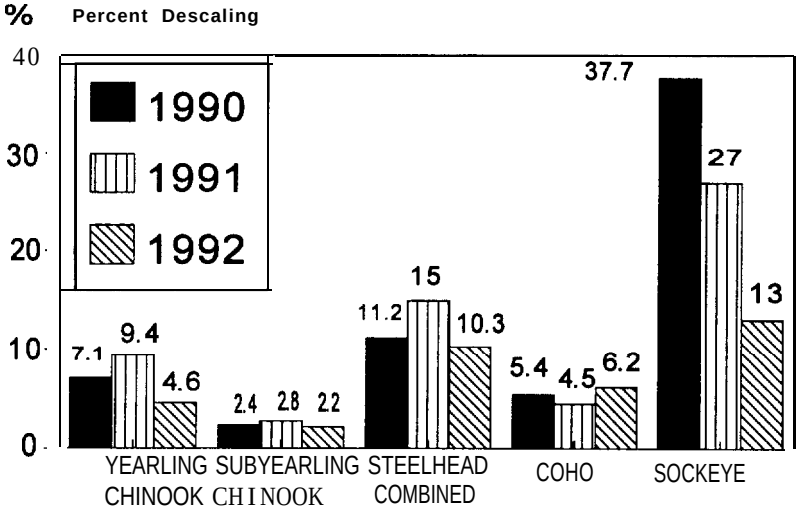

FIGURE 8. Percent Descaling, Bonneville Dam DSM#1, 1990 - 1992

Sockeye, as is typical at Bonneville Dam, had the highest descaling rates at about 13%. This descaling level for sockeye, however, is significantly lower than has ever been recorded at Bonneville, and is based on the smallest sample size ever recorded, only 638 fish (Table 1). Overall sample mortality rates were less than 1% for all species.

Percent average descaling and mortality seen in the samples taken at the second powerhouse in 1992 are as follows;

BONNEVILLE DAM DSM#2

	YEARLING CHINOOK	SUBYEARLING CHINOOK	STEELHEAD	COHO	SOCK
TOTAL SAMPLED	358	1461	7	119	1
% DESCALED	9.2%	2.8%	0%	7.6%	100%
% MORTALITY	2.0%	0.4%	0%	0%	0%

Brand Recovery Tests

Continuing tests to evaluate brand recognition and recording efficiency of fish handlers were conducted at Bonneville Dam in 1992. A total of 15 recovery tests were conducted using 7 to 15 fish per test. In all, 48 yearling chinook, 91 subyearling chinook and 22 steelhead were used for a total of 161 test fish. These fish were collected from the DSM#1 samples, transported to a holding area in the second powerhouse, and branded with a >Y brand using a variety of rotations and locations. The fish were held for 48 hours to allow brands to become visible.

Test fish were then introduced into the first powerhouse DSM#1 holding tank immediately after the trap had been raised and the sample had been dumped into the holding tank. This could not be done without the fish handlers knowledge, but fish handlers were not aware of the number and species branded or the rotation and location of brands. Combined brand detection test results are as follows:

Species	# of Tests	Total # Branded	Total # Recovered	Percent Recovered
Yearling Chinook	4	48	46	96%
Subyearling Chinook	8	91	82	90%
Steelhead	3	22	22	100%
Total	15	161	150	93%

Fish handlers at Bonneville Dam were able to detect and properly record 150 out of 161 branded salmonids introduced into the DSM#1 holding tank for a detection rate of 93%. These tests may have been compromised due to poor brand quality on test fish. More than a third (38%) of the subyearling chinook brands, and 8 of 48 (16%) of the yearling chinook brands were of poor quality, making them difficult to read. An effort will be made to improve branding techniques in subsequent tests.

Fry Incidence

Sample catches for subyearling chinook fry and coho fry (<60mm) were 2,741 and 135, respectively. Approximately 2.4% of all subyearling chinook and 0.57% of all coho captured were fry. Chinook fry were captured from March 11 to July 12 with the majority passing in April and early May. Coho fry were captured between March 11 and June 14 with most passing in April.

Incidental Catch

The juvenile American shad (Alosa sapidissima) collection count began increasing in the DSM#1 samples in mid July and peaked on November 10th (Appendix D, Figure 2). The cumulative juvenile shad collection count for 1992 was three times the 1991 count (1992 - 4,504,033; 1991 - 1,481,768) due in part to the increased sampling effort this year over 1991, and the 23% increase in the adult shad run in 1992 (CoE adult fish ladder counts). Sampling ended 10 days earlier in 1992 during the later half of the shad migration.

Juvenile shad collection at the DSM#1 compared to the adult shad run from 1989 - 1992 is as follows;

YEAR	AMERICAN SHAD ADULTS	JWENILES	SAMPLE HRS.
1989	3,105,300	435,441	8
1990	4,012,000	2,934,762	8
1991	2,363,100	1,481,768	8
1992	3,073,000	4,504,033	24

Juvenile pacific lamprey (Entosphenus tridentatus) appeared in DSM#1 samples in low numbers from the start of sampling to July Appendix D, Figure 4). Collection only totalled 526 fish for 1992. Collection counts for 1991 and 1990 were 4,568 and 1780, respectively.

SUMMARY

The 1992 smolt monitoring project of the National Marine Fisheries Service provided data on the seaward migration of juvenile salmon and steelhead at John Day and Bonneville Dams. All pertinent fish capture and condition data as well as dam operations and river flow data were provided to the Fish Passage Center for use in developing fish passage indices, migration timing, and for water budget and spill management.

ACKNOWLEDGMENTS

Support for this monitoring project comes from the region's electrical ratepayers through the Bonneville Power Administration under the Northwest Power Planning Council Fish and Wildlife Program.

The success of this program continues to involve cooperative interaction with NMFS Coastal Zone and Estuarine Studies Division and the U.S. Army Corps of Engineers on-site biologists, assistants and others who provided valuable guidance and assistance at John Day and Bonneville Dams.

We acknowledge the very capable efforts of our biologists, technicians, maintenance and contract persons; their work was vital. Key people were Scott Carlon at Bonneville Dam, Randy Absolon at John Day Dam, and Doug Frantum and his assistants for assembling and keeping the airlift sampling components in working order.

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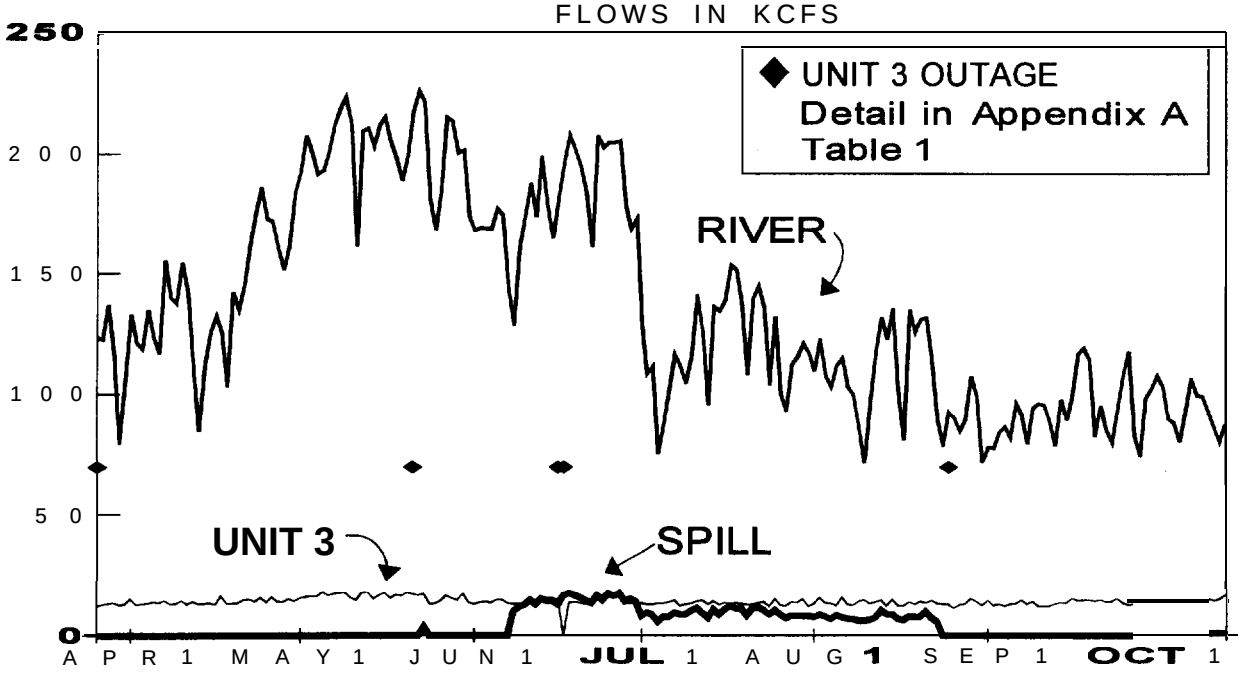
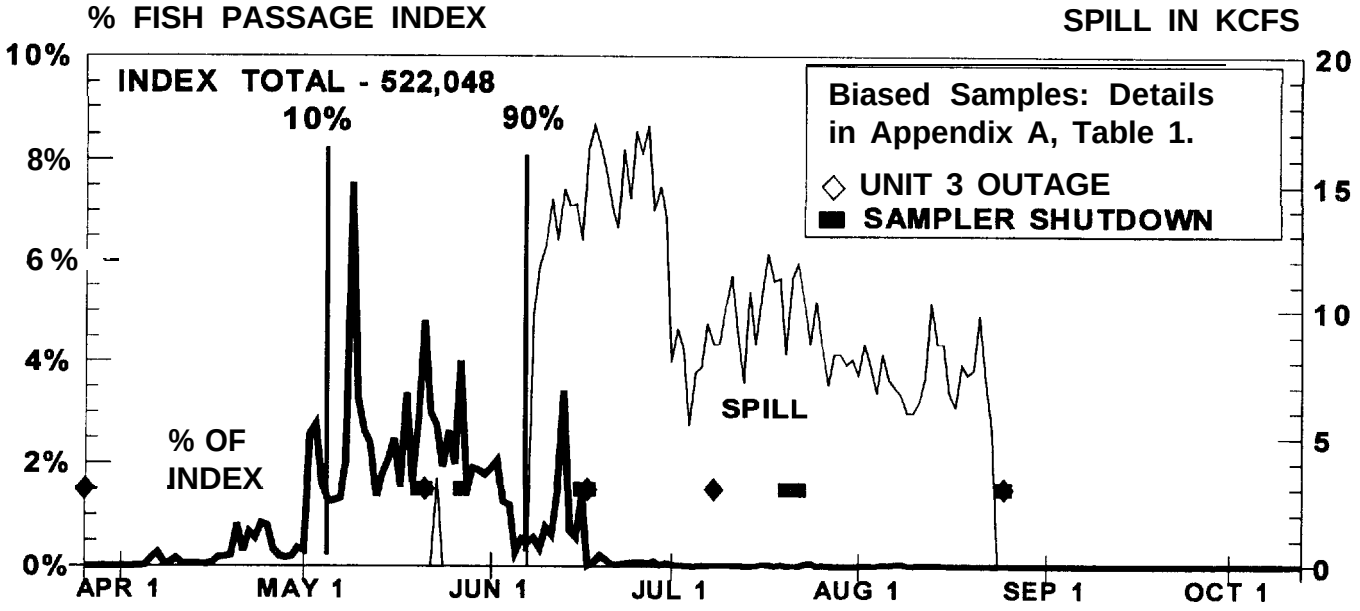
APPENDIX A
JOHN DAY DAM - 1992

RIVER, SAMPLED UNIT, SPILL
DAILY AVERAGE FLOW
JOHN DAY DAM - 1992
FLOWS IN KCFS



MONITORING SEASON
FIGURE 1

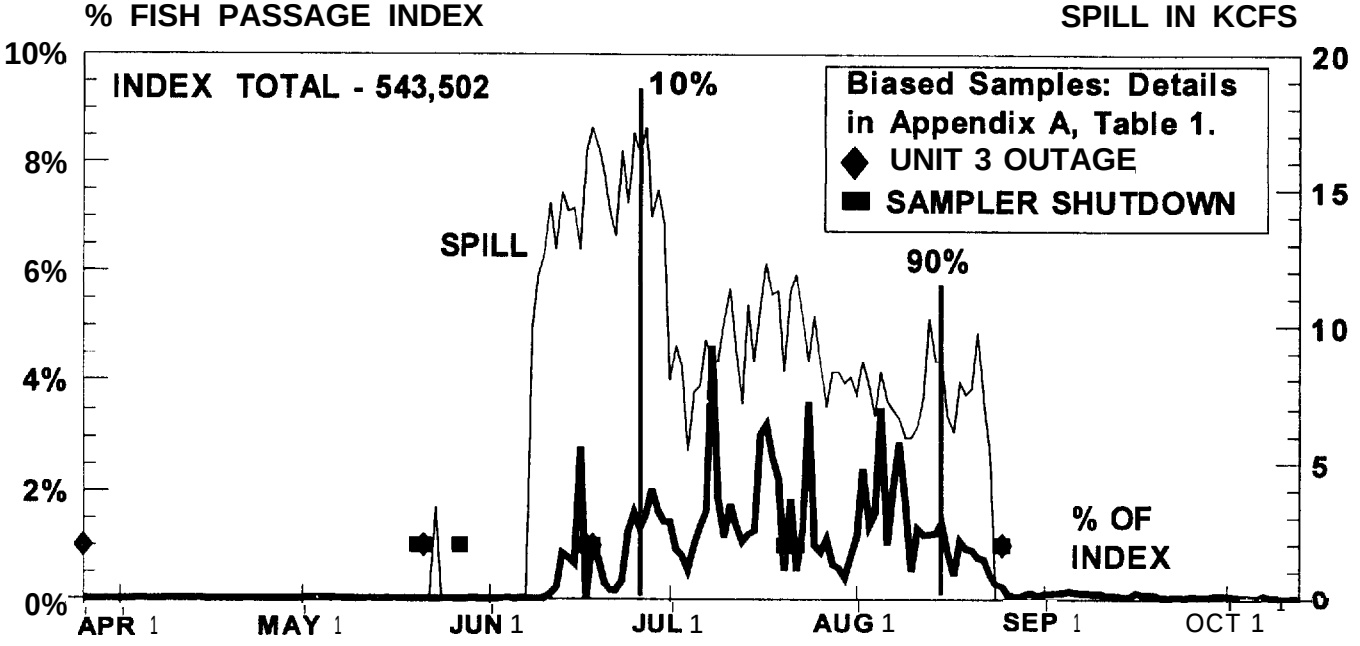
YEARLING CHINOOK
PASSAGE PATTERN
JOHN DAY DAM - 1992



MONITORING SEASON

FIGURE 2

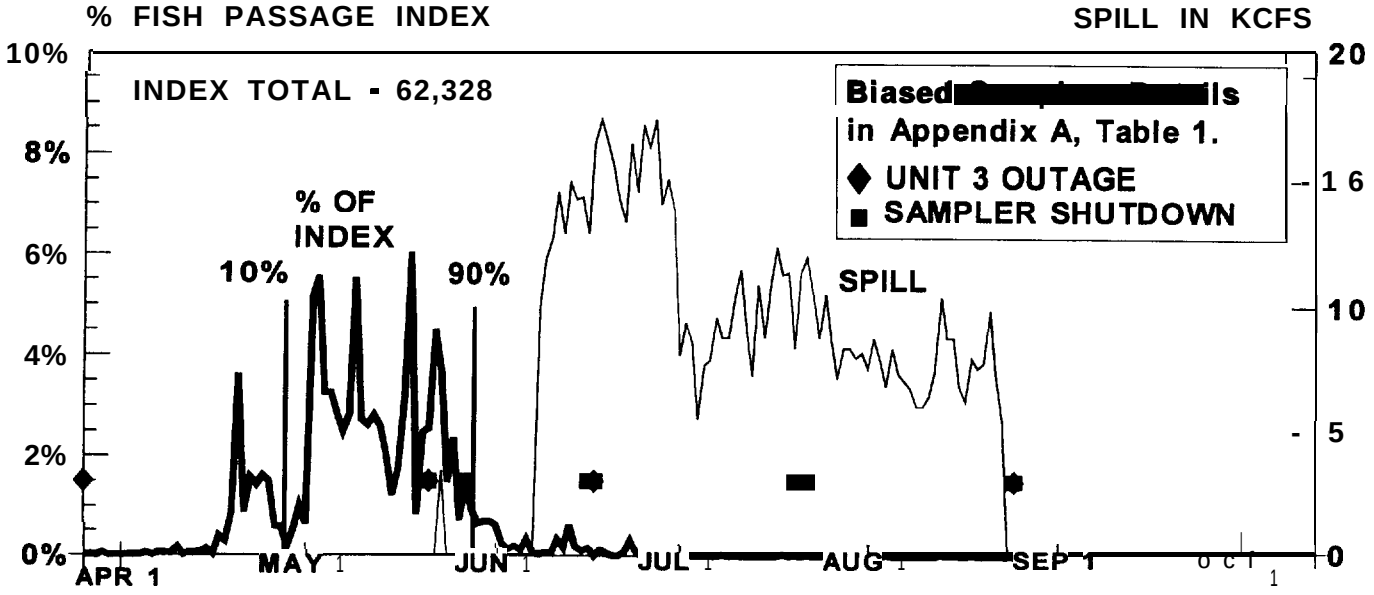
SUBYEARLING CHINOOK
PASSAGE PATTERN
JOHN DAY DAM - 1992



MONITORING SEASON

FIGURE 3

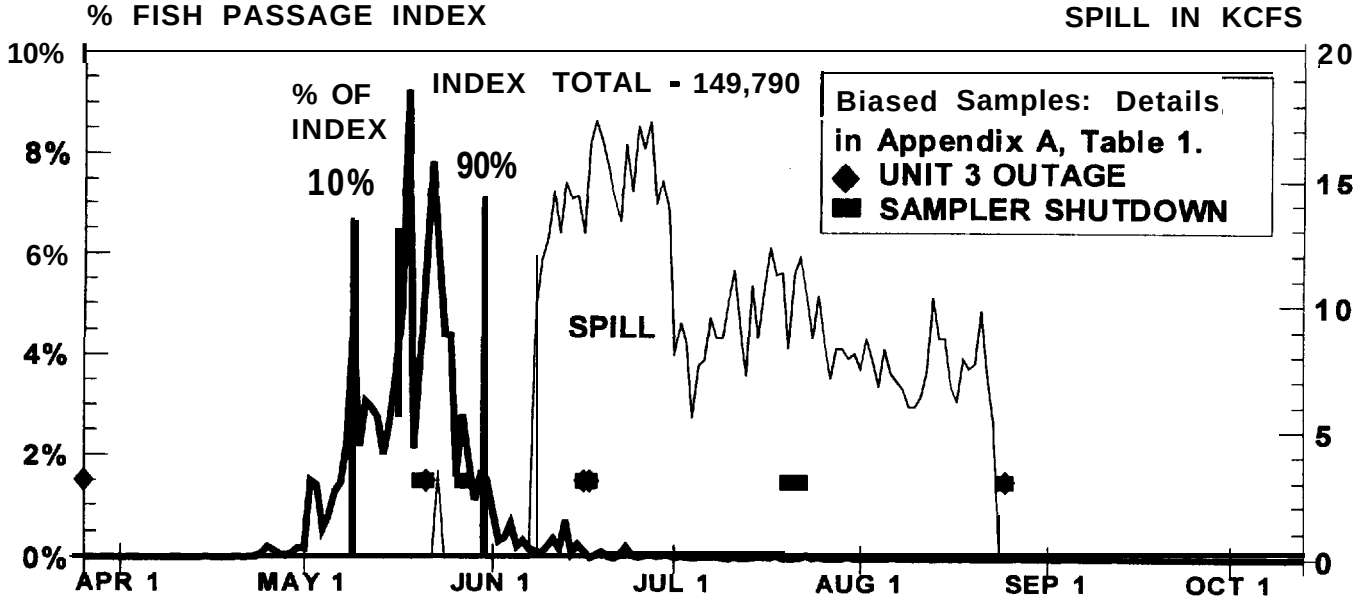
WILD STEELHEAD (UNCLIPPED)
PASSAGE PATTERN
JOHN DAY DAM - 1992



MONITORING SEASON

FIGURE 4

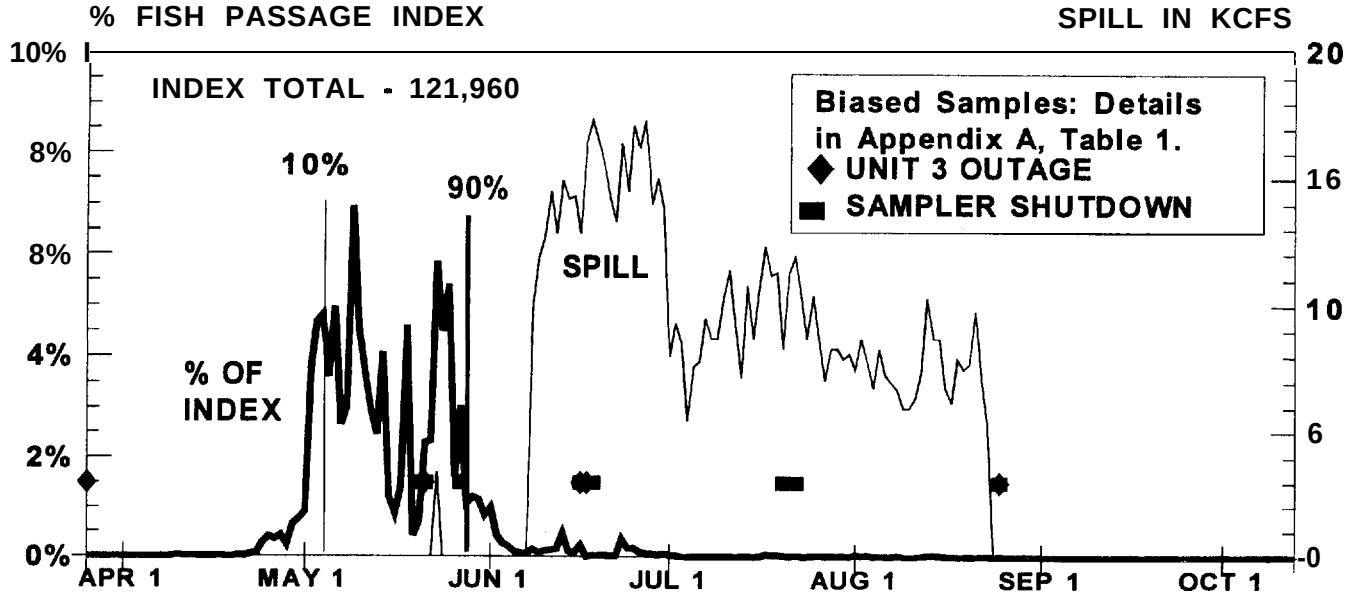
HATCHERY STEELHEAD (CLIPPED)
PASSAGE PATTERN
JOHN DAY DAM - 1992



MONITORING SEASON

FIGURE 5

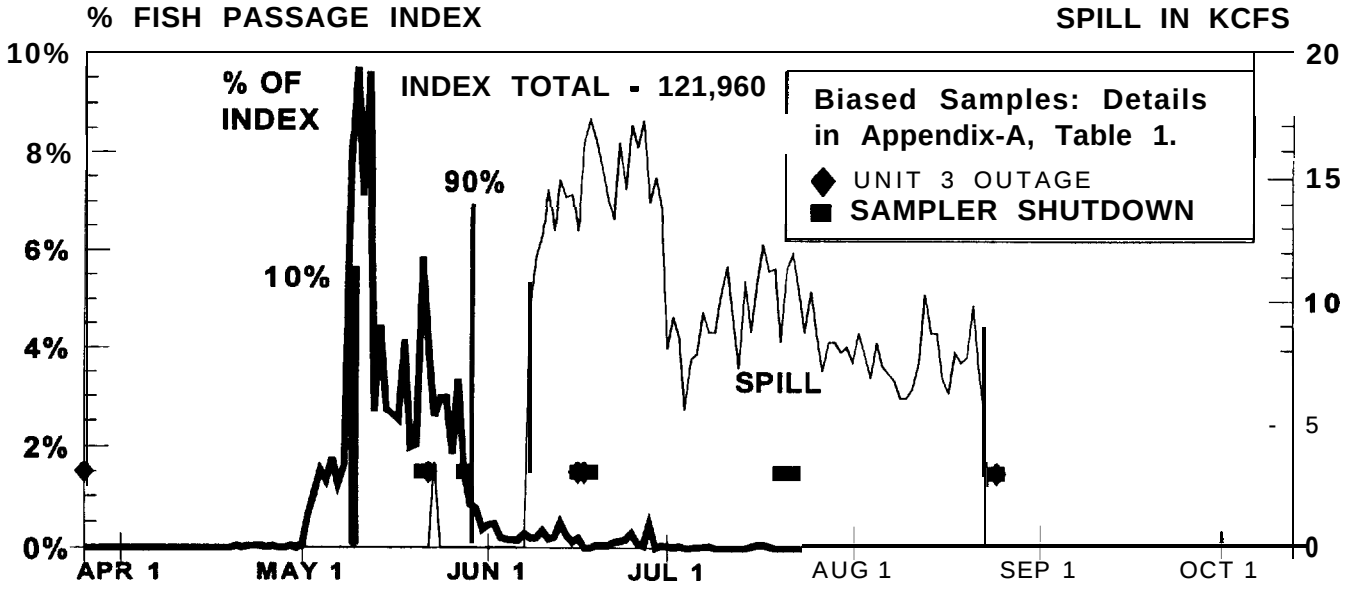
COHO
PASSAGE PATTERN
JOHN DAY DAM - 1992



MONITORING SEASON

FIGURE 6

SOCKEYE
PASSAGE PATTERN
JOHN DAY DAM - 1992



MONITORING SEASON

FIGURE 7

APPENDIX A TABLE 1.

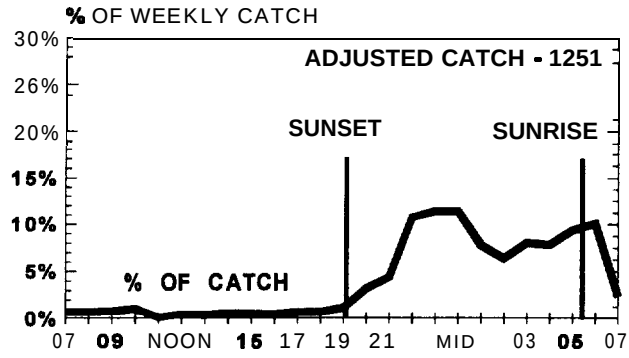
Biased sample dates, John Day Dam 1993 monitoring season (in hours).

End Date	Unit 3	3B Airlift	3C Airlift
3/26	16	--	--
5/20	--	5	5
5/21	10	12	12
5/27	--	--	4
6/17	24	24	24
6/18	10	12	12
7/20	--	24	24
7/21	--	24	24
7/22	--	10	--
8/25 *	9	11	11
Totals	69	122	116

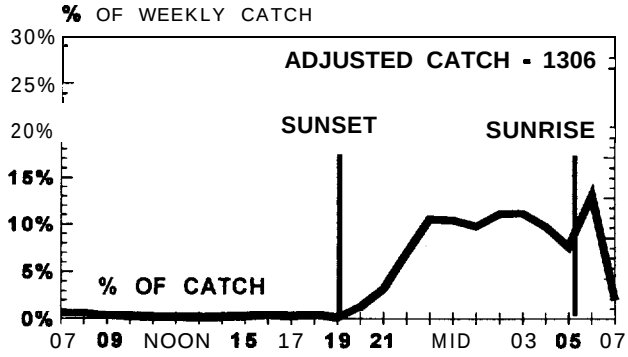
* 10/13 - 10/31 Unit 3 shutdown (432 hours).

YEARLING CHINOOK

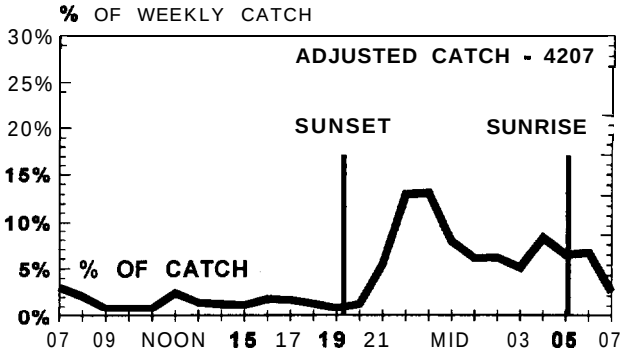
WEEKLY DIEL PATTERN
JOHN DAY DAM, 1992



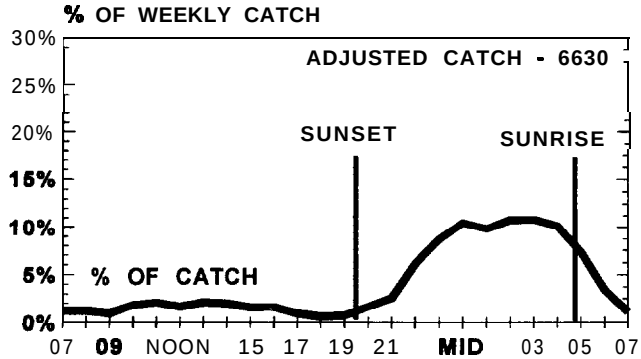
APRIL 16 - APRIL 21
FIGURE 6



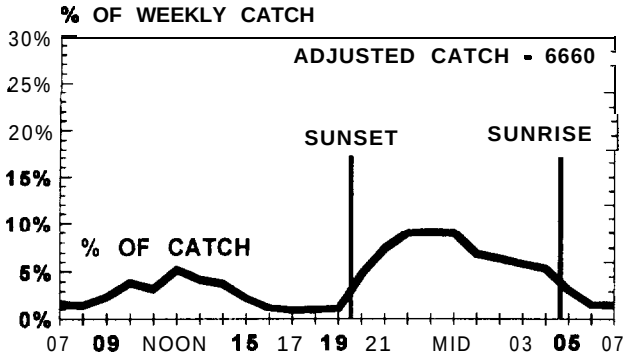
APRIL 22 - APRIL 26
FIGURE 9



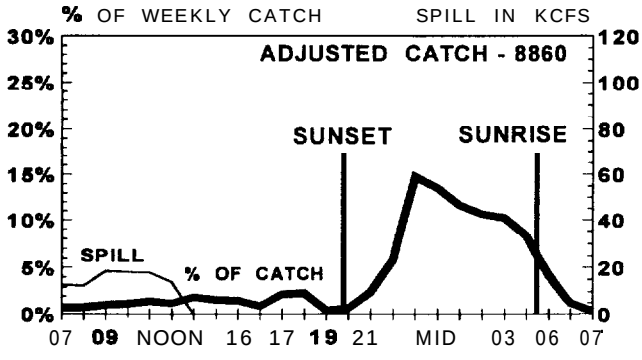
APRIL 29 - MAY 06
FIGURE 10



MAY 06 - MAY 12
FIGURE 11



MAY 13 - MAY 19
FIGURE 12

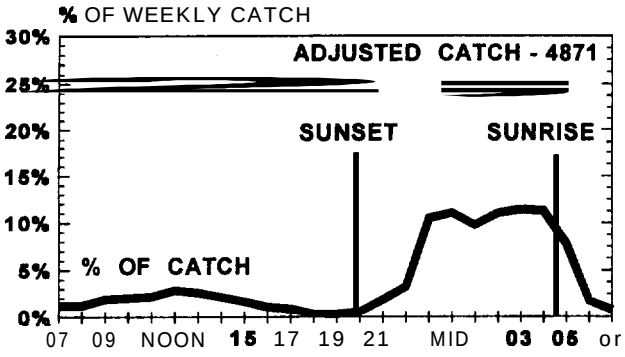


MAY 20 - MAY 26
FIGURE 13

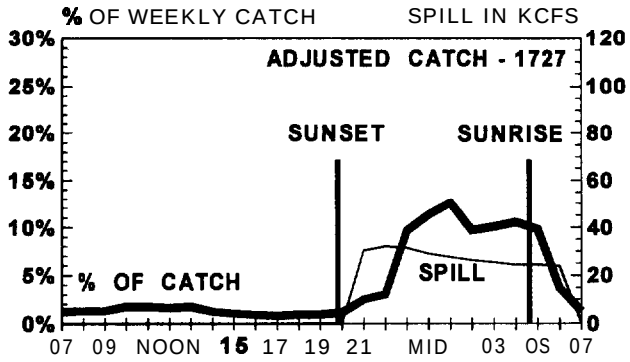
YEARLING CHINOOK

WEEKLY DIEL PATTERN

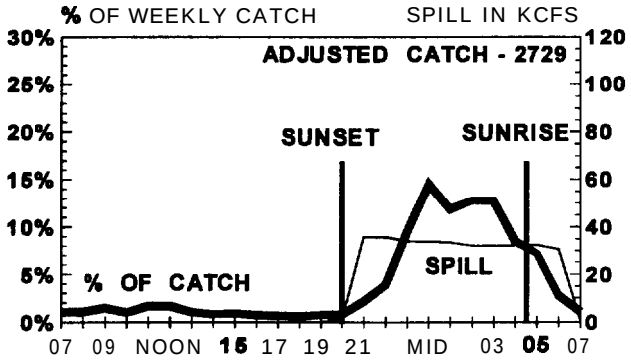
JOHN DAY DAM, 1992



MAY 27 - JUN 02
FIGURE 14



JUN 03 - JUN OS
FIGURE 16

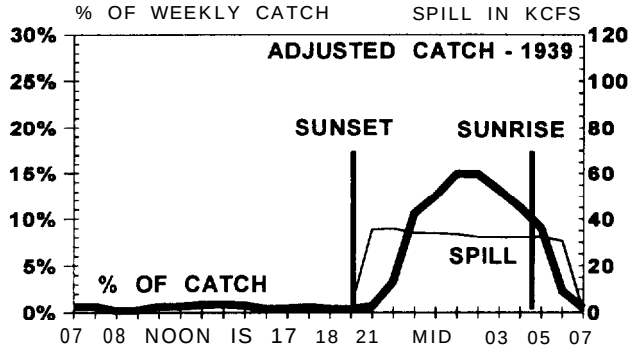


JUN 11 - JUN 17
FIGURE 16

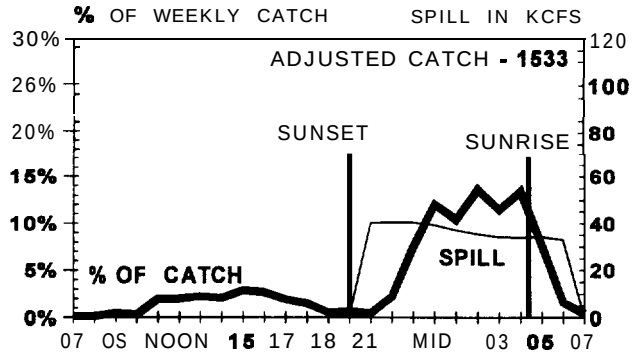
SUBYEARLING CHINOOK

WEEKLY DIEL PATTERN

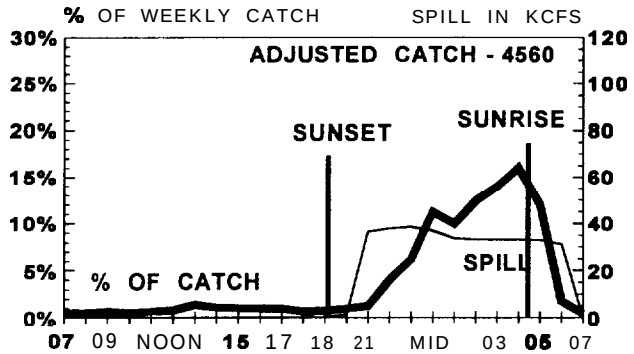
JOHN DAY DAM, 1992



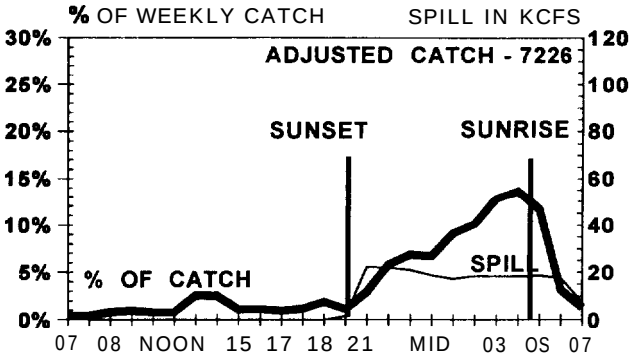
JUN 11 - JUN 17
FIGURE 17



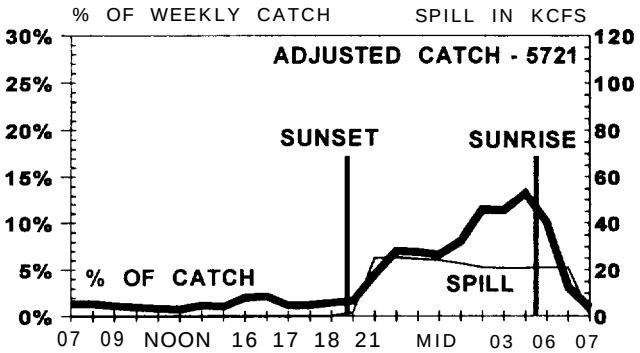
JUN 16 - JUN 24
FIGURE 16



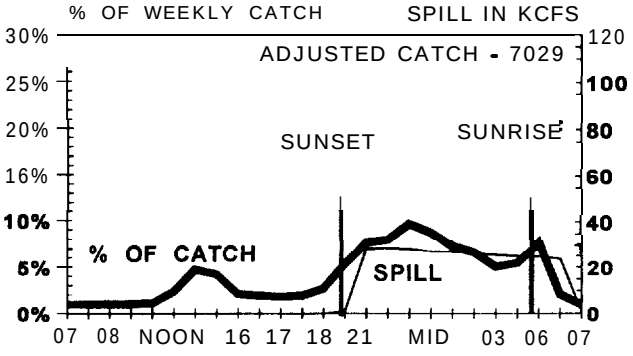
JUN 26 - JUL 01
FIGURE 19



JUL 02 - JUL 06
FIGURE 20



JUL OS - JUL 16
FIGURE 21

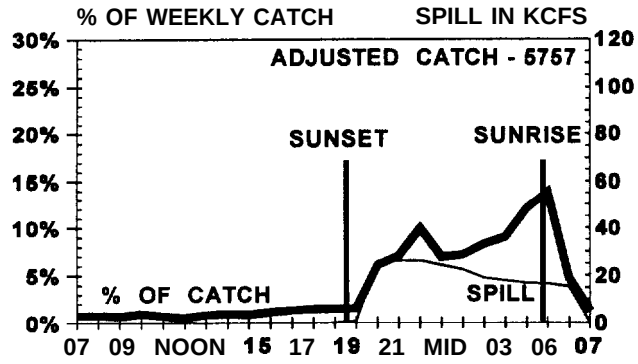


JUL 16 - JUL 22
FIGURE 22

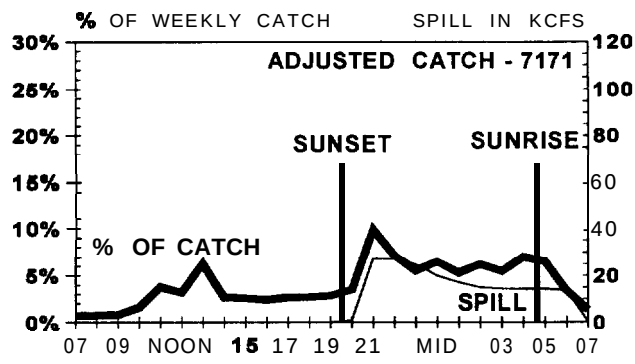
SUBYEARLING CHINOOK

WEEKLY DIEL PATTERN

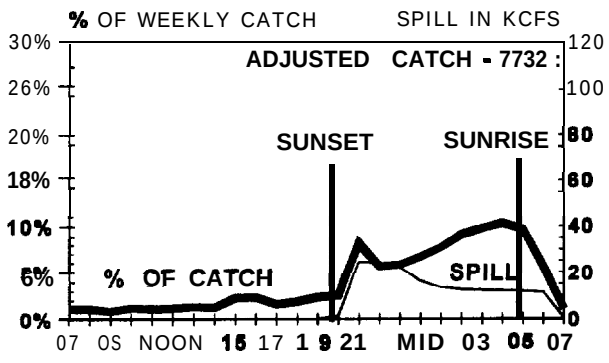
JOHN DAY DAM, 1992



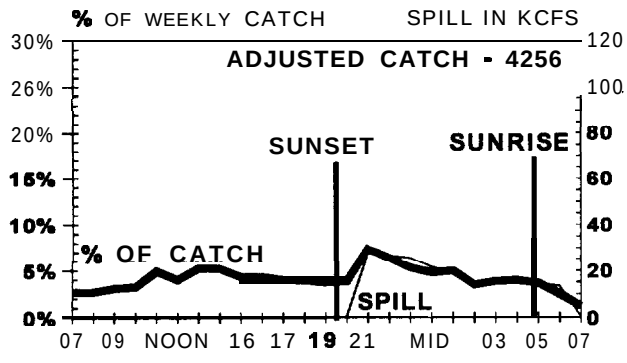
JUL 23 - JUL 29
FIGURE 23



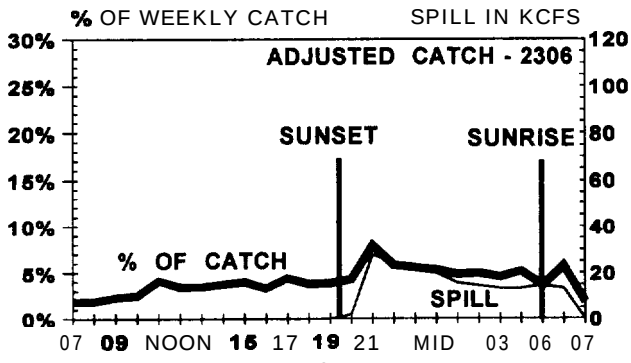
JUL 30 - AUG 05
FIGURE 24



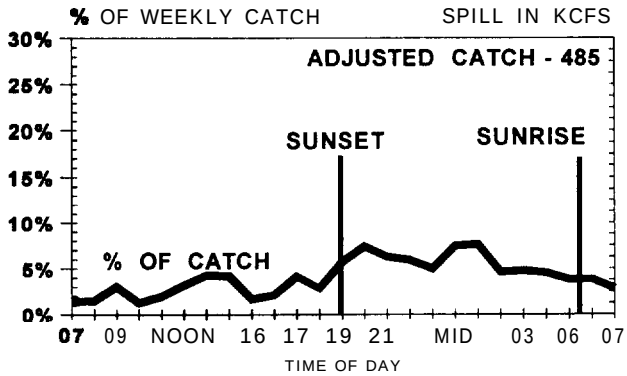
AUG 06 - AUG 12
FIGURE 26



AUG 13 - AUG 19
FIGURE 26



AUG 20 - AUG 26
FIGURE 27

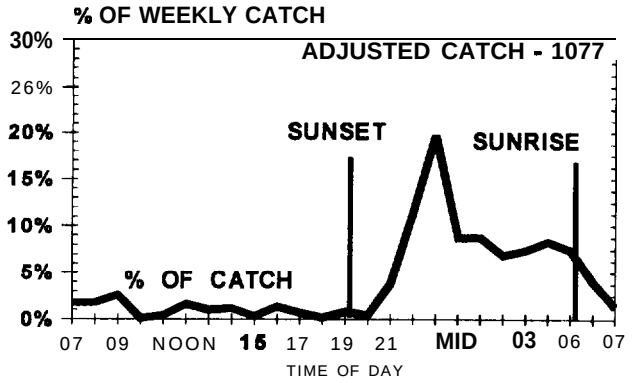


AUG 27 - SEP 02
FIGURE 28

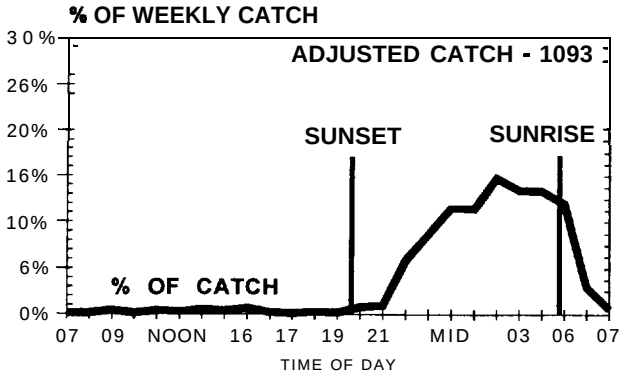
WILD STEELHEAD (UNCLIPPED)

WEEKLY DIEL PATTERN

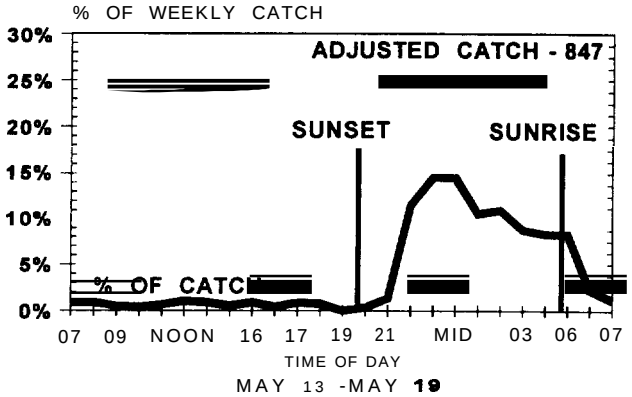
JOHN DAY DAM, 1992



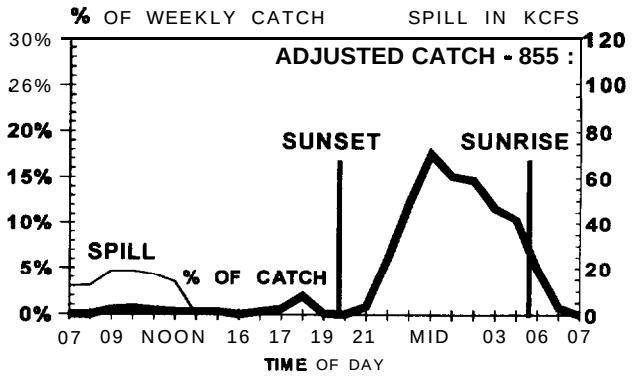
APR 29 - MAY 06
FIGURE 29



MAY 06 - MAY 12
FIGURE 30



MAY 13 -MAY 19
FIGURE 31

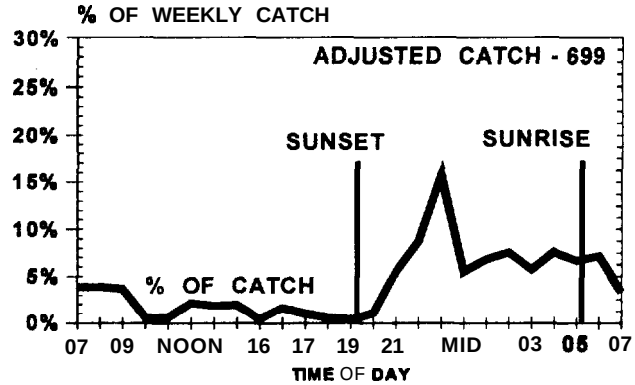


MAY 20 - MAY 26
FIGURE 32

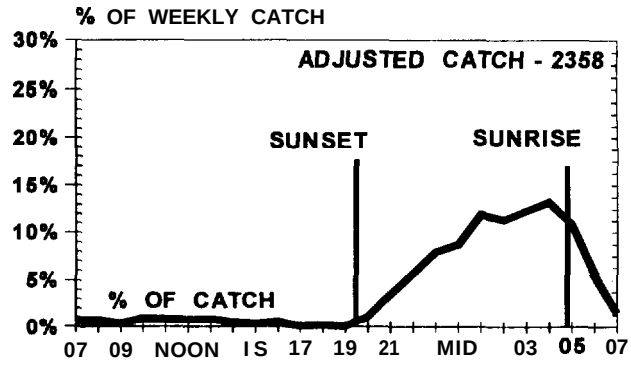
HATCHERY STEELHEAD (CLIPPED)

WEEKLY DIEL PATTERN

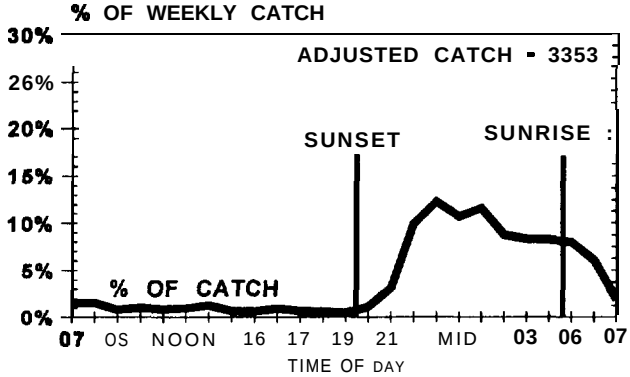
JOHN DAY DAM, 1992



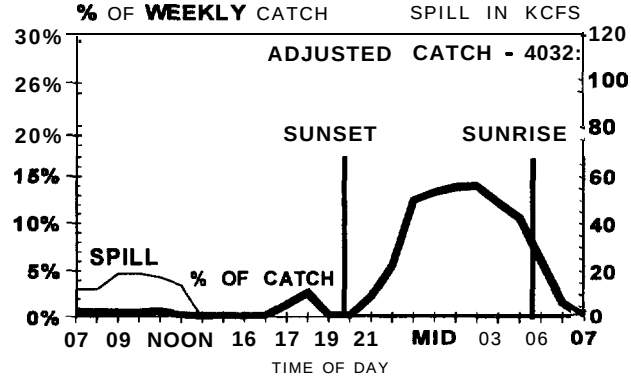
APR 26 - MAY 06
FIGURE 33



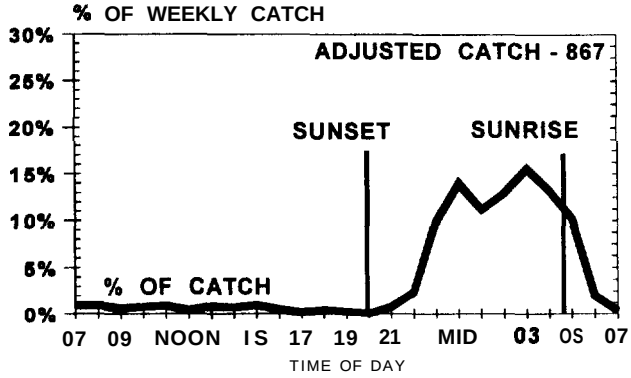
MAY 06 - MAY 12
FIGURE 34



MAY 13 - MAY 19
FIGURE 26



MAY 20 - MAY 26
FIGURE 36

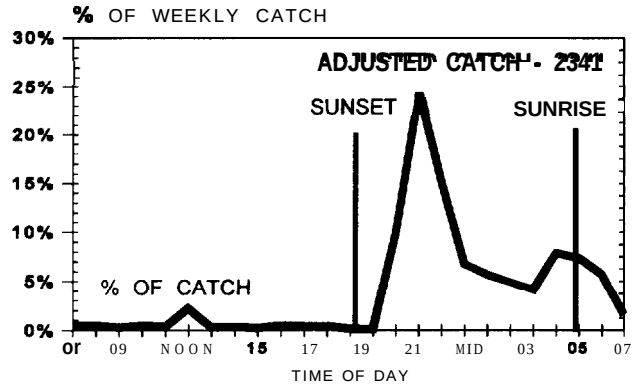


MAY 27 - JUN 02
FIGURE 27

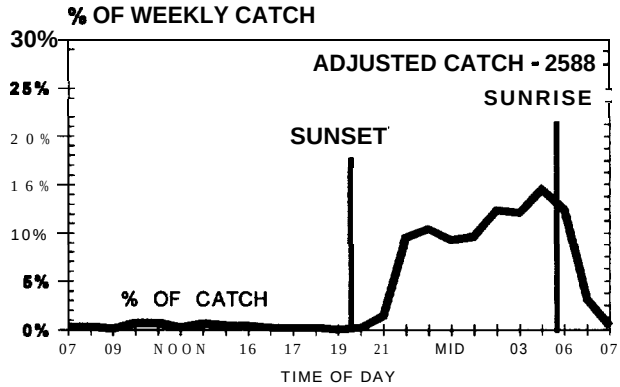
COHO

WEEKLY DIEL PATTERN

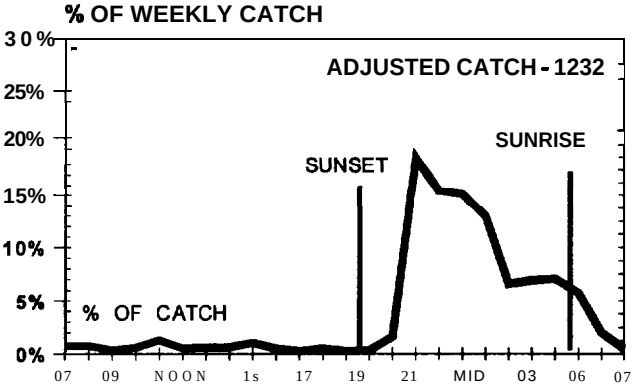
JOHN DAY DAM, 1992



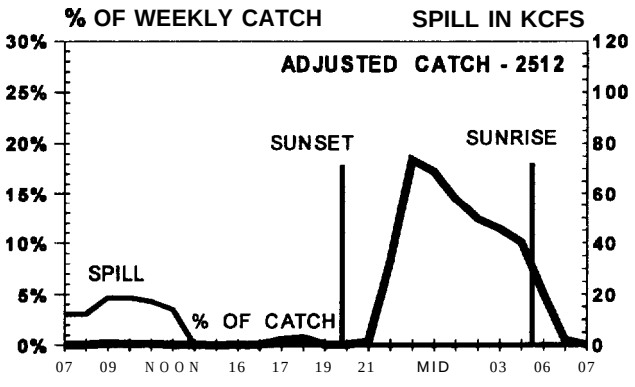
APR 29 - MAY 05
FIGURE 38



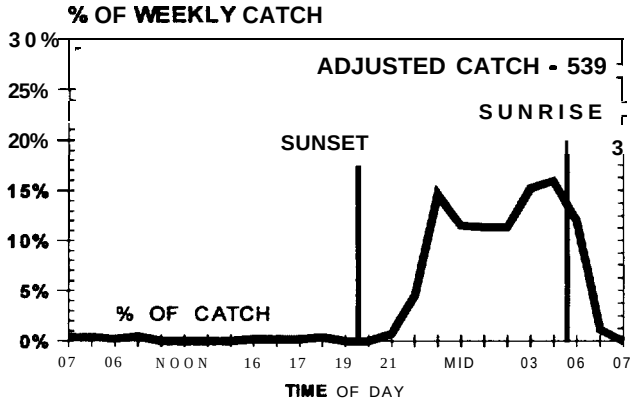
MAY 06 - MAY 12
FIGURE 39



MAY 13 - MAY 19
FIGURE 40

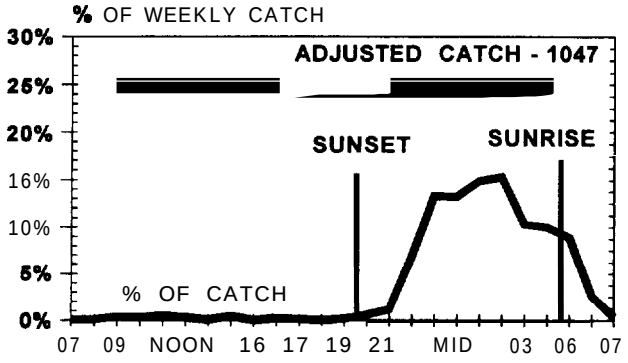


MAY 20 - MAY 26
FIGURE 41

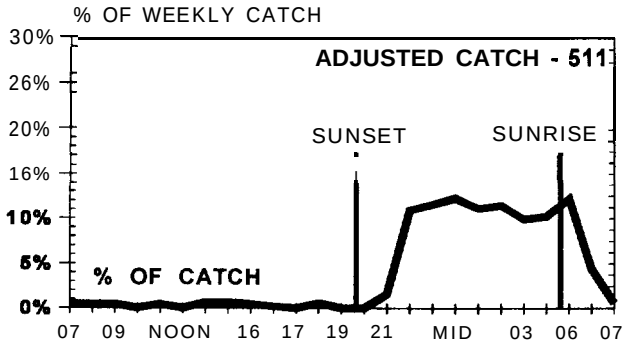


MAY 27 - JUN 02
FIGURE 42

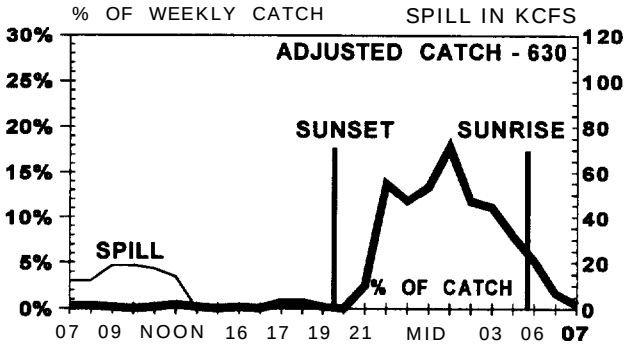
SOCKEYE
WEEKLY DIEL PATTERN
JOHN DAY DAM, 1992



MAY 06 - MAY 12
FIGURE 43



MAY 13 - MAY 19
FIGURE 44



MAY 20 - MAY 26
FIGURE 46

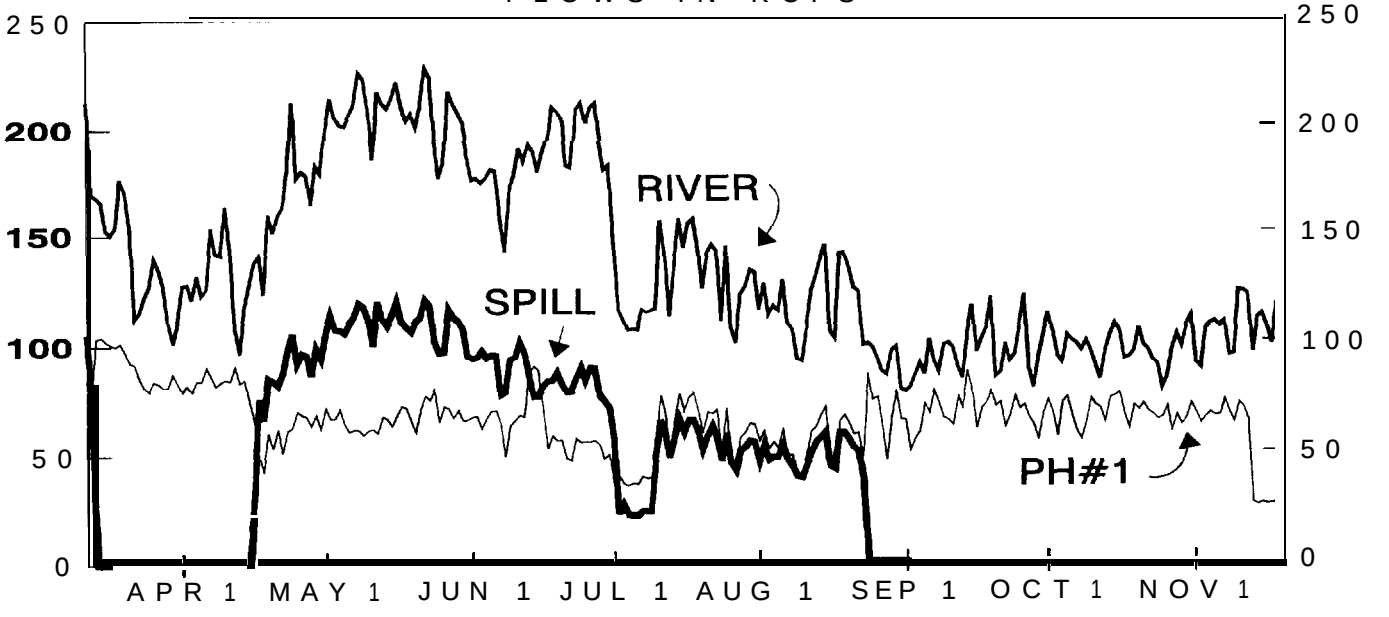
APPENDIX B
BONNEVILLE DAM - 1992

RIVER, SPILL AND POWERHOUSE #1

DAILY AVERAGE FLOWS

BONNEVILLE DAM - 1992

FLOWS IN KCFS



MONITORING SEASON

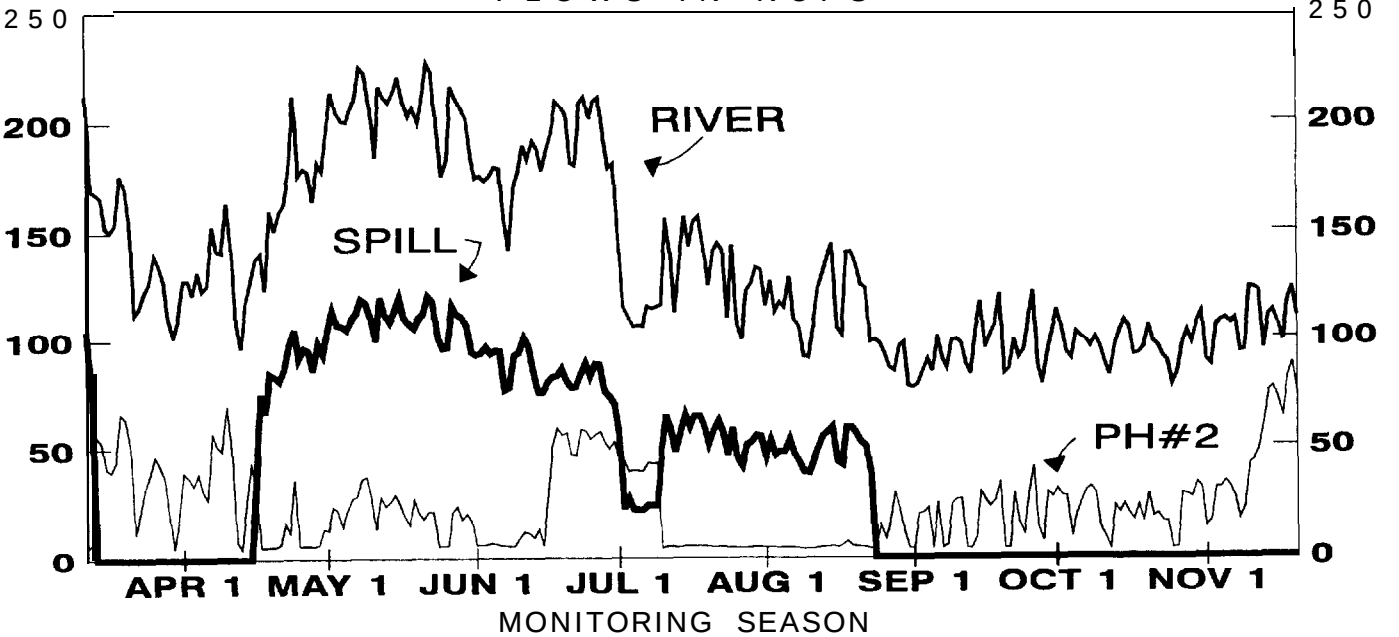
FIGURE 1

RIVER, SPILL AND POWERHOUSE #2

DAILY AVERAGE FLOWS

BONNEVILLE DAM - 1992

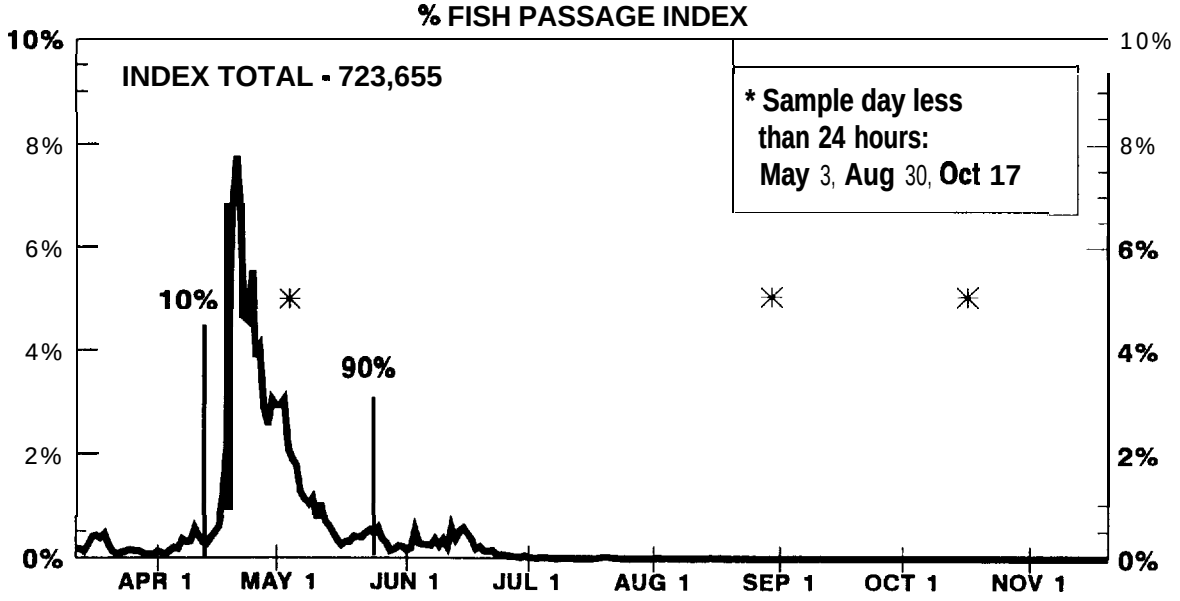
FLOWS IN KCFS



MONITORING SEASON

FIGURE 2

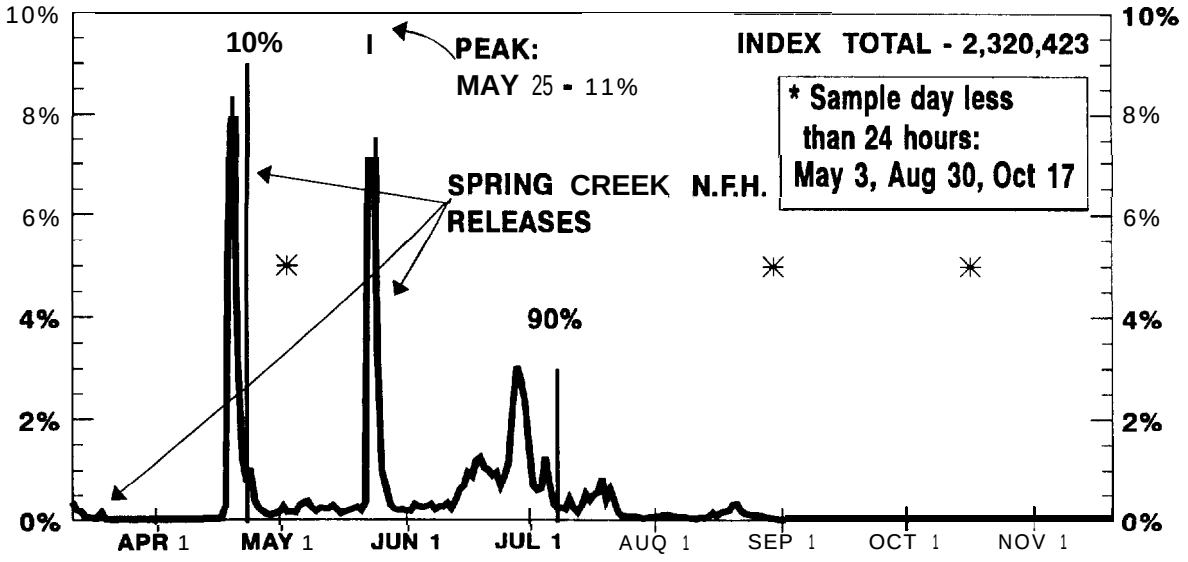
YEARLING CHINOOK
PASSAGE PATTERN
BONNEVILLE DAM, DSM#1 - 1992
% FISH PASSAGE INDEX



MONITORING SEASON

FIGURE 3

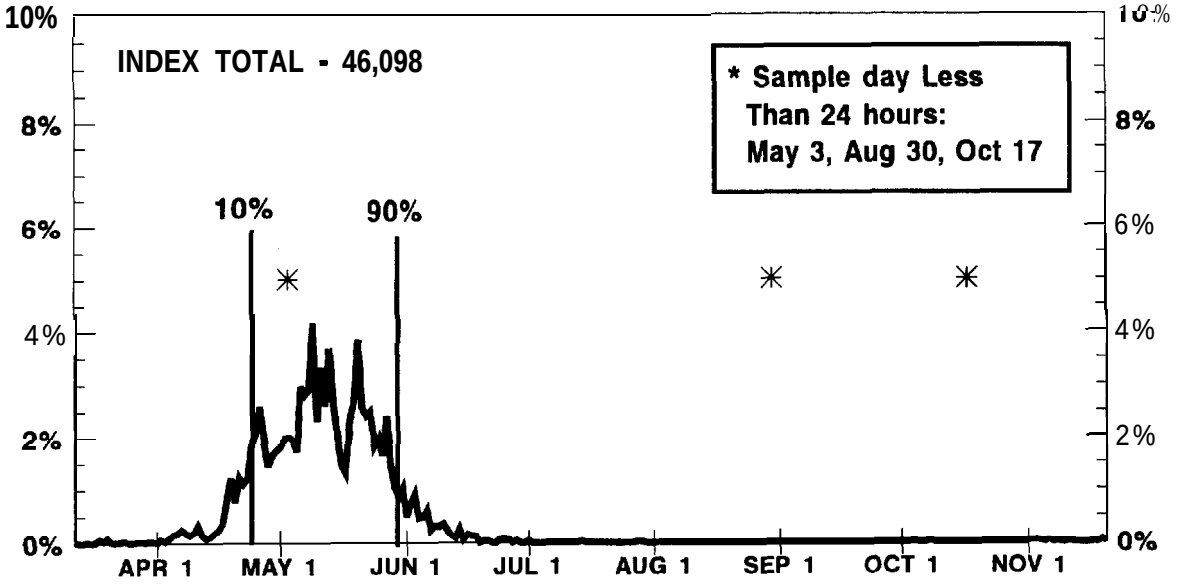
SUBYEARLING CHINOOK
PASSAGE PATTERN
BONNEVILLE DAM, DSM#1 - 1992
% FISH PASSAGE INDEX



MONITORING SEASON

FIGURE 4

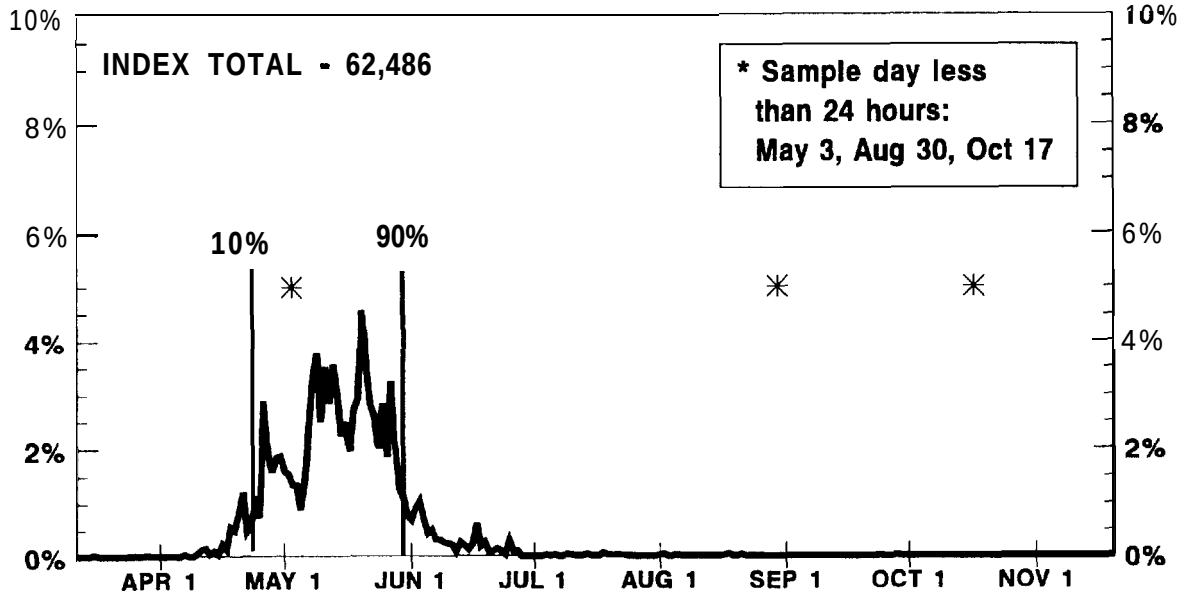
WILD STEELHEAD (UNCLIPPED)
PASSAGE PATTERN
BONNEVILLE DAM, DSM#1 - 1992
% FISH PASSAGE INDEX



MONITORING SEASON

FIGURE 5

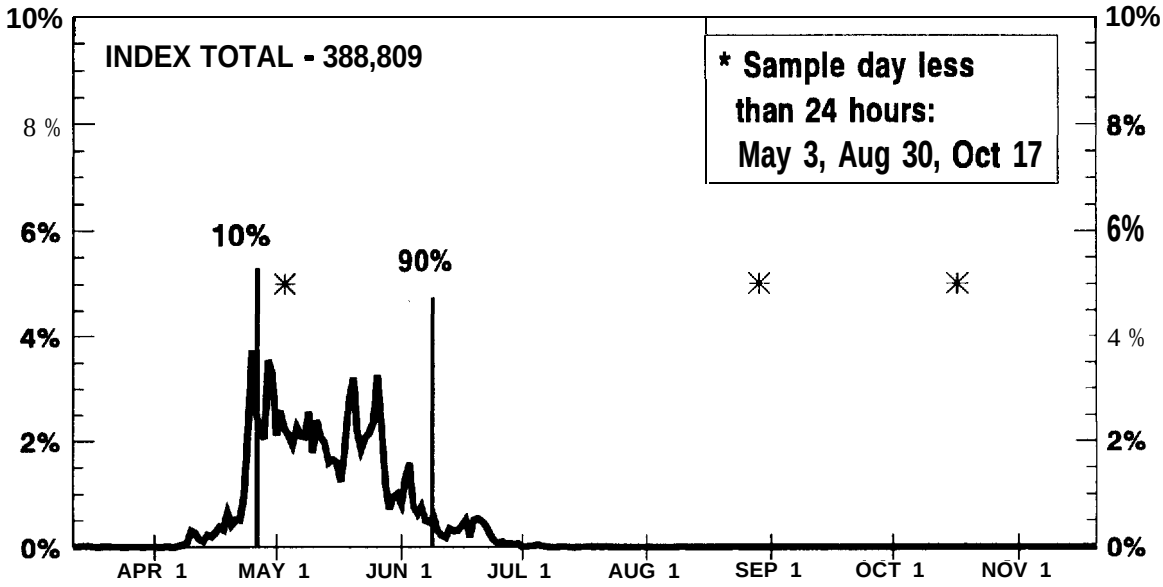
HATCHERY STEELHEAD (CLIPPED)
PASSAGE PATTERN
BONNEVILLE DAM, DSM#1 - 1992
% FISH PASSAGE INDEX



MONITORING SEASON

FIGURE 6

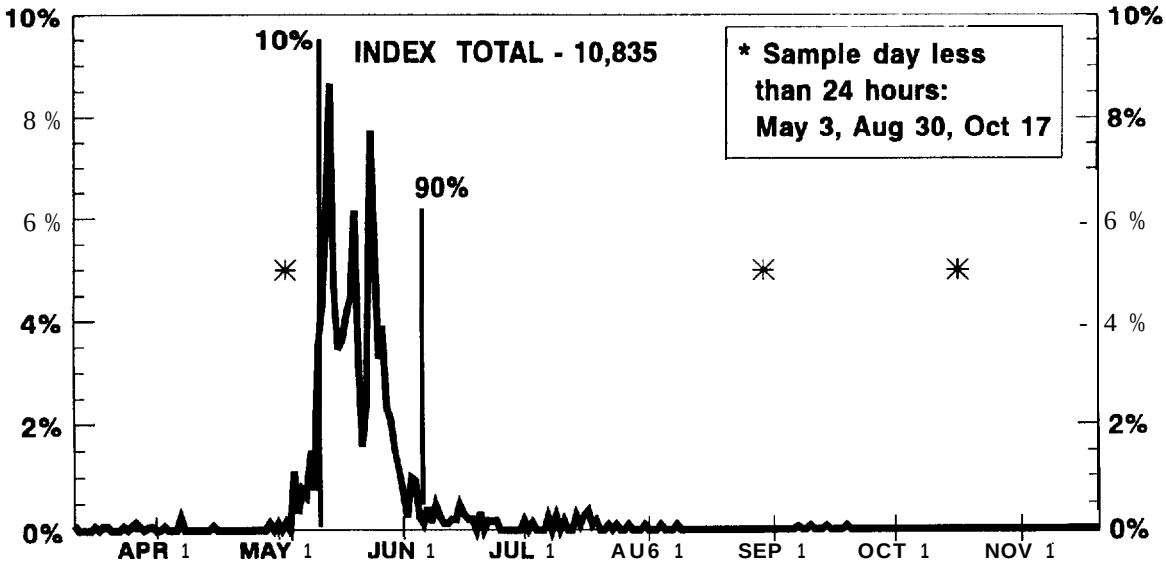
COHO
PASSAGE PATTERN
BONNEVILLE DAM, DSM#1 - 1992
% FISH PASSAGE INDEX



MONITORING SEASON

FIGURE 7

SOCKEYE
PASSAGE PATTERN
BONNEVILLE DAM, DSM#1 - 1992
% FISH PASSAGE INDEX



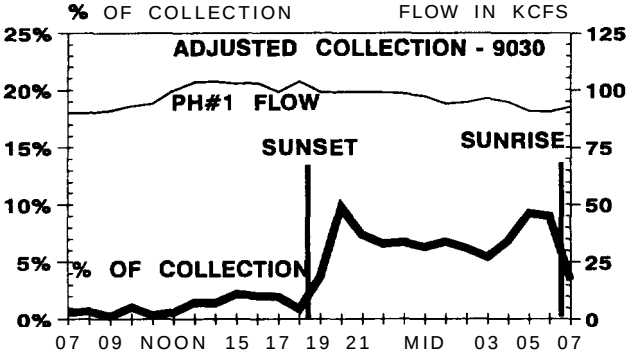
MONITORING SEASON

FIGURE 8

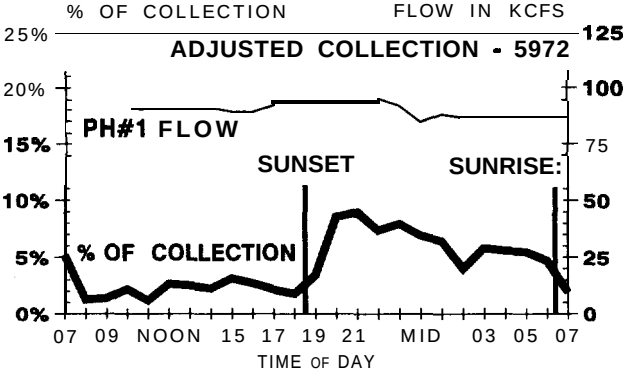
YEARLING CHINOOK

DIEL PATTERNS

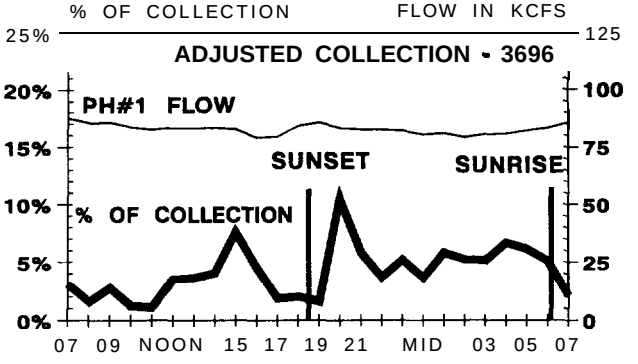
BONNEVILLE DAM, DSM#1 - 1992



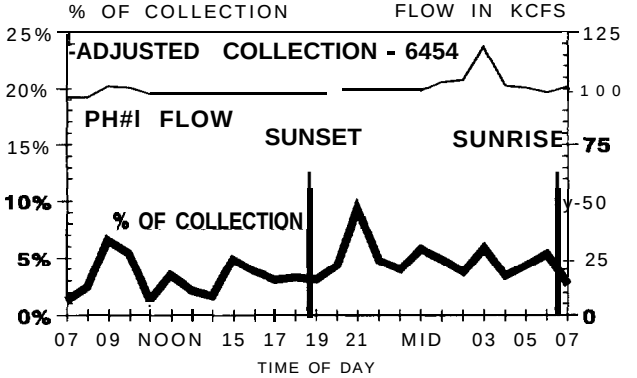
MAR 11 -MAR 17
FIGURE 9



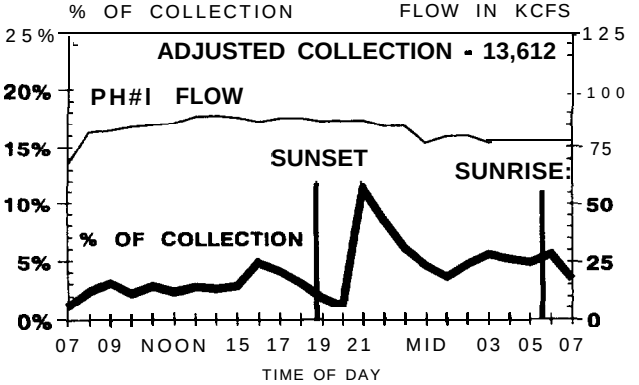
MAR 18 - MAR 24
FIGURE 10



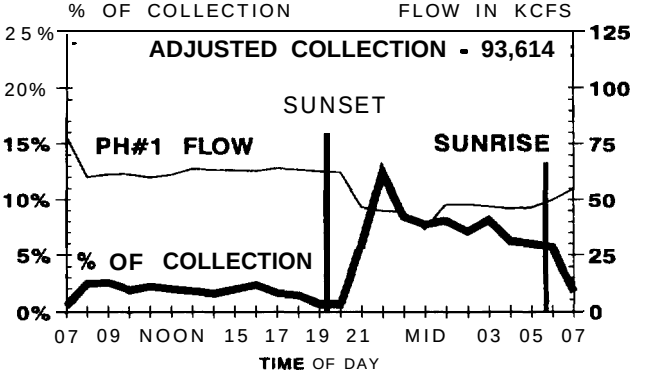
MAR 25 - MAR 31
FIGURE 11



APR 01 - APR 07
FIGURE 12

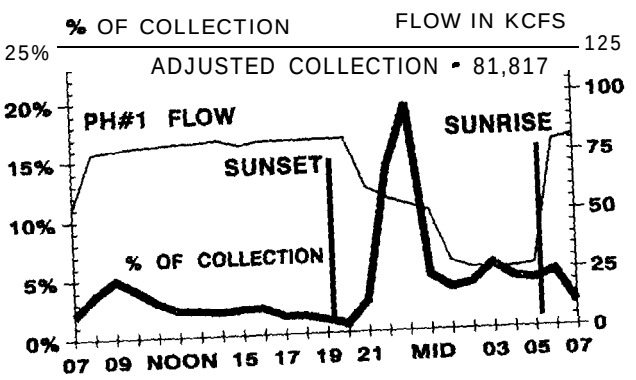


APR 08 - APR 14
FIGURE 13

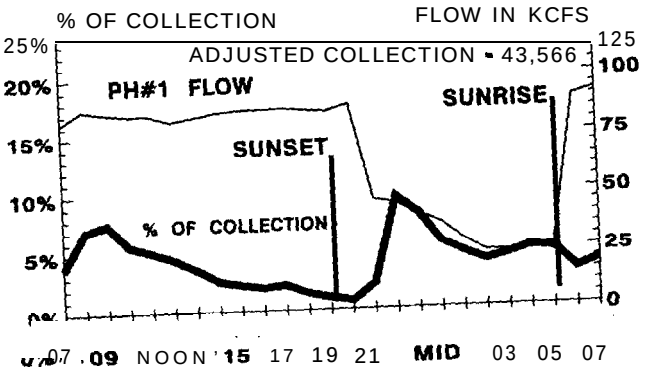


APR 15 - APR 21
FIGURE 14

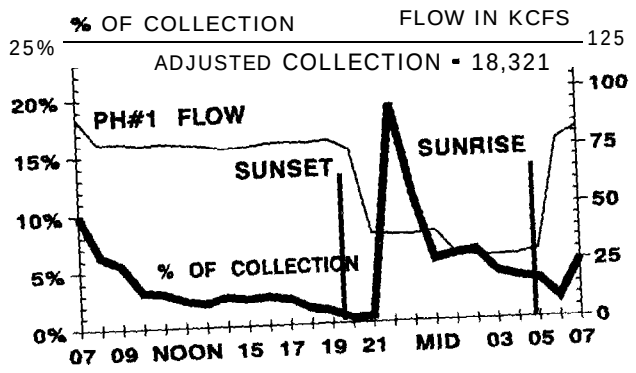
YEARLING CHINOOK
DIEL PATTERNS
BONNEVILLE DAM, DSM#1 - 1992



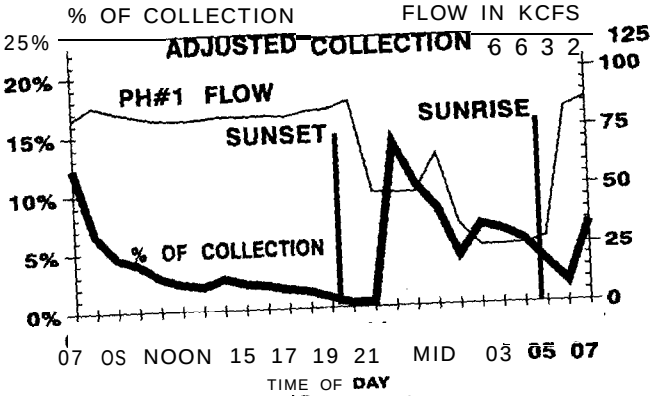
TIME OF RAY
APR 22 - APR 28
FIGURE 15



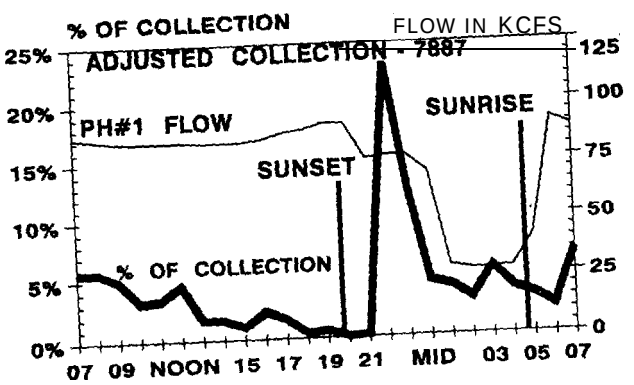
TIME OF DAY
APR 29 - MAY 05
FIGURE 16



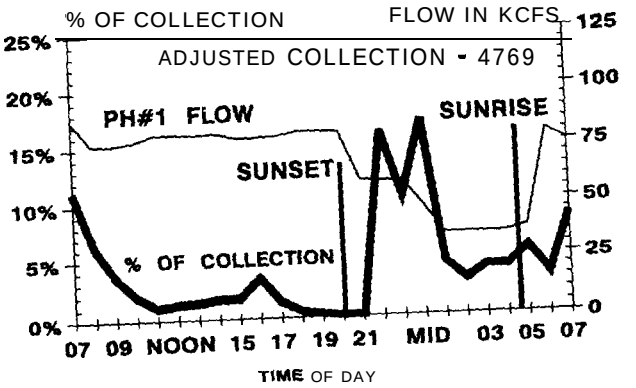
TIME OF DAY
MAY 06 - MAY 12
FIGURE 17



TIME OF DAY
MAY 13 - MAY 19
FIGURE 18



TIME OF DAY
MAY 20 - MAY 26
FIGURE 19

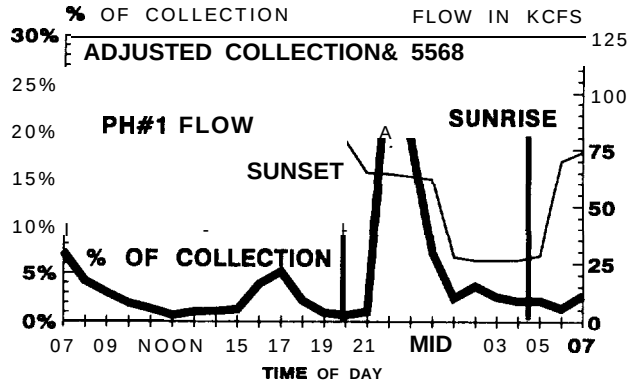


TIME OF DAY
MAY 27 - JUN 02
FIGURE 20

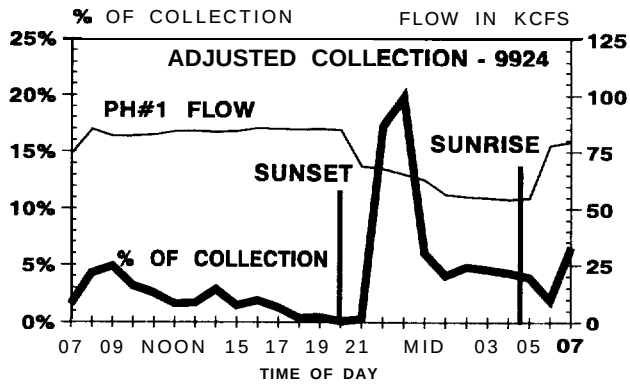
YEARLING CHINOOK

DIEL PATTERNS

BONNEVILLE DAM, DSM#1 - 1992



JUN 03 - JUN 09
FIGURE 21



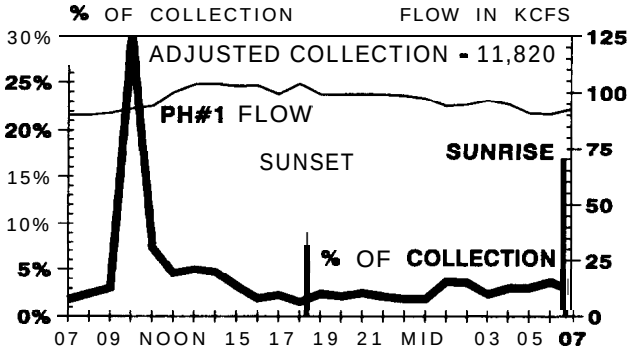
JUN 10 - JUN 16
FIGURE 22

SUBYEARLING CHINOOK

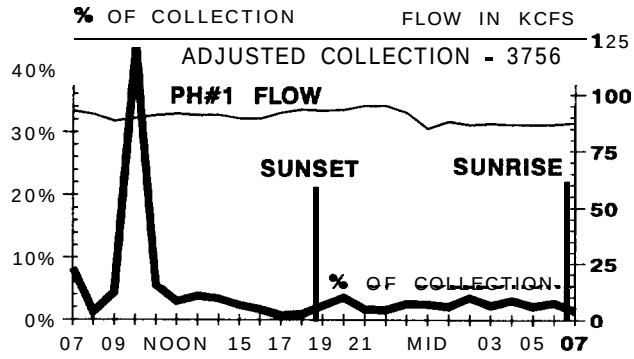
DIEL PATTERNS (TULE STOCK)

BONNEVILLE DAM, DSM#1 - 1992

3/5 RELEASE (SCNFH)

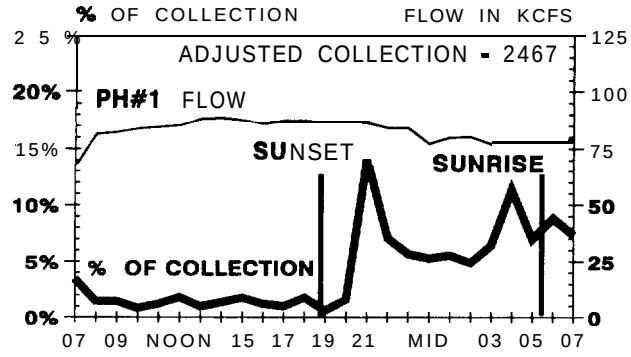


MAR 11 -MAR 17
FIGURE 23

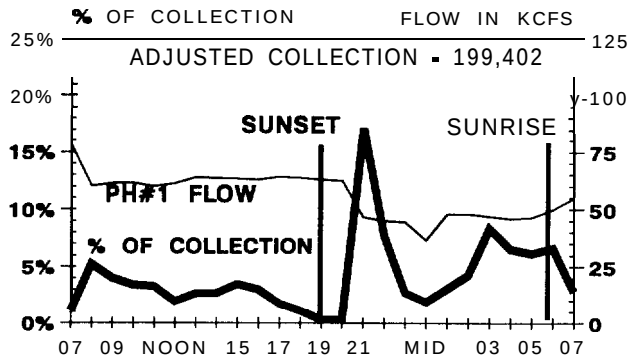


MAR 18 - MAR 24
FIGURE 24

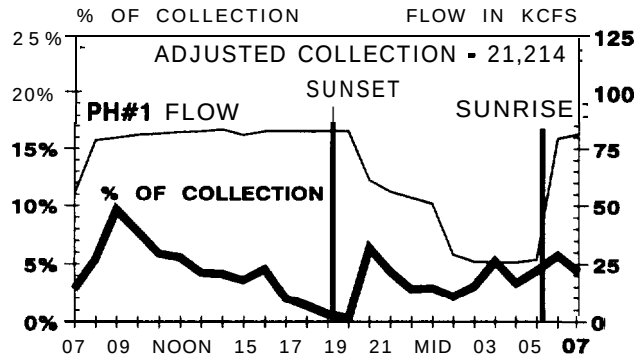
4/16 RELEASE (SCNFH)



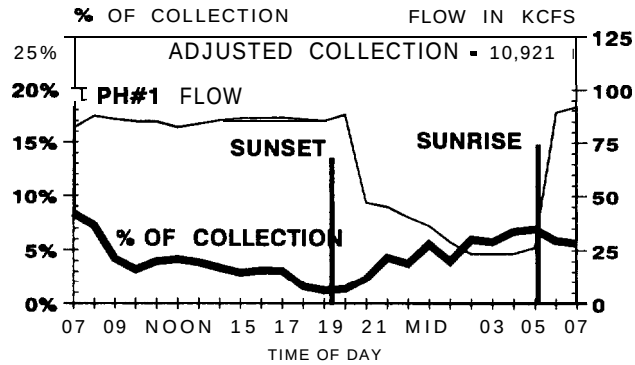
APR 08 - APR 14
FIGURE 25



APR 15 - APR 21
FIGURE 26



APR 22 - APR 28
FIGURE 27



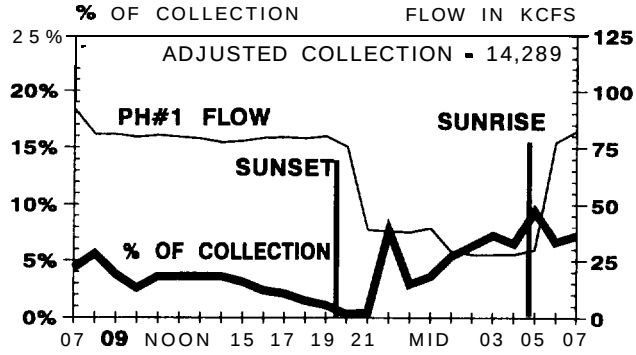
APR 29 - MAY 05
FIGURE 29

(SCNFH) Spring Creek National Fish Hatchery

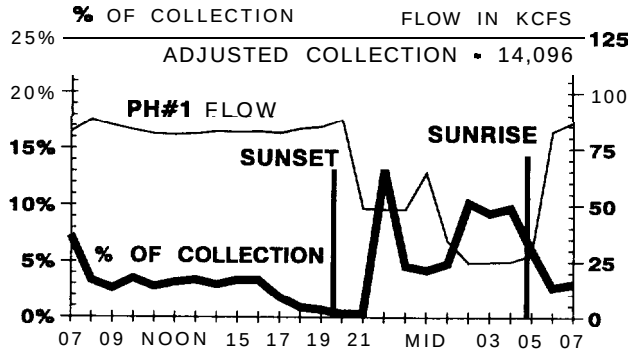
SUBYEARLING CHINOOK

DIEL PATTERNS (TULE STOCK)

BONNEVILLE DAM, DSM#1 - 1992

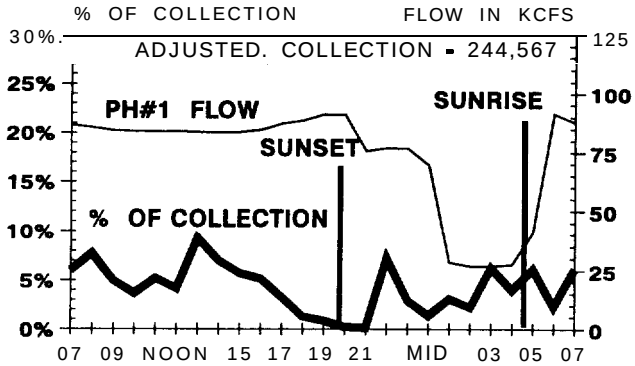


MAY 06 - MAY 12
FIGURE 29

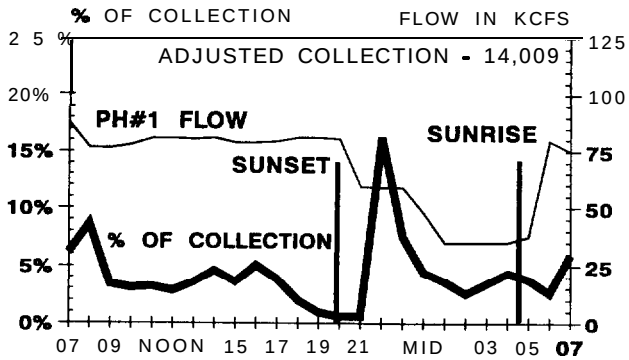


MAY 13 - MAY 19
FIGURE 30

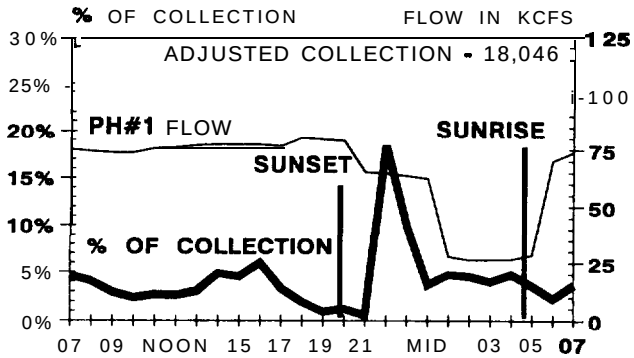
5/21 RELEASE (SCNFH)



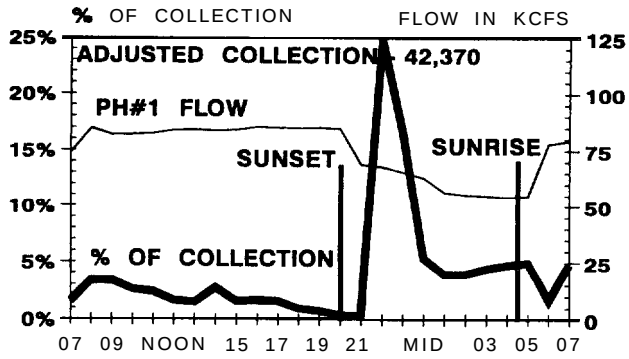
MAY 20 - MAY 26
FIGURE 31



MAY 27 - JUN 02
FIGURE 32



JUN 03 - JUN 09
FIGURE 33



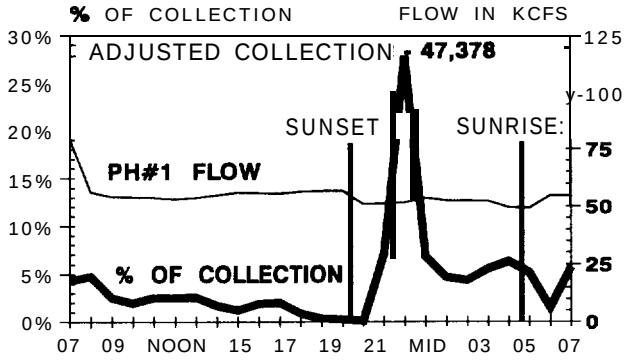
JUN 10 - JUN 16
FIGURE 34

(SCNFH) Spring Creek National Fish Hatchery

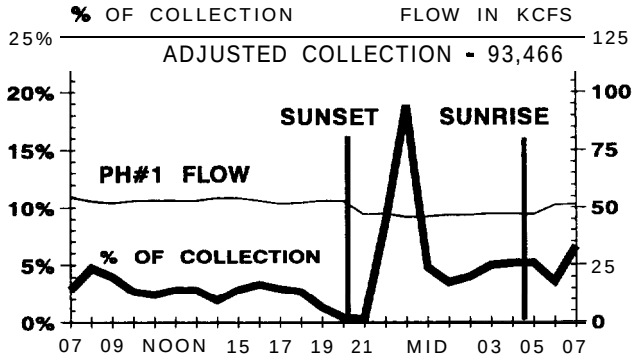
SUBYEARLING CHINOOK

DIEL PATTERNS (UPRIVER BRIGHT STOCK)

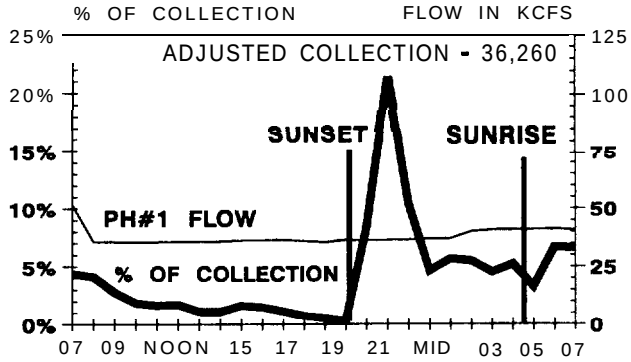
BONNEVILLE DAM, DSM#1 - 1992



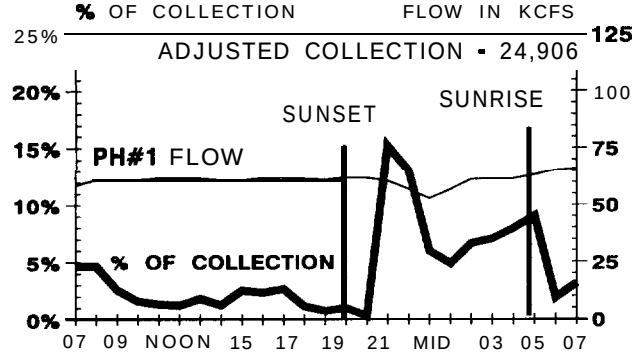
JUN 17 - JUN 23
FIGURE 35



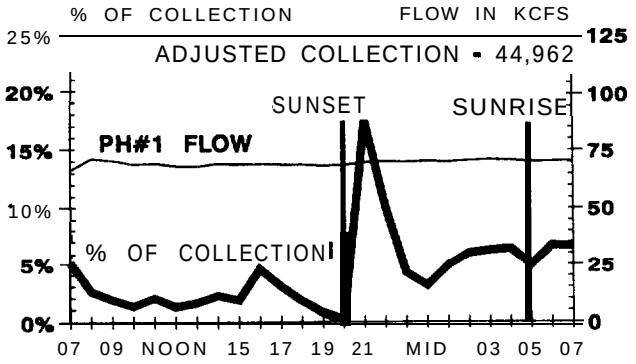
JUN 24 - JUN 30
FIGURE 36



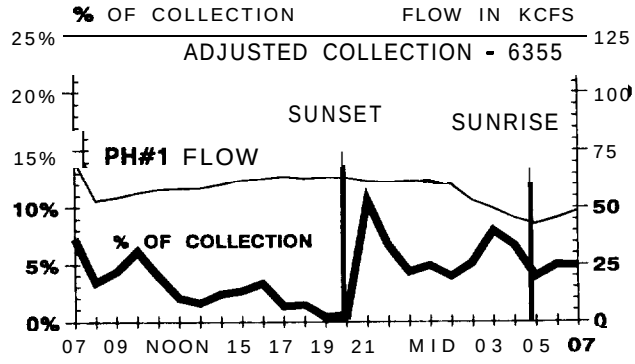
JUL 01 - JUL 07
FIGURE 37



JUL 08 - JUL 14
FIGURE 38



JUL 15 - JUL 21
FIGURE 39

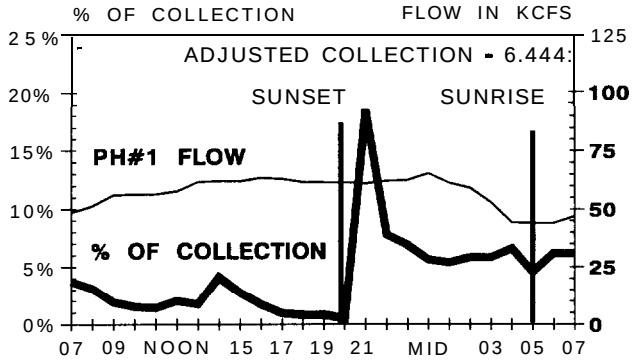


JUL 22 - JUL 28
FIGURE 40

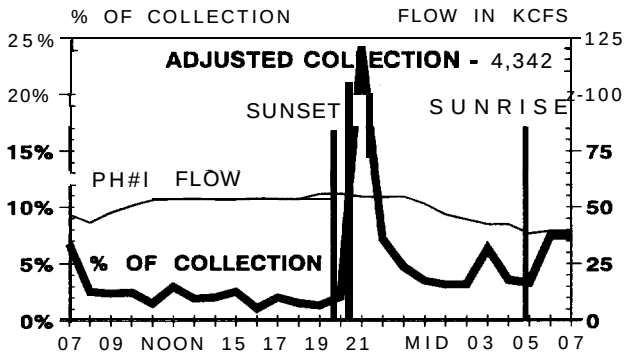
SUBYEARLING CHINOOK

DIEL PATTERNS (UPRIVER BRIGHT STOCK)

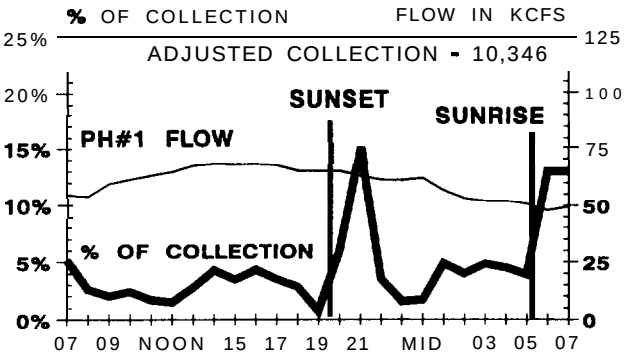
BONNEVILLE DAM, DSM#1 - 1992



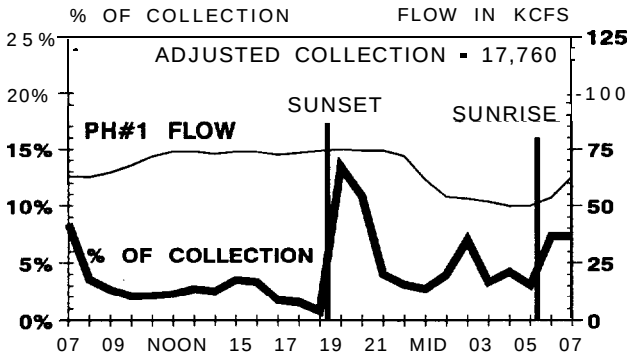
JUL 29 - AUG 04
FIGURE 41



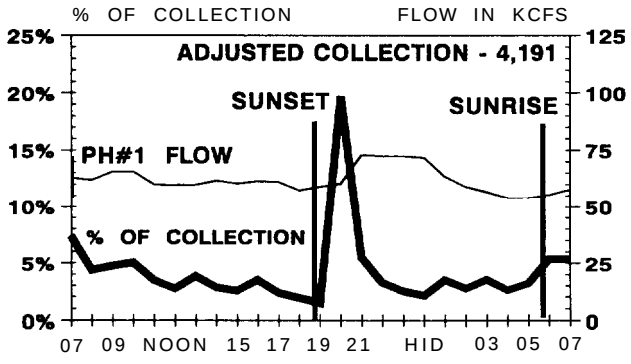
AUG 05 - AUG 11
FIGURE 42



AUG 12 - AUG 18
FIGURE 43



AUG 19 - AUG 25
FIGURE 44

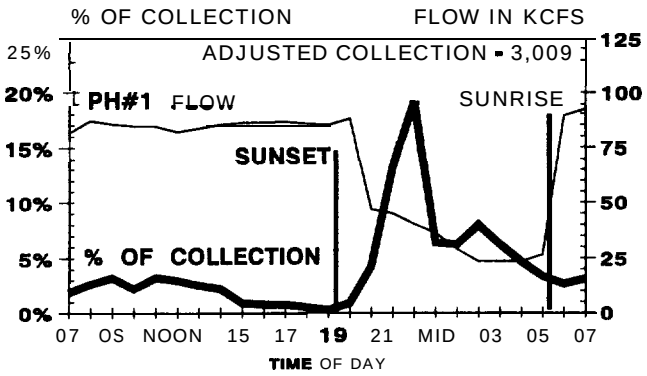


AUG 26 - SEP 01
FIGURE 45

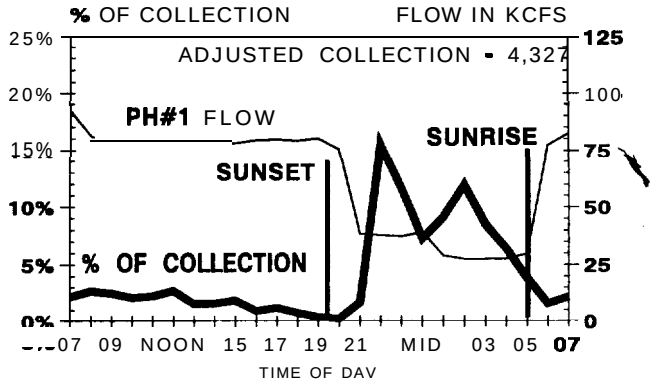
UNCLIPPED STEELHEAD

DIEL PATTERNS

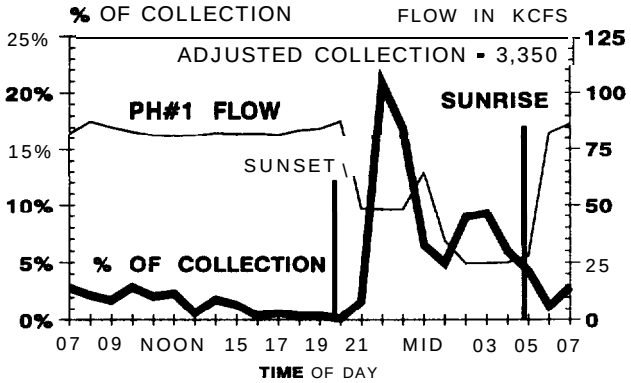
BONNEVILLE DAM, DSM#1 - 1992



APR 29 - MAY OS
FIGURE 46



MAY 06 - MAY 12
FIGURE 47

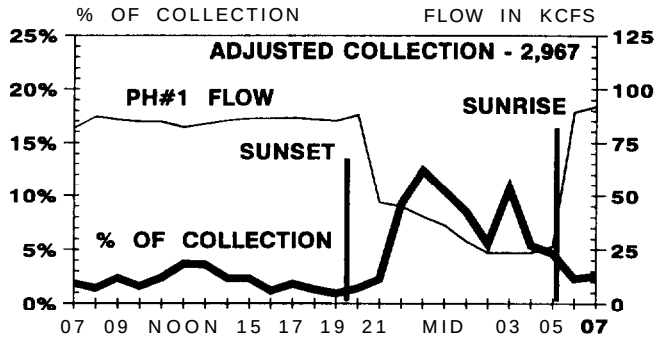


MAY 13 -MAY 19
FIGURE 45

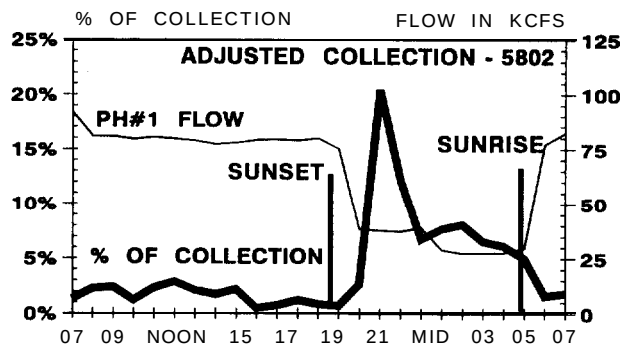
CLIPPED STEELHEAD

DIEL PATTERNS

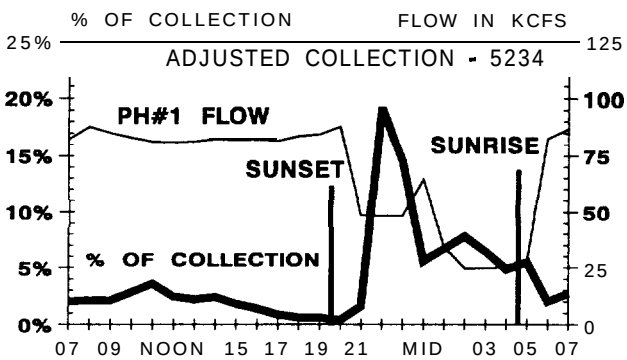
BONNEVILLE DAM, DSM#1 - 1992



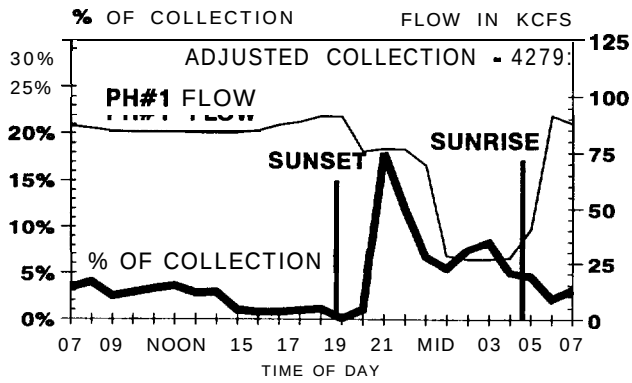
APR 29 - MAY 05
FIGURE 49



MAY 06 -MAY 12
FIGURE 50



MAY 13 -MAY 19
FIGURE 51

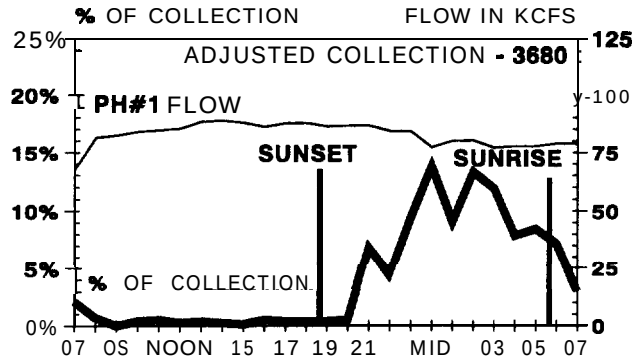


MAY 20 - MAY 26
FIGURE 52

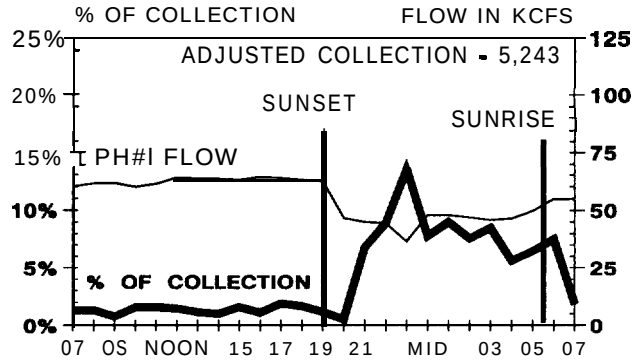
COHO

DIEL PATTERNS

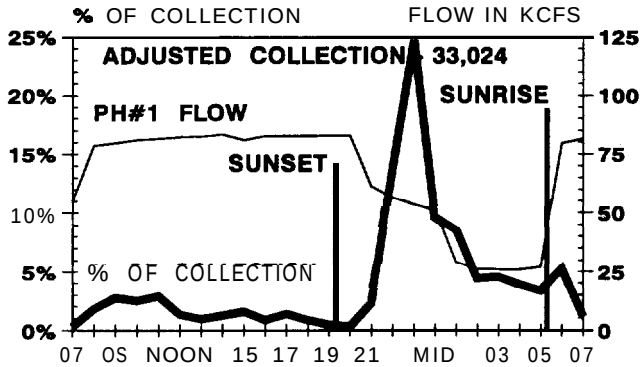
BONNEVILLE DAM, DSM#1 - 1992



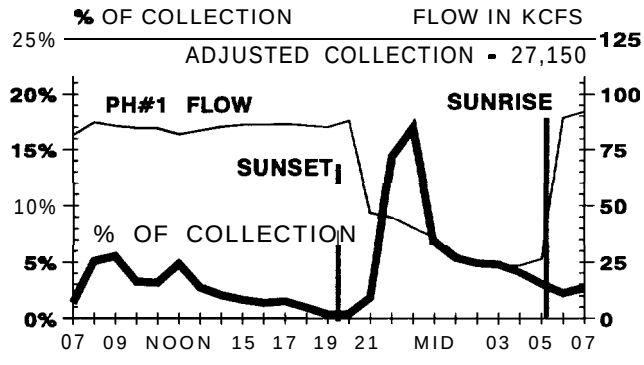
APR 08 - APR 14
FIGURE 53



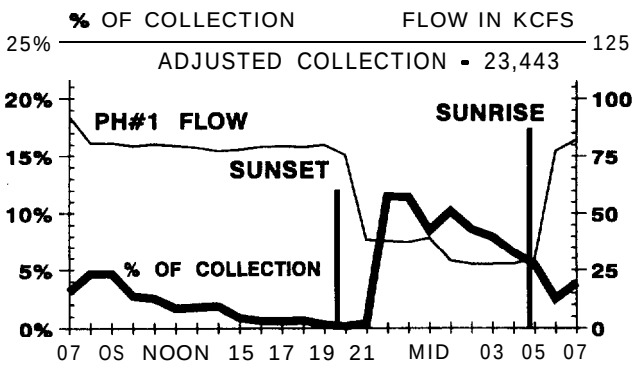
APR 15 - APR 21
FIGURE 54



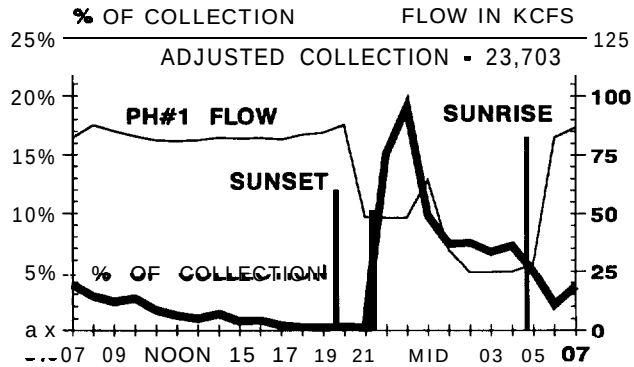
APR 22 - APR 29
FIGURE 55



APR 29 - MAY 05
FIGURE 56



MAY 06 - MAY 12
FIGURE 57

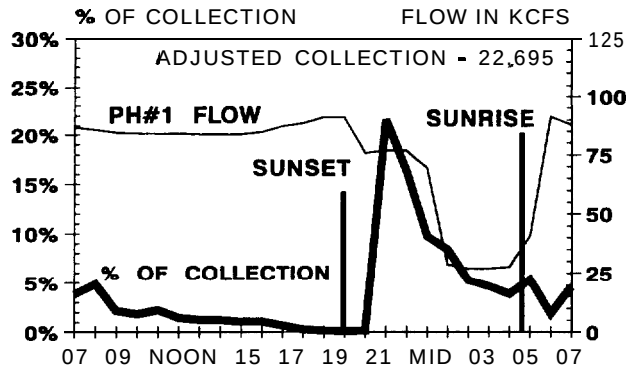


MAY 13 -MAY 19
FIGURE 59

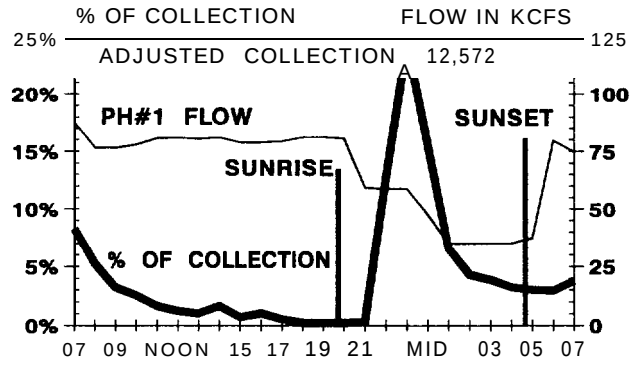
COHO

DIEL PATTERNS

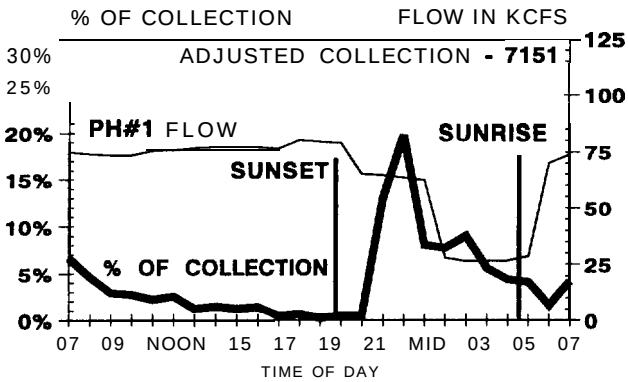
BONNEVILLE DAM, DSM#1 - 1992



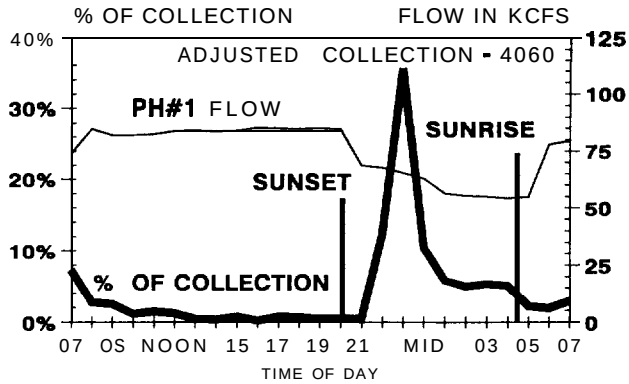
MAY 20 - MAY 26
FIGURE 59



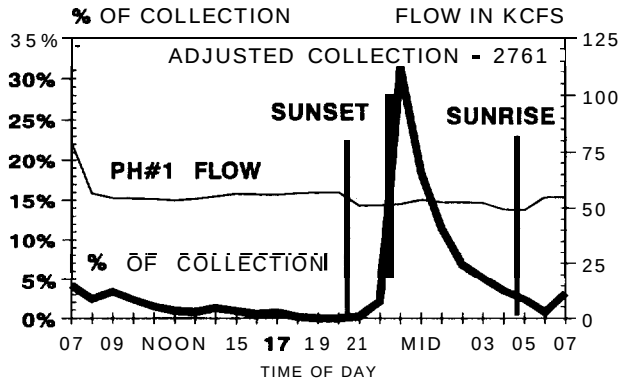
MAY 27 - JUN 02
FIGURE 60



JUN 03 - JUN 09
FIGURE 61



JUN 10 - JUN 16
FIGURE 62



JUN 17 - JUN 23
FIGURE 63

APPENDIX C
JOHN DAY DAM
DELAYED MORTALITY TESTS

CONTENTS **PAGES**

DELAYED MORTALITY TEST RESULTS
JOHN DAY DAM, 1992

INTRODUCTION

An effort to evaluate the effects of the handling procedures at John Day Dam on migrating juvenile salmonids by measuring short term delayed mortality rates (48 hour holding) on handled and non-handled test groups was conducted during the 1992 season. Tests were designed to compare the mortality of fish handled using our standard anesthetizing procedure compared to fish that were not handled beyond airlift collection.

METHODS

The fish used in these tests were collected from the hourly capture using the airlift pump system described by Brege et al. (1990) during normal smolt monitoring at John Day Dam. Due to limited holding facilities, only yearling and subyearling chinook were tested. Yearling chinook were captured from May 4th to June 6th, and subyearling chinook from June 30th to August 12th.

The handled groups consisted of fish captured and processed during our normal nightly sampling routine. After fish had been gravity fed to the sample holding tank from the raised airlift basket, approximately 40 fish were guided into the preanesthetizing chamber. Any dead or moribund fish were removed and the remaining fish anesthetized with a 67 mg/L solution of benzocaine and alcohol. Once anesthetized, fish were carefully net transferred to the examination trough containing about 13 mg/L of tricaine (MS-222) to keep fish calm during examination. All of the test species were then placed into holding tanks.

The non-handled (control) groups were collected by adding an extension to the six inch PVC pipe that delivers the fish from the airlift basket. This diverted the fish into a holding tank where they were held for the duration of the test. When it appeared that a sufficient number of fish had been collected, the extension was removed and any remaining fish were processed and used in the handled group. Any dead or moribund fish immediately present were removed.

Fish used in the control groups were captured in the same hours' sample as those used in the handled groups whenever possible. If not enough fish were caught to do this, fish were taken from the next hours' sample. Handled groups averaged 40 fish per replicate test. All control groups ranged between 50 to 100

unsorted fish. Since these groups could not be handled, it was hoped that by taking this many fish, enough of the target species would be collected for comparison with the handled groups. All groups were left undisturbed in covered holding tanks for 48 hours. There were 23 replicate tests of both handled and non-handled control groups for yearling chinook, and 24 replicates for subyearling chinook.

Test fish were held in a partitioned 6" X 10" holding tank. A constant flow of river water at 60 gallons per minute circulated through the tank. During the tests, water temperatures ranged from 58 to 64 degrees F. for yearling chinook, and 69 to 72 degrees for subyearling chinook. At the end of the 48 hour holding period, each group was anesthetized, counted, and inspected for condition, and all mortalities were inspected for a possible cause of death.

RESULTS AND DISCUSSION

Delayed mortality test result details are presented in the attached tables 1 & 2 at the end of this report. A summary of the total percent mortality for handled and control groups, as well as the combined mortality for each species is presented below;

			HANDLED		CONTROL		COMBINED	
SPECIES	water Temp. oF	# of Rep Tests	Morts / Total	% Morts	Morts / Total	% Morts	Morts / Total	% Morts
Yearling Chinook	58-64	23	32 / 948	3.4%	47 / 973	4.8%	79 / 1921	4.1%
Subyearling Chinook	69-72	24	154 / 857	18.0%	19.9 / 993	19.9%	352 / 1850	19.0%

Yearling chinook mortality in combined handled and control tests averaged 4.1%. Control groups suffered more mortalities (4.8%) than handled groups (3.4%). This may be due to the procedure we used to collect some of the control groups for these tests. On those dates when we caught a large amount of fish in one hours' sample, about 100 were diverted from the trap into a holding tank to use as controls, and the remainder were diverted to use in the handled group. It is thought that the weaker fish may get drawn out of the airlift basket first and end up in the control group, while the more vigorous fish stay in the basket longer, and end up in the handled group.

There were 12 replicates for yearling chinook where the control group contained the entire catch from one hour, and the handled group contained the entire catch from the next hour. In these replicates the potential bias due to the vigor of the fish would be eliminated. The mortality rates for these replicates was **4.1%** for the handled groups, and 3.9% for the control groups.

For subyearling chinook, combined handled and control test mortality was high, averaging 19%. Again, control groups had a slightly higher mortality (19.9%) than handled groups (18%). There were ten replicates where the control group was the total catch for one hour, and the handled group was the total catch from the next hour. The mortality rates for those tests are 15.5% for handled, and 20.0% for controls, which does not support the idea that the more vigorous fish hold up in the basket and end up in the handled group.

The overall mortality rates for subyearling chinook are significantly higher than the rates for yearling chinook. This is primarily due to the prevalence of stress and disease related to the higher water temperatures that occur this time of year. Overall, 90% of mortalities showed signs of disease. This is similar to the 1991 tests when 96% of mortalities showed signs of **disease.** The signs included fungus on the nose and/or tail, and columnaris symptoms.

The average mortality rate for subyearling chinook, and the water temperatures during those tests were both higher in 1992. This year, the average water temperature was 70.5 degrees, with an average mortality rate of 19% in the tests. In 1991, water temperature was 67.7 degrees and test mortality was 17.4%.

In 1991 five of 11 replicates were done before water temperatures reached 68 degrees (Hawkes et al. 1992). In 1992 only one of 23 replicates was completed before the water temperature reached 68 degrees. In 1991 the mortality rates jumped significantly when water temperatures reached 68 degrees. The higher water temperatures that were encountered this season may have contributed to the higher mortality rates.

Physical condition played an important role in smolt survival for all test groups. Descaled fish were more likely to die in both handled and control groups. The relationship between descaling and mortality in the tests are summarized as follows;

	HANDLED			CONTROL		
SPECIES	Desc. Total	Desc. Mort / Total Mort	Desc. Mort / Total Desc.	Desc. Total	Desc. Mort / Total Mort	Desc. Mort / Total Desc.
Yearling Chinook	114 / 948 = 12%	22 / 32 = 68.8%	22 / 144 = 15.3%	98 / 973 = 10.1%	32 / 47 = 68.1%	32 / 98 = 32.7%
Subyrlng. Chinook	17 / 857 = 2%	12 / 154 = 7.8%	12 / 17 = 70.6%	19 / 993 = 1.9%	17 / 198 = 8.6%	17 / 19 = 89.5%

Descaling rates in these tests for yearling chinook were high (11%), reflecting the high average descaling rate for this species during 1992 at John Day Dam (10.1%). Approximately 68.4% of the mortalities in both handled and controlled groups were descaled, and 22.3% of all descaled fish in the tests died (54 out of 242).

Descaling rates for subyearling chinook in the tests averaged 2%, which is equivalent to average descaling rate in the samples for this species over the season. A total of 8.2% of all mortalities were descaled, and 80.6% (29 out of 36) of all descaled fish in both groups died.

CONCLUSION

The mortality rate in combined handled and control tests was 4.1% for yearling chinook, and 19% for subyearling chinook. Subyearling mortality rates were probably elevated due to higher water temperatures, lower river flows that increase travel time, and increased predation; all factors that can raise stress levels aggravating disease infections resulting in weaker fish. Test results for both species showed higher mortalities in control groups than handled groups, which may be due to the study design.

The difference between control (4.8%) and test group (3.4%) mortality rates in yearling chinook indicate that the current handling procedures at John Day Dam do not have a significant adverse effect on fish survival. This agrees with 1991 test results (Hawkes et al. 1992).

For subyearling chinook, there was no significant difference in the delayed mortality tests results between handled (18%) and control (19.9%) groups. However, the higher mortality rates that occur with subyearling chinook may mask any difference in mortality due to handling procedures. The wide fluctuations in mortality rate indicate that once river temperature rise above 68 degrees, survival is more directly related to the condition of a particular group of fish rather than the additional stress of handling.

No change is recommended in the current fish anesthetization and handling methods at John Day Dam airlift sampling at this time, but care should be taken to insure that sample related scale loss be kept at a minimum.

The delayed mortality tests conducted in 1991 and 1992 have given us some valuable information on the possible effects our handling has on fish survival. The possible benefits of further tests would have to be weighed against the mortality that occurs as a result of the tests, the delay in sending updated data to managing agencies, and the delay in the outmigration of test fish.

We wish to acknowledge Randy Absolon for conducting this study at John Day dam in 1992.

LITERATURE CITED

Brege, Dean A., R.C. Johnsen, and W.E. Farr, 1990. An airlift pump for sampling juvenile salmonids at John Day Dam. North American Journal of Fisheries Management 10:481-483.

Hawkes, L.A., R.D. Martinson, W.W. Smith, 1992. Monitoring of Downstream Salmon and Steelhead at Hydroelectric Facilities - 1991. Dept. Comm., NOAA, NMFS, ETSD, Portland, OR. 19p plus Appendices. (Report to BPA, Project No. 84-14, Contract DE-AI79-85BP20733).

APPENDIX C, TABLE 1.

YEARLING CHINOOK DELAYED MORTALITY TEST RESULTS

		TEST						CONTROL						
		TOTALS			MORTS			TOTALS			MORTS			
END DATE	REP	END OTAL	N	D	N	D	% MORT	END TOTAL	N	D	N	D	% MORT	WATER TEMP
	1	39	36	2	1	0	2.56	50	42	4	3	1	8.00	58
5/4	2*	50	45	4	0	1	2.00	25	21	4	0	0	0.00	58
	3*	41	36	5	0	0	0.00	39	35	4	0	0	0.00	59
5/6	4	51	47	3	0	1	1.96	36	31	2	2	1	8.33	59
	5	27	26	1	0	0	0.00	66	60	5	1	0	1.52	57
5/11	6	45	40	4	1	0	2.22	50	42	6	1	1	4.00	57
	7	29	26	2	0	1	3.45	47	34	4	1	8	19.15	61
5/18	8*	53	45	6	0	2	3.77	48	38	3	0	7	14.58	61
5/22	9*	48	38	4	2	4	12.50	37	30	4	0	3	8 11	59
5/22	10	47	44	2	1	0	2.13	28	20	5	3	0	10 71	59
5/24	11	40	32	7	0	1	2.50	50	48	1	0	1	2 00	61
5/24	12	43	30	9	1	3	9.30	34	30	2	0	2	5.88	61
5/26	13	31	31	0	0	0	0.00	30	29	1	0	0	0.00	60
5/26	14	47	45	2	0	0	0.00	26	26	0	0	0	0.00	60
5/28	15	30	28	1	1	0	3.33	46	42	2	1	1	4.35	60
5/28	16*	56	45	10	0	1	1.79	43	41	2	0	0	0.00	60
5/30	17*	31	28	2	0	1	3.23	28	26	2	0	0	0.00	60
5/30	18*	30	29	1	0	0	0 00	29	25	2	0	2	6 90	60
	19*	30	24	5	0	1	3.33	48	45	2	0	1	2.08	64
6/1	20*	46	29	14	0	3	6 52	41	32	8	0	1	7 44	64
6/3	21*	48	45	1	2	0	4.17	79	75	3	0	1	1.27	63
6/3	22*	54	44	6	1	3	7.41	27	27	0	0	0	0 00	63
6/6	23*	32	31	1	0	0	0.00	66	61	0	3	2	7.58	64
TOTALS		948	824	92	10	22	3.4%	973	860	66	15	32	4 8%	
TOTALS OF * TESTS ONLY		519	439	59	5	16	4.1%	510	456	34	3	17	3.9%	

Notes: "N" denotes normal fish, and "D" denotes descaled fish.

* indicates tests where the control group was the entire catch from one hour and the test group the entire catch from the next hour.

APPENDIX C, TABLE 2.

SUBYEARLING CHINOOK DELAYED MORTALITY TEST RESULTS

END DATE	REP #	TEST TOTALS END TOTAL	TEST TOTALS N	TEST TOTALS D	TEST MORTS N	TEST MORTS D	TEST % MORT	CONTROL TOTALS END TOTAL	CONTROL TOTALS N	CONTROL TOTALS D	CONTROL MORTS N	CONTROL MORTS D	CONTROL % MORT	WATER TEMP
	1*	63	62	0	1	0	1.59	49	49	0	0	0	0.00	67
7/50	2	27	19	0	8	0	29.63	39	34	0	5	0	12.82	68
	3	31	28	0	2	1	9.68	38	33	0	3	2	13.16	68
7/7	4	49	41	1	5	2	14.29	53	43	1	9	0		68
7/13	5*	51	44	0	7	0	13.73	57	46	0	11	0	16.98 19.30	69
7/15	6*	42	34	0	8	0	19.05	45	36	0	9	0	20.00	69
7/17	7*	35	26	1	8	0	22.86	37	31	0	6	0	16.22	73
	8	25	20	0	5	0	20.00	40	37	0	3	0	12.82 7.50	72
7/19	9	48	46	0	2	0	4.17	39	34	0	5			72
7/21	11	50	35	3	10	2	24.00	36	31	0	3	2	13.89	72
7/27	12	30	27	0	3	0	10.00	43	40	0	3	0	6.98	71
7/27	13	36	23	0	13	0	36.11	44	33	0	11	0	25.00	71
7/29	14*	30	27	0	3	0	10.00	42	37	0	5	0	11.90	71
7/29	15	36	29	0	7	0	19.44	38	29	0	9	0	23.68	71
8/3	16	32	31	0	1	0	3.13	36	30	0	6	0	16.67	72
8/3	17*	31	30	0	1	0	3.23	42	38	0	4	5	41.86 9.52	72
	18	27	23	0	4	0	14.81	43	25	0	13			71
8/5	19*	30	25	1	2	2	13.33	43	24	0	15	4	44.17	71
8/7	20	38	26	0	12	0	31.58	63	48	1	12	2	22.22	70
8/7	21	40	26	0	13	1	35.00	43	26	0	15	2	39.53	70
8/10	22	33	26	0	7	0	21.21	36	31	0	5	0	13.89	71
8/10	23*	40	36	0	4	0	10.00	34	28	0	6	0	17.65	71
8/12	24*	33	12	0	21	0	63.64	53	30	0	23	0	43.40	71
TOTALS		857	698	5	142	12	18.0%	993	793	2	181	17	19.9%	
TOTALS OF 5 TESTS ONLY		386	324	2	57	3	15.5%	440	352	0	82	6	20.0%	

Notes: "N" denotes normal fish, "D" denotes descaled fish.

* indicates tests where the control group was the entire catch from one hour, and the test group the entire catch from the next hour.

- replicate 10 was not included because of problems that occurred during the completion of the test.

APPENDIX D
INCIDENTAL CATCH - 1992

JUVENILE SHAD
CAPTURE PATTERN
JOHN DAY DAM - 1992

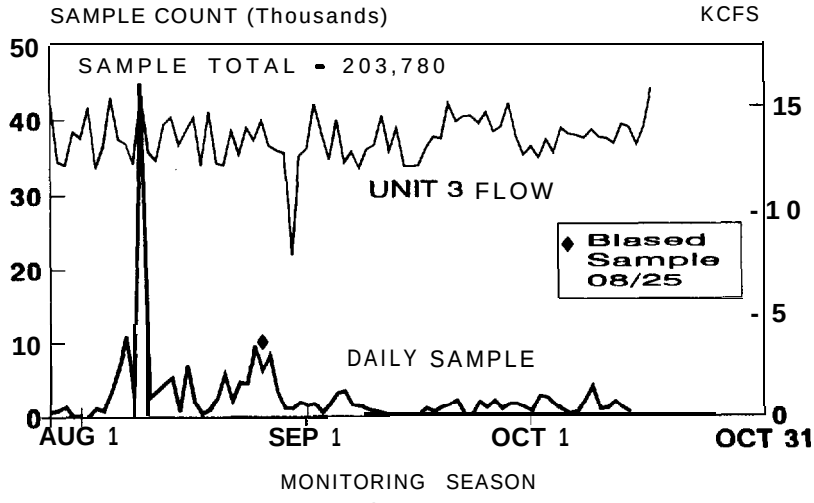


FIGURE 1

JUVENILE SHAD
CAPTURE PATTERN
BONNEVILLE DAM, PH#I - 1992

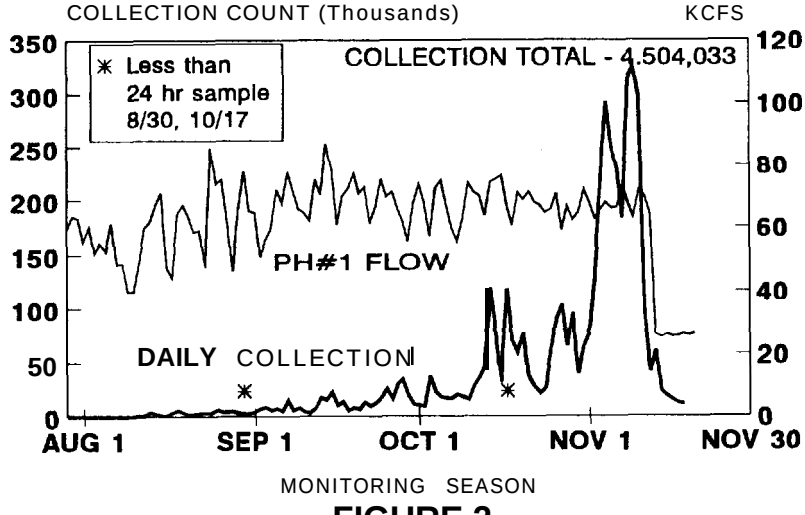


FIGURE 2

JUVENILE LAMPREY
CAPTURE PATTERN
JOHN DAY DAM - 1992

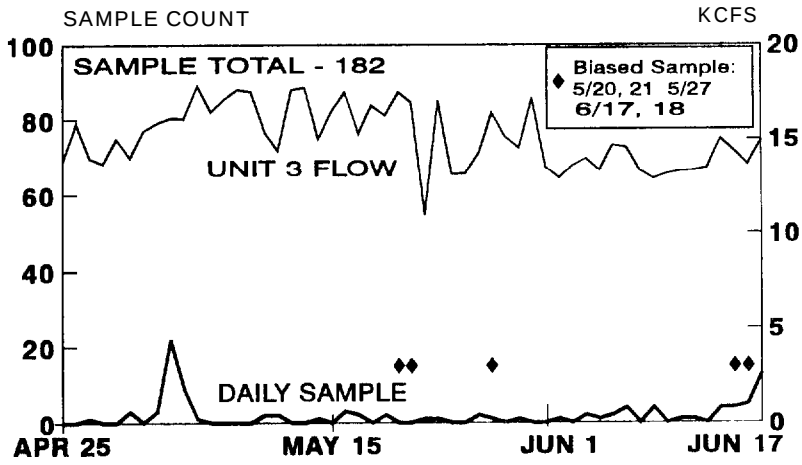


FIGURE 3

JUVENILE LAMPREY
CAPTURE PATTERN
BONNEVILLE DAM, PH#1 - 1992

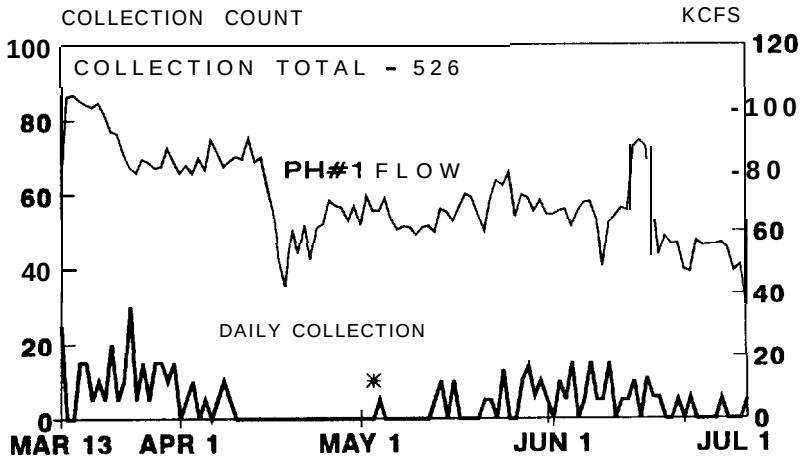


FIGURE 4

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