Yakima River Spring Chinook Enhancement Study

Annual Report FY 1988

by

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1.0 ACKNOWLEDGEMENTS

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2.0 ABSTRACT

Smolt outmigration was monitored at Wapatox on the Naches River and Prosser on the lower Yakima. The spring outmigration at Wapatox was estimated to be smolts. The 1988 spring outmigration of wild spring chinook from the Yakima Basin was estimated to be 251,975 smolts at Prosser.

The survival from egg to smolt was calculated using the 1986 redd counts and the 1988 smolt outmigration at Prosser. The estimated survival was 1.808, which gives a mean egg to smolt survival over six years of 4.4%.

In 1988 a total of 3,590 adult and 324 jack spring chinook salmon returning to the Yakima River were counted at Prosser fish ladder. This gives a total Of 3,914 salmon returning to Prosser Dam. The median dates of passage were May 12 and May 16 for adults and jacks respectively. An additional 333 fish were estimated to have been caught in the Yakima River subsistence dipnet fishery below Horn Rapids and Prosser Dams. Therefore, total return to the Yakima system was 4,247 spring chinook salmon.

Spring chinook were counted at Roza Dam from April 1 to September 30, 1988. Passage at Roza Dam was 1,633 adult and 103 jack spring chinook for a total of 1,736 wild fish. The median dates of passage at Roza Dam were

May 29 and May 26 for spring chinook adults and jacks respectively.

The smolt to adult (S,) survival was calculated based on the 1983 smolt outmigration estimated at Prosser and the 1984 return of jacks (3 year old fish) the 1985 return of four year old adults, and the 1986 return of five year old fish to the Yakima River. It was estimated that 6,012 wild three, four, and five year old fish returned from an estimated smolt outmigration of 135,548 fish in 1983. This gives an estimated survival from smolt to adult of 4.4%.

The smolt to adult survival for the 1984 smolt outmigration was 5.3% with 423 jacks returning in 1984, 5,163 four year old adults returning in 1986, and 983 five year old fish returning in 1987 from an estimated 123,732 smolts in 1984.

Spring chinook adults from fourteen different hatchery release groups were recovered in 1988. A total of 176 coded wire tags were recovered and these were expanded to an estimated 187 returning hatchery fish in 1988. Two of these fish were jacks.

3.0 INTRODUCTION

The population of Yakima River spring chinook salmon (Oncorhvnchus tshawvtscha) has been drastically reduced from historic levels reported to be as high as 250,000 (Smoker, 1956). This reduction is the result of a series of problems includingmainstem Columbia dams; dams within the Yakima itself; severely reduced flows due to irrigation diversions; outmigrant loss in irrigation canals; increased thermal and sediment loading; and overfishing. Despite these problems, the escapement of spring chinook to the Yakima River has continued at levels ranging from 166 to 9,442 since 1957.

In October, 1982, the Bonneville Power Administration contracted the Yakima Indian Nation to develop method8 to increase production of spring chinook in the Yakima System. The Yakima Nation's Current enhancement policy attempts to maintain the genetic integrity of the spring chinook stock native to the Yakima Basin, Relatively small numbers of hatchery fish have been released into the basin in past years. Data from the Wenatchee System indicate a return rate from hatchery smolts of less than .25% (Mullan, 1982). Return rates from the current Yakima study smolt releases are .07%. These low return rates indicate that few fish would have returned from these early hatchery releases.

Thus the genetic input from hatchery fish into Yakima Basin stocks is probably negligible.

The goal of this study is to develop data that will be used to present management alternatives for Yakima River spring chinook. The study has five major objectives. The first objective is to determine the distribution, abundance and survival of wild Yakima River spring chinook. Naturally produced populations are being studied to determine if these runs can be sustained in the face of present harvest and environmental conditions. Survival through each life stage is being evaluated in an attempt to determine limitations to natural production in the basin. Survival to emergence studies are being conducted to determine survival through the incubation stage. Analysis of the relationship between survival to emergence and gravel substrate quality is being undertaken. Seining at selected sites and electroshocking surveys have been conducted to evaluate distribution and abundance of juvenile fish. Smolt outmigrations are monitored at the Wapatox juvenile trap on the Naches River and at the Prosser juvenile trap on the mainstem Yakima River. Adult returns are determined by monitoring the Yakima Tribal dipnet fishery, counting adults at Prosser and Roza fish ladders, and through spawning ground surveys. Physical parameters such as water temperatures and stream flow are monitored

throughout the basin.

The second major objective of this study is to determine the relative effectiveness of different methods of hatchery supplementation. This objective is divided into three sub-objectives:

a) Determination of optimal release time Smolt releases are the norm, but fingerlings were released in June, September, and November of 1984 and 1985. Downstream survival of these smolts was evaluated and adult returns are being monitored.

b) Determination of optimal manner of release In the past, fish have either been transported from a hatchery and released into the Yakima River, or raised in rearing ponds. These methods, as well as the use of acclimation ponds, will be evaluated.

c) Determination of optimal release stocks Smolts were released in 1986 and 1987 as hatchery X hatchery, hatchery X wild, and wild X wild crosses to determine the effect of genetic makeup on the success of various releases. Success will be measured as the number of adults returning, as well as whether spawning timing is similar to the wild stock.

Adverse interactions between hatchery releases and wild stocks were minimized by scatter-planting hatchery fish so densities in the river remained low enough to minimize competition for food and space.

The last three major objectives of the study are:

3) to locate and define areas in the watershed which may be used for the rearing of spring chinook;

4) to define strategies for enhancing natural production of spring chinook in the Yakima River; and

5) to determine the physical and biological limitations on production within the system.

These objectives will be met at the end of the study when the database is complete.

This project is a multi-year undertaking that will evaluate differentmanagementand enhancement strategies. At the conclusion of this study, a series of alternatives will be developed that can be used to determine how best to enhance the runs of spring chinook in the Yakima Basin. Annual reports were presented for 1983 (Wasserman and Hubble, 1983), 1984 (Wasserman, Hubble, and Watson, 1985), 1985 (Fast, Hubble, and Watson, 1986), 1986 (Fast, Hubble, and Watson, 1986) and 1987 (Fast, Hubble, and Watson, 1987). A detailed description of methods and materials used in this study can be found in these earlier reports. This current report is concerned with new findings in 1988 and some re-evaluation of previous data in light of current information.

4.0 DESCRIPTION OF STUDY AREA

The Yakima River is located in central Washington and flows 217 miles from its headwaters in the Cascade Mountains (elevation 2,448 ft) to the Columbia River near Richland at river mile (RM) 335 (Figure 1). The Yakima River Basin drains 6,155 square miles of the east slopes Of the Cascade Mountains in Kittitas and Yakima Counties. The Yakima River flows east and south through the Kittitas Valley from its ruggedly glaciated headwaters. South of the valley the river cuts through Manastash and Umtanum ridges in a deep canyon. The river enters the middle valley above Yakima through a gap cut in Selah Ridge and leaves through Union Gap in Ahtanum Ridge. Rattlesnake Hills, crossing eastern Yakima and northern Benton Counties, and the Horse Heaven Hills to the south are prominent features bordering the'lower river in its 80 mile reach from Union Gap to the Columbia River. The Yakima River enters the Columbia River near Richland at an elevation of 300 feet.

The major tributaries, with the exception of Satus and Toppenish Creeks, enter the river above the city of Yakima. The Naches River is the largest tributary, entering the Yakima at RM 101 and extending 51 miles to the junction of the Bumping and Little Naches Rivers. The Naches River drains an area of 1,106 square miles. Other important tributaries of the Naches include the

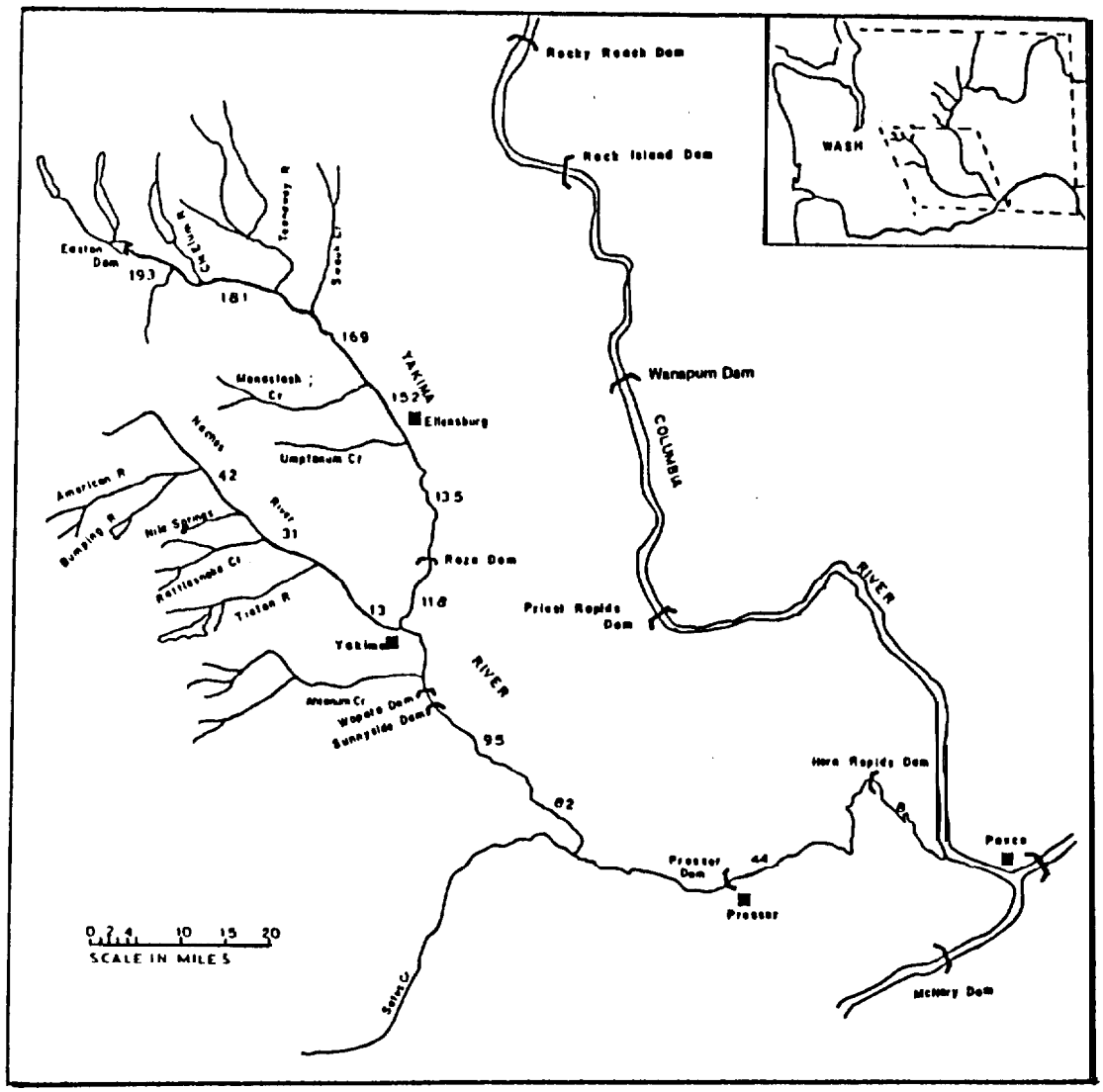

Figure 1. Study area on the Yakima River system.

American and Tieton Rivers and Rattlesnake Creek.

Important tributaries in the upper Yakima are the Teanaway and Cle Elum Rivers. Numerous creeks, including Manastash, Taneum, and Swauk, flow into the Yakima in the Kittitas Valley. The climate of the Yakima Basin varies from wet-alpine in the Cascade Mountains to semi-arid conditions at the lower elevations. The crest of the mountains receive 80 to 140 inches of precipitation per year while approximately one third of the basin receives ten inches or less. Summer temperatures average 55 F in the mountains and 82 F in the valleys. During the winter monthly maximum temperatures range from 25 F to 40 F and low temperatures range from -20 F to -25 F.

The Yakima River Basin produces 3.5 million acre feet average annual runoff, unregulated. The U.S. Bureau of Reclamation's Yakima Irrigation Project has transformed the semi-arid region into a productive agricultural region. Approximately 500,000 acres are presently under irrigation, consuming 2.25 million acre feet each year. There are numerous dams and irrigation diversions on the river. These include Horn Rapids, Prosser, Sunnyside, Wapato, Roza, and Easton. A screening structure is associated with each of these dams except at Easton (which is currently being constructed). For an extensive description of the Yakima Basin, see Bryant and Parkhurst (1950).

In the Yakima system, reservoir storage acts to regulate flows. Man-made Kachess, Keechelus, and Cle Elum Lakes in the upper Yakima and Bumping and Rimrock Lakes on the Naches system are the major storage sites. These storage areas supplement flows during the irrigation season (March-October) and store water in the winter. Irrigation and power diversions generally reduce flows in the lower sections of the Yakima River. Sunnyside and Wapato dams near rivermile 108 divert approximately one-half the total river flow at each site into irrigation diversions in the summer and fall. Prosser diversion removes approximately 1,400 cfs for irrigation and power production throughout most of the year. Due to the large irrigation diversions at Prosser and Parker, flows drop dramatically in the lower river from June to October. Approximately 50% of the flows withdrawn at diversion sites re-enter the river downstream after being used for irrigation or hydropower.

Prior to 1980, flows remained high on the spawning grounds in September and October for irrigation purposes. Many fish that spawned at this time deposited their eggs in shallow water near the bank. When flows were decreased at the end of the irrigation season, these redds were often dewatered. Following court action in 1981 the irrigation flows were decreased in the Yakima branch during the first week of September so that this

problem would not continue. To offset the reduction of flows from the upper Yakima in September, flow is increased in the Naches River mainly from **Rimrock** Reservoir releases. This increased flow enters the Naches River below the areas where most spring chinook spawning occurs so it is not believed to impact spawning success.

5.0 METHODS AND MATERIALS

5.1 NATURAL PRODUCTION

5.1.1 SURVIVAL TO EMERGENCE STUDIES

5.1.1.1 Fry Trapping

In the fall of 1987 a total of five spring chinook redds were selected to be capped for survival from egg to fry studies. The females associated with each redd were collected and the length fecundity model developed in 1986 was used to estimate the number of eggs deposited in each redd. The redds were capped in February of 1988 and early emerging fry were collected and counted. However, due to extremely high runoff during the spring snowmelt the traps were not checked for several weeks. When the flood waters receded the emergence nets were not fish tight and the live boxes of several traps had been lost due to high flows. Due to the incomplete record of fry emergence in 1988 no analysis or reporting of survival to emergence data will be included-in this annual report.

5.1.2 PROSSER SMOLT TRAP

Prosser smolt trap was operated continuously from November 14, 1987 to June 30, 1988. Prosser trap operates from a bypass pipe that shunts fish from rotary drum screens in Chandler Canal back to the mainstem Yakima River. In 1984, 1985, 1986 and 1987 trapping efficiency (the percentage of outmigrants passing Prosser Dam diverted into the trap) was calculated via a series of releases of marked fish. The statistical methodology for efficiency calculations was evaluated by Douglas Chapman of the University of Washington Center for Quantitative Science. A detailed description of the evaluation process can be found in Appendix B of the 1986 BPA annual report. The basic procedure was as follows. Once each week, fish captured in the trap during the night were cold-branded. Two groups were branded differently, with one group released two miles upstream of the canal intake, and the other in the canal. Efficiency (E_i) was based on the recapture rate of branded fish as follows:

$$E_i = \frac{C_i}{R_{ri}\,(\,C_{ci}\,/R_{ci}\,)}$$

where E_i = fraction of fish diverted into the canal in the ith experiment;

R_{ci} = number released directly into the canal

in the ith experiment;

R_{ri} = number released directly into the river in the ith experiment;

C_{ci} = number recaptured from the canal release in the ith experiment; and

C_{ci} = number recaptured from the river release in the ith experiment.

During the 1984, 1985, 1986 and 1987 spring chinook smolt migrations a total of 68 separate efficiency tests were performed. A relationship was developed between the combined 1984-87 efficiency data and river discharge. This relationship was then used to estimate the total number of juvenile fish passing Prosser dam in each of the years the trap was operating. The confidence intervals for the calculated total smolt passage for each year was estimated from a linearized form of the logistic equation Y = 1/1+E (-A+BX). Lengths, weights and scales were taken from random samples of all species and release groups on a daily basis. In addition unbranded ad-clipped hatchery spring chinookwere sacrificed for coded wire tag analysis on a daily basis.

5.1.3 WAPATOX SMOLT TRAP

The purpose of Wapatox smolt trap is to monitor the spring chinook smolt outmigration in the spring and the pre-smolt outmigration the rest of the year from the Naches subbasin. Wapatox smolt trap is located on the Naches River at RM 17, just downstream from the confluence of the Tieton and Naches Rivers (see Figure 1). The trap is constructed on the Wapatox by pass canal. Fish entering the canal are shunted into a by pass pipe (culvert) by a series of rotating drum screens across the diversion canal.

The 1987 Fall trapping of spring chinook pre-smolts ceased October 29, 1987 when Wapatox Diversion Canal ceased operation in order to meet instream flow regulations. Wapatox smolt trap was operated March 4, 1988 when the rotary drum screens were put into place. The trap was normally checked at least 5 times per week and more often during peak migration periods. Only salmonid species were enumerated. Fish were anesthetized with MS-222 and fork lengths and weights were recorded.

Spring and fall outmigration estimates were calculated assuming that trap efficinecy was directly correlated to percent discharge into the canal (p.d.c.). The efficiency model developed in 1987 was not used since daily river discharge was generally outside the tested range.

When the trap was inoperable, an estimate of the daily catch was made by interpolation of daily catches preceding and following these periods.

5.1.4 ADULT RETURNS

Adult spring chinook salmon harvested below Prosser in the 1988 Yakima Tribal ceremonial dipnet fishery were monitored under the BIA 638 contract.

The Prosser and Roza Dam adult fish counting stations were monitored in 1988. Counting at Prosser began April 1 and continued through September. Roza Dam was monitored from April 1 through September 30. Water clarity at Roza Dam was such that fish swimming over the counting board could be visually examined for the presence or absence of an adipose fin. All adipose-clipped fish were collected in a second trap and sacrificed to recover the coded wire tags.

Spawning ground surveys were inititated on the American River in mid-July under a contract from the U.S. Canada Treaty. The Yakima Indian Nation was the lead agency under a contract from the Columbia River Inter-Tribal Fish Commission. Spawning ground surveys were conducted throughout each reach of spawning area once every other week. All carcasses were examined for adipose fins, and fork length and mid-eye to hypural plate length were recorded. Scale samples were taken, and gonads were examined to determine sex and egg retention in females. Following examination the tail Of each fish was removed so it would not be examined more than once.

5.1.5 ESTIMATES OF SURVIVAL THROUGH VARIOUS LIFE STAGES

5.1.5.1 Egg to fry:

As previously discussed, survival from egg deposition to emergence was not completed in 1988. Total egg deposition was calculated as mean fecundity of Yakima River females (based on the length fecundity model) multiplied by the number of redds located on the spawning grounds.

The total number of fry produced (F) was calculated as:

F = mean fecundity of Yakima River spawners x number of redds x survival from egg deposition to emergence.

5.1.5.2 Egg to Smolt:

Survival from egg to smolt (S_{es}) was calculated as:

$$S_{es} = \frac{\text{estimated number of smolts at Prosser}}{\text{total egg deposition for year class.}}$$

5.1.5.3 Fry to Smolt:

Survival from fry to smolt (S_{fs}) was estimated as:

$$S_{fs} = \frac{\text{number of smolts estimated to pass Prosser}}{\text{fry for year class}}$$

Estimates of egg deposition and fry production were made for 1981 to 1988 based on redd counts from spawning ground surveys, Survival from egg to smolt and from fry to smolt were based on 1981, 82, 83, 84, 85, and 86 redd counts and 1983, 84, 85, 86, 87, and 88 smolt outmigration estimates at Prosser.

5.1.5.4 Smolt to Adult:

The complete smolt to adult survival (S,) of wild spring chinook salmon in the Yakima system was calculated from the 1983, 1984, 1985 and 1986 smolt outmigration estimated at Prosser and the return of jacks (3 years old fish), four year old adults, and five year old adults corresponding to each years smolt run. The jack and four year old adults (two ocean fish) returning in 1987 and 1988 respectively, from the 1986 smolt outmigration were also analysed for this report.

5.2 HATCHERY OPERATIONS

5.2.1 BROOD STOCK EVALUATIONS

Hatchery spring chinook introduced into the Yakima River from 1958 to 1987 have come from numerous sources and stocks (Table 1), although, as previously mentioned, their contribution to the genome of naturally spawning Yakima River fish has probably been minimal. An experimental brood stock program was undertaken in 1984 and continued in 1985 to evaluate the benefits of using spring chinook from the Yakima River as a source of gametes. The purpose was to culture indigenous fish and to determine the optimal stock for enhancement programs.

The best stock for enhancement programs will be determined by a comparison of returns of adult fish from four release groups: (1) a pond-acclimated group of hatchery-reared "hybrids" (Yakima River males crossed with Leavenworth Hatchery females), (2) an acclimated group of hatchery-reared "natives" (Yakima males crossed with Yakima females), (3) an acclimated group of pure hatchery smolts (Leavenworth males crossed with Leavenworth females), and (4) a group of pure hatchery smolts released directly into the river. Groups l-3 were allowed volitional release from an acclimation pond in the upper Yakima River. These groups will be used to determine if cultured fish that are the progeny of Yakima

River spring chinook have a greater success in returning to the Yakima River than do non-indigenous stocks. The fourth group will be used as a control on the value of acclimating spring chinook in ponds for various periods before allowing volitional release. Returns from group four will be compared directly to group three.

Table 1. Historical plants of spring chinook in the Yakima River Basin.

Brood year	Release date	Hatchery	Sire fish/Lb	Number released	Brood stock	Release location
1958	8/59	Klickitat	143	20,000	Klickitat	Yakima River
1960	5/61	Leavenworth	330	18,000	Icicle	Yakina River
1961	2/62	Leavenuorth	1000	5,000	Icicle	Yakiaa River
1962	12/62	Leavenworth	1000	5,000	Icicle	Yakira River
1962	63			12,500		Nile Springs
1963	64			10,000		Nile Springs
'1971	6/73	Klickitat	58	162,400	Klickitat	Naches River
1971	6/73	Klickitat	58	162,400	Klickitat	American River
1974	75			8,580		Nile Springs
1974	4/76	Ringold	3	7,230	Ringold	Nile Springs
1974	9/76	Klickitat	29	42,775	Klickitat	Nile Springs
1975	3/77	Klickitat	19	13,300	Klickitat	Nile to Richland
1976	3/78	Klickitat	7	2,462	Cowlitz	Nile Springs
1977	4/79	Carson	20	50,000	Carson	Yakiaa River
1977	4/79	Klickitat	12	25,000	Cowlitz	Nile Springs
1978	4/80	Klickitat	IO	24,000	Klickitat	Nile Springs
1978	4/80	Leavenworth	18	30,260	Carson	Yakima River
1979	4/81	Klickitat	14	33,616	Klickitat	Nile Springs
1979	4/81	Leavenworth	20	400,221	Leavenworth	Yakiaa River
1980	4/82	Leavenworth	14	100,050	Leavenworth	Nile Springs
1980	4/82	Leavenworth	15	401,714	Leavenworth	Yakima River
1981	4-5/83	Leavenworth	18	103,110	Leavenworth	Nile Springs
1981	4/83	Leavenuorth	19	97,012	Leavenworth	Yakina River
1982	4/84	Entiat	19	29,636	Carson	Nile Springs
1982	4/84	Entiat	25	42,552	Carson	Yakima River
1983	6/84	Leavenworth	66	102,837	Carson	Yakima River
1983	9/84	Leavenworth	25	102,833	Carson	Yakima River
1983	11/84	Leavenworth	22	108,305	Carson	Yakina River
1983	4/85	Leavenworth	18	50,000	Carson	Yakima River
1984	6/85	Leavenworth	66	100,000	Leavenworth	Yakima River
1984	9/85	Leavenvorth	25	100,000	Leavenuorth	Yakina River
1984	11/85	Leavenworth	22	100,000	Leavenworth	Yakira River
1984	3/86	Leavenworth	21	51,846	Carson	Yakina River
1984	4/86	Leavenworth	20	50,657	Carson	Yakima River
1984	3/86	Leavenworth	17	46,476	Carson/Yakima	Yakina River
1984	3/86	Leavenworth	17	33,052	Yakima	Yakina River
1985	3/87	Leavenworth	21	42,436	Carson	Yakima River
1985	3/87	Leavenworth	17	44,899	Carson/Yakima	Yakima River
1985	3/87	Leavenworth	17	47,576	Yakina	Yakima River
1985	4/87	Leavenworth	20	42,796	Carson	Yakima River

Note: Native spring chlnook broodstock in Klickitat River at times was supplemented with Carson, Cowlitz, Eagle Creek, and Willamette Fish.

5.2.2 ADULT HATCHERY RETURNS

Fourteen groups of adult hatchery fish returned to the Yakima River in 1988. Coded-wire tags were recovered from three sources; the Yakima dip net fishery, the spawner surveys and carcass recovery surveys in the Naches River, and from the adult trap at Roza Dam. All tags recovered were expanded by the sample rate (fish sampled/total number of fish caught for a fishery or carcasses sampled/total number of spawners estimated in each river for spawner surveys) and by the mark rate or coded-wire tag retention rate.

Survival rate for hatchery smolt to adult was calculated by dividing the total expanded return of adults from each release by the estimated passage of smolts by Prosser from that release. The expanded return numbers were also divided by the total number of smolts released in each group to obtain a hatchery planting to adult survival rate.

6.0 RESULTS AND DISCUSSION

6.1 NATURAL PRODUCTION

6.1.1 SURVIVAL TO EMERGENCE STUDIES

Results of survival to emergence studies will not be presented due to extremely high spring runoff preventing data collection during much of the emergence period.

6.1.2 PROSSER SMOLT TRAP

Smolt outmigration was estimated from a logistic relationship between percent river diversion and percent entrainment (Fast et. al., 1985). A logistic relationship was fit to data from test releases made in 1984, 1985, 1986 and 1987. This relationship was used to estimate 1987 outmigration (Appendix B of the 1986 BPA annual report). Test releases will be made throughout the duration of the project. The diversion-entrainment relationship will be refined and the outmigration of previous years re-estimated on a yearly basis.

6.1.2.1 Winter Movement

The Prosser smolt trap was operated continuously from November 14, 1987 through March 31, 1988 to monitor the winter outmigration of juvenile spring chinook and other salmonids. A total of 62,846 salmonids were counted including 59,898 wild spring chinook, 2,945 wild

steelhead trout, 1 hatchery steelhead trout and 2 coho juveniles. A daily breakdown is presented in Appendix B.1.-B.5.

The estimated winter outmigration of spring chinook smolts past Prosser is 72,270. Sixty-five point seven percent of the spring chinook winter outmigration occurred during the third week of December (Table 2). Only 15.2% outmigrated during January, February, and March combined. The 1986-87 winter outmigration peaked the first week of December with a strong outmigration following the second week (Fast et al. 87). Signifcant numbers appear to move in December in both 1987 and 1988. In 1987 and 1988 spring chinook winter outmigrations (previous to March 31) made up 26.2% and 22.1% respectively of the combined spring and winter outmigration. This year the left pelvic fin was removed on 17.3% of the spring chinook passing the smolt trap. This clip will identify returning adults as winter outmigrants and will provide data for preliminary estimates on the contribution of winter outmigrants to production.

Mean fork length of spring chinook for November through March was 120 mm, 118 mm, 115 mm, 115 mm and 142 mm respectively (Table 3). Mean condition factors for the same time period ranged from 10.4 to 10.8 (Table 3).

Table 2. Estimated weekly outmigration of juvenile spring chinook and wild steelhead at Prosser trap from November 14, 1987 through March 31, 1988.

Period of estimation	Total spring chinook	Total wild steelhead
11/14/87-11/21/87[a]	3,305	80
11/22/87-11/30/87	2,030	1
12/01/87-12/07/87	451	8
12/08/87-12/14/87	343	192
12/15/87-12/21/87	47,371	1,225
12/22/87-12/31/87	7,806	193
01/01/88-01/07/88	1,022	30
01/08/88-01/14/88	733	28
01/15/88-01/21/88	3,869	768
01/22/88-01/31/88	1,939	445
02/01/88-02/07/88	490	52
02/08/88-02/14/88	614	147
02/15/88-02/21/88	135	20
02/22/88-2/29/88[a]	725	20
03/01/88-03/07/88	619	28
03/08/88-03/14/88	64	20
03/15/88-03/21/88	159	38
03/22/88-03/31/88	62	317
	72,270	3,540
Totals	7,820	40,365

[a]Trap was inoperable; estimated passage based on interpolation.

Table 3. Monthly mean lengths, weights and conditionfactors for wild spring and fall chinook caputured January through June, 1983, 1984, 1985, 1986, 1987 and 1988 at Prosser smolt trap.

Year	January fork length (mm)	weight (gm)	condition factor (a)	February fork length (mm)	weight (gm)	condition factor (a)	March fork length (mm)	weight (gm)	condition factor (a)	April fork length (mm)	weight (gm)	condition factor (a)	May fork length (mm)	weight (gm)	condition factor (a)	June fork length (mm)	weight (gm)	condition factor (a
Spring chinook																		
1988	115	16.3	10.4	115	17.0	10.8	142	36.4	10.7	126	20.5	10.1	127	21.1	10.0	123	21.1	10.7
1987	114	16.0	10.4	120	18.5	10.4	nd	nd	nd	130	26.8	10.9	123	20.6	10.8	123	21.5	11.5
1986	111	nd	t-d	115	15.8	10.7	135	33.0	12.3	129	22.8	10.6	126	22.2	10.6	127	23.0	10.8
1985	122 (a)	nd	nd	122 (b)	nd	nd	156	44.1	11.0	139	30.1	10.7	126	22.0	10.2	134	33.3	10.7
1584	nd	nd	nd	nd	nd	nd	134	26.3	10.8	133	25.8	10.8	135	25.9	10.3	140	32.4	10.7
1983	nd	rd	nd	nd	nd	nd	(c)	(c)	(c)	129	24.5	11.1	126	24.2	11.0	127	nd	nd
Fall chinook																		
1988	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	96	nd	rd	87	7.3	10.9	94	9.2	10.9
1587	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	89	7.8	11.1	79	5.6	11.3	89	a.4	
1986	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	86	6.5	11.2	99	11.4	11.5	90	9.0	12.6
1985	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	i9	5.6	10.8	90	8.6	10.8	86	9.0	11.4
1984	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(f)	(f)	(f)	94	10.7	12.2	99	12.6	11.7
1983	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	(e)	88	9.2	12.3	89	9.0	12.3	90	10.5	13.5

nd= No data available.
(a) Estimated as (w/l*l*l) x 1,000,000; where w= weight and l= fork length in millimeters.
(b) Anonymous, 1985. January and February data were combined.
(c) Chandler Canal smolt trap not operated in March 1983.

6.1.2.2 Spring Movement

Atotalof 270,628 salmonids were counted at Prosser smolt trap April, 1 through June 30, 1988. The total catch included 79,023 wild spring chinook, 45,362 wild fall chinook, 21,029 hatchery fall chinook, 16,593 wild steelhead, 5,386 hatchery steelhead, and 103,235 hatchery coho.

Total estimated outmigration of salmonids is presented in Table 4. Estimated outmigration of wild spring chinook, fall chinook and steelhead smolts was 255,407, 74,853 and 70,003 respectively. Estimated outmigration of hatchery fall chinook, steelhead and coho was 66,925, 15,950 and 612,244 respectively.

Estimated outmigration of wild spring chinook smolts in the months March through June was 159,588, 91,949, 3,900 respectively. No fish were counted in July. The week of highest smolt outmigration occurred April 15-21, when 69,017 smolts outmigrated (Figure 2). However, the single highest day of outmigration was May 14, when 43,318 spring chinook smolts passed Prosser. The date of median passage was April 23, 1988, the same day as in 1987.

The estimated outmigration for all species is approximately 3% higher than the true outmigration, because, the seperator was not fish tight for most of the season,

Table 4. Outmigration for 1988, Prosser smolt trap.

Dates	Wild spring chinook	Wild fall chinook	Hatch. fall chinook	Wild steel head	Hatch. steel head	Hatch. coho
4/1-4/7	6,244	0	0	718	0	0
4/8-4/14	38,966	10	0	1,541	2	27
4/15-4/21	69,017	1,864	0	13,663	3,505	12,293
4/22-4/30	45,331	6,852	0	9,606	4,500	20,471
Subtotal	159,558	8,726	0	25,528	8,007	32,791
5/1-5/7	13,196	4,316	0	3,524	1,494	14,579
5/8-5/14	85,591	34,820	0	47,958	lo,668	389,433
5/15-5/21	14,415	7,691	0	7,606	3,604	75,449
5/22-5/31	4,845	9,937	122	2,031	543	13,469
Subtotal	118,047	56,764	122	61,119	16,309	492,930
6/1-6/7	2,090	8,054	2,628	1,335	670	1,891
6/8-6/14	1,385	20,566	19,967	615	166	658
6/15-6/21	381	6,331	25,356	211	129	200
6/22-6/30	44	1,183	18,798	149	120	139
Subtotal	3,900	36,134	66,833	2,310	1,085	2,688
Season	281,505	101,624	66,925	80,957	25,401	528,409

[a]estimated passage was based on interpolation.

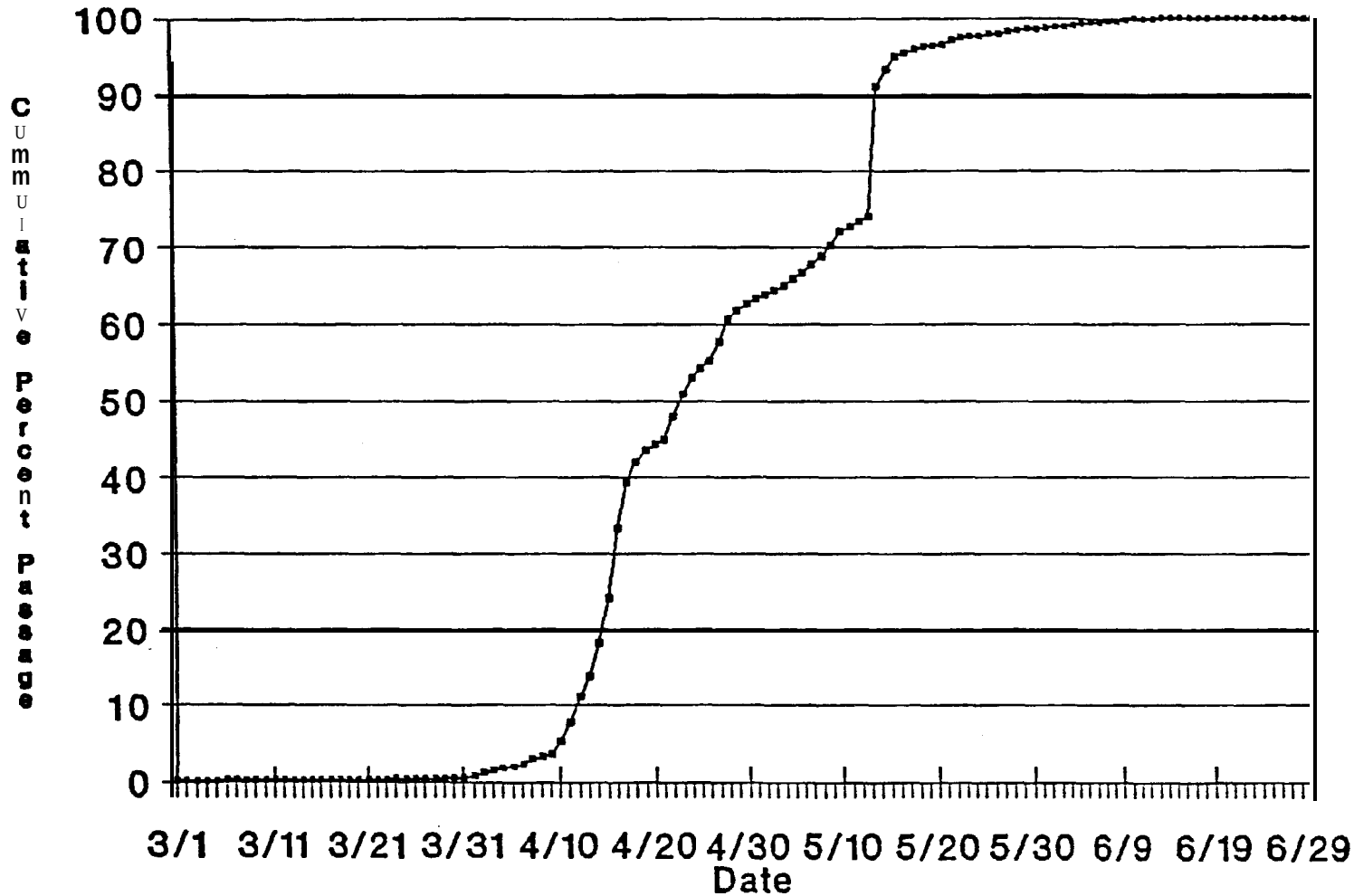

Figure 2. Cumulative percent passage of wild spring chinook smolts at Prosser March 1 through June 30, 1988.

The outmigration of wild spring chinook was much lower than anticipated. This may in part be due to accidental dewatering of the reach between Easton Dam and the Cle Elum River confluence between June 9 and June 12 that reached a low of 17 cfs on June 11. Normal flows in early June are in excess of 100 cfs to privde rearing habitat. The exact number of mortalities caused by stranding and additional predation can not be estimated. This reach makes up the majority of the spawning habitat for the Yakima River system and thus the mortalities are assumed to be significant (Personnal Communications, Tuck 87).

Mean monthly fork length for spring chinook in April, May and June were 126 mm, 127 mm and 123 mm respectively (Table 3).

Mean monthly condition factors for April, May and June were 10.1, 10.0 and 10.7, respectively (Table 3).

6.1.3.3 Distinguishing Spring from Fall Chinook

Length frequencies and scale analyses were used to differentiate spring and fall chinook outmigrants. Monthly length frequencies of chinook sampled in 1988 are depicted in Figure 3. Lengths are bimodally distributed in April and May, with fall chinook comprising the first mode and spring chinook the second mode. Fall chinook comprised most the smolt outmigration

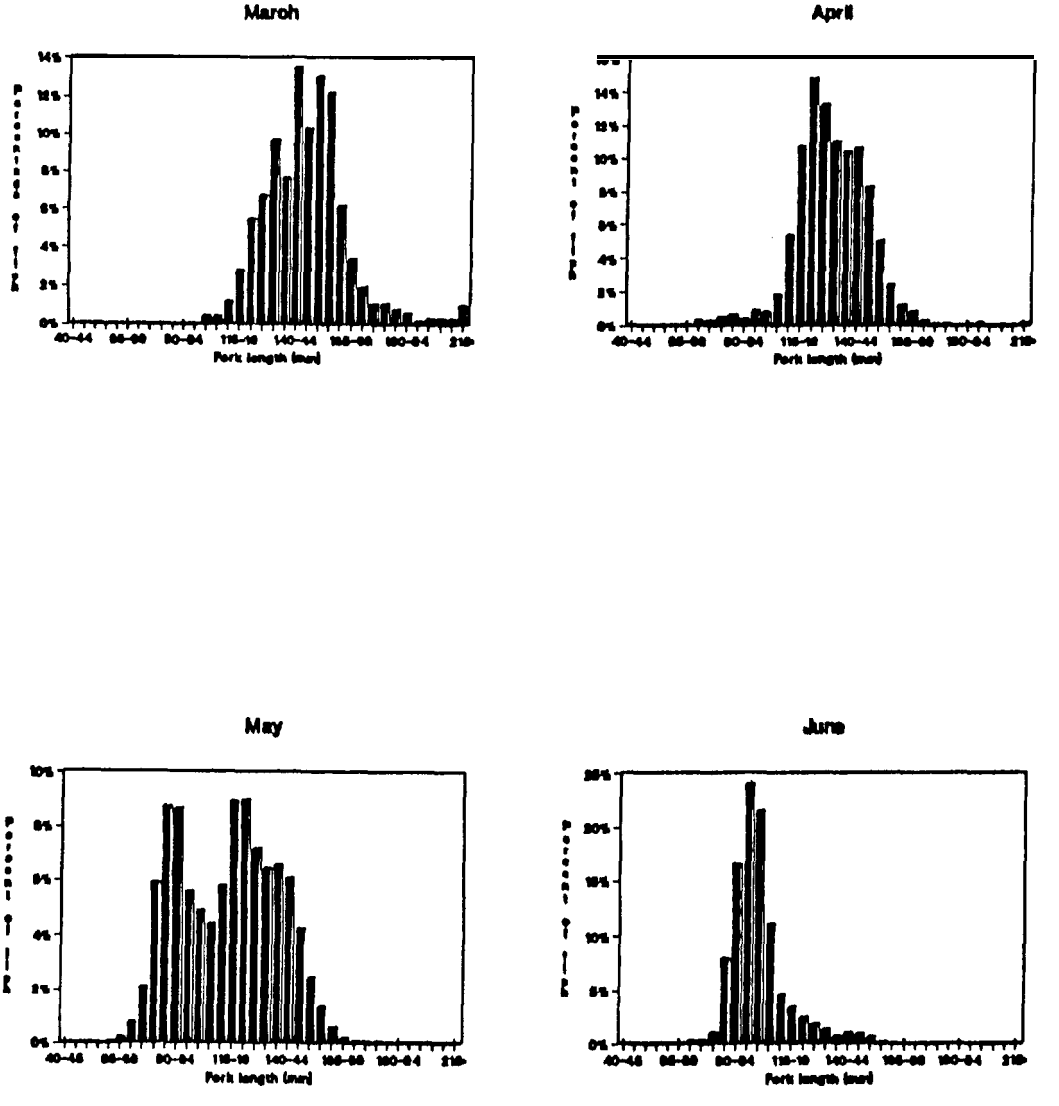

Figure 3. Length frequency distribution for wild spring chinook caught at Prosser smolt trap in March through June, 1988.

in June.

Explicitly, the number of wild fall chinook migrating past Prosser Dam in a given week was estimated as follows:

$$Nj = \sum_{i=a}^{i=b} [(Li,j)(Fi,j)] = Nf,j \qquad \text{equation 1.}$$

where a and b are length increment bounds, with "a" representing "less that 40 mm," "b" representing "greater than 199 mm", and with intervening steps of mm--(40-44,45-49,...,195-199);

Li,j = the percent of sampled wild chinook in week j falling in length interval i ;

Fi,j = the percent of fish in length interval i in week j determined from scale analysis to be fall chinook, i.e., O-age;

Nj = the estimated outmigration of all wild chinook in week j ; and

Nf,j = the estimated number of wild fall chinook in week j.

6.1.3.4 Salmonid Smolt Survival Rates to Prosser

The survival of smolts from release points ranging from 57 to 145 miles above Prosser has been poor since monitoring of outmigrations began in 1983 (see Appendix Tables C.1-C.3). Over the past five years, the mean

survival of pond-acclimated spring chinook, and non-acclimated spring chinook, steelhead, fall chinook and coho has been 31 percent, 27 percent, 25 percent, 27 percent and 48 percent, respectively. The preceding figures describe survival rates for hatchery-reared fish only. Survival rates for wild spring chinook were estimated from 23 replicated releases made in April, 1988. These releases indicated that the survival of wild spring chinook smolts was equivalent for fish released above Roza Dam, above Sunnyside Dam and below Sunnyside Dam, and averaged 57 percent, and that the survival of smolts released below Wapatox was lower, averaging 40 percent. From 1984 through 1988, an increasing number of screens and smolt by-passes at large diversion dams were rebuilt, and by 1987, all of the major diversions dams, except Wapatox, were rebuilt. Never-the-less smolt survival rates, as summarized in Appendix Tables C.l and C.2, remained low. This fact has serious implications for the Yakima/Klickitat Production Project, especially in light of the fact an additional 20 percent of the outmigtation may be lost between Prosser Dam and McNary Dam (see Appendix Table C.3).

It has been speculated that poor smolt survival, even after correction of the problems at diversion dams, is attributable to predation in reaches of the the open

river, particularly those reaches below major diversion which are rather severely dewatered during dry springs. The predator under greatest suspicion is the northern squawfish, although gulls are known to feed heavily on smolts in a few locations. The specific mechanism proposed is as follows. During dry springs, when the reservoirs are spilling little or no water, river flows, water velocities and mean depths drop dramatically, especially below major diversions. Accordingly, the in-basin residence time and predatory vulnerability of outmigrants is greatly increased. As the river shrinks and fewer near-shore refuges are accessible, smolts and predators are concentrated in smaller areas, and the consumption rates of predators (the functional response) increases. Smolts in the end of the outmigration, in mid to late May, are especially unlucky, as increasing water temperatures further accelerate predator consumption rates.

Available data from the literature indicates smolt losses of the magnitude observed in the Yakima could be mainly or entirely attributable to squawfish predation. In the last two weeks of April, 1987, when 57 percent of the 1987 spring chinook outmigration occurred, the passage at Prosser was estimated at 141,800 spring chinook smolts. Assuming that 1/14th of this number entered the

reach from Sunnyside Dam to Prosser Dam each day of these two weeks, the mean smolt density in the Sunnyside to Prosser reach was 1130 smolts/sq. km during this period. Vigg (1988) developed a functional response relationship for squawfish in the John Day Reservoir predicting smolt consumption (smolts/predator/day) as a function of smolt density. This relationship suggests squawfish in the Sunnyside to Prosser reach in the last two weeks of April, 1987, would have been consuming about 0.3 smolts per day. (Note that this figure is probably low, as the area of the reach used in the density calculation was based on bank-full flow; flows in late April, 1987 were not bank full, and density was probably at least twice as great as the figure used. A consumption rate of 0.3 smolts/predator/day may, however, be fairly descriptive of the mean rate over the entire outmigration period.) The total outmigraion in the spring (February through June) of 1987 was 252,000. Assuming 57 percent of this figure was lost in the Sunnyside to Prosser reach (See Appendix Table C.2), the total number entering the reach was 252,000/.57 or 442,000, and the loss was therefore 190,000. If squawfish feed at a rate of 0.3 smolts/day/squawfish over a 68 day period (April through the first week of June), it would take 190,000/(68 X 0.3) or about 9,300 squafish to consume 190,000 smolts. If the mean feeding rate were 1 smolt/day, the necessary

population would be only 2,800 squawfish. Squawfish populations of this magnitude could easily reside in the Yakima system. The total area of the mainstem Yakima and Naches drainage (at bank-full flows) is about 3,030 hectares. If squawfish densities in the Yakima are comparable to the 12/ha observed in Lake Washington (Bartoo, 1977), as many as 36,360 fish could reside in the drainage.

6.1.3 WAPATOX SMOLT TRAP

The fall pre-smolt outmigration was only monitored during October because operation of Wapato Diversion Canal ceased in order to provide adequate instream flows downstream to the facility. The estimated number of spring chinook outmigrants in October was 7,820 (see Table 5). Mean fork length in October was 90 mm.

The smolt outmigration was monitored March 4, when the screens were installed, through June 17. A monthly summary of the estimated number of spring chinook outmigrants in 1988 is presented in Table 5. Estimated spring chinook smolt outmigration in March, April, May and June was 11,076; 27,725; 1,295 and 269 respectively. Total estimated outmigration past Wapatox was 40,365 smolts.

The estimated weekly catch of spring chinook is presented in Table 6. Highest estimated outmigration occurred April l-7, when an estimated 13,282 smolts outmigrated. This represents 60.3% of the total estimated outmigration. Median passage date was April 5.

Monthly size distributions of spring chinook smolts are presented in Figure 4. Mean monthly fork lengths in April, May and June were 92, 95 and 96 mm, respectively.

Table 5. Summary of monthly outmigration of spring chinook at Wapatox in 1985 through 1988.

Year	Species	March	April	May	June	July	August	September	October	November
1985	Spring chinook	[b]	38,786	2,823	323	193	140	4,941	39,271	15,573[a]
1986	Spring chinook	[b]	2,925	3,902	765	509	169	2,178	8,707	48,779
1987	Springchinook	[b]	13,561	2,335	245	608	1,158	3,464	7,820	[b]
1988	Spring chinook	11,076	27,725	1,295	269	[b]	[b]	[b]	[c]	[c]

[a] Trap was only operated 11/1 to 11/10.

[b] Trap not in operation.

[c] Data not available at time of writing.

Table 6. Estimated weekly catches of spring chinook at Wapatox, fall, 1987 and spring, 1988.

Fall, 1987		Spring, 1988		
Date	Chinook pre-smolt	Date	Chinook smolt	Cumulative percent smolt passage
		3/4-10	2,096	5.2
		3/11-17	2,589	9.0
		3/18-24	4,833	15.5
		3/25-31	4,833	27.4
9/30-10/6	357	4/1-7	13,282	60.3
10/7-13	1,611	4/8-14	8,758	62.0
10/14-20	1,651	4/15-21[a]	4,327	92.8
10/21-27	1,980	4/22-28	1,253	95.9
10/28-11/3	3,930	4/29-5/5	393	96.8
11/4-10	1,856	5/6-12	384	97.0
11/11-17	1,609	5/13-19	371	98.7
11/18-24	23,247	5/20-26	176	99.2
11/25-12/1	21,868	5 m - w	112	99.4
		6/3-9[a]	I.38	99.8
		6/10-16	93	100.0
Totals	58,109		40,365	

[a]Trap was inoperable a portion of this week due to high river discharge and interpolation was used to estimate daily catches on these days.

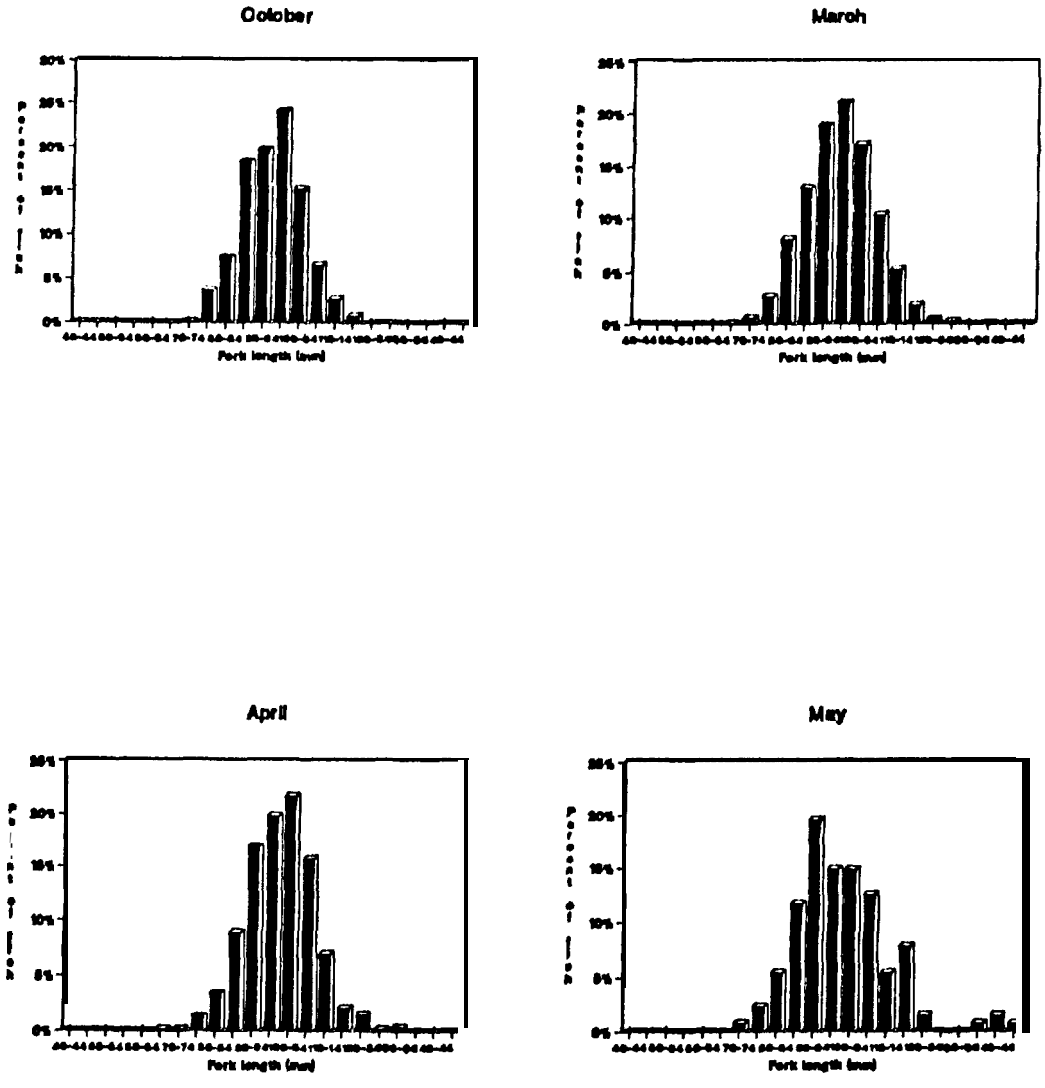

Figure 4. Monthly size distribution of spring chinook at Wapatox in October 1987 and March, April and May 1988.

6.1.4 ADULT RETURNS

In 1988 a total of 3,590 adult and 324 jack spring chinook salmon returning to the Yakima River were counted at Prosser fish ladder at RM 48 (Tables 7 and 8). This gives a total of 3,914 salmon returning to Prosser Dam (Table 9). The raw daily fish counts for Prosser Dam are presented in Appendix Tables A.1 through A.4. The mean dates of passage were May 12 and May 16 for adults and jacks respectively. An additional 333 fish were estimated to have been caught in the Yakima River subsistence dipnet fishery below Horn Rapids and Prosser Dams (Table 10). Therefore, total return to the Yakima system was 4,247 spring chinook salmon (Table 11).

Spring chinook were counted at Roza Dam from April to September 30, 1988. Passage at Roza Dam was 1,633 adult and 103 jack spring chinook for a total of 1,736 wild fish (Tables 12, 13, and 14). A total of 202 adult and 2 jack hatchery spring chinook were collected at Roza Dam to recover the coded wired tags for release group identification. An additional 111 fish were harvested between Prosser and Roza Dams in the subsistence dipnet fishery (Table 9). Daily raw counts of fish passage at Roza Dam are presented in Appendix Tables A.5 through A.9. The median dates of passage at Roza Dam were May 29 and May 26 for spring chinook adults and jacks respectively.

Table 7. Weekly adult spring chinook passage at Prosser Dam, 1988. (1) Index week number; (2) Week-ending date; (3) Weekly passage; (4) Weekly proportion; (5) Cumulative passage; (6) Cumulative proportion

(1)	(2)	(3)	(4)	(5)	(6)
12	325	0	0.0000	0	0.0000
13	401	0	0.0000	0	0.0000
14	408	1	0.0003	1	0.0003
15	415	20	0.0056	21	0.0058
16	422	145	0.0404	166	0.0462
17	429	390	0.1086	556	0.1548
18	506	979	0.2726	1535	0.4275
19	513	708	0.1972	2243	0.6246
20	520	704	0.1960	2947	0.8207
21	527	310	0.0863	3257	0.9070
22	603	171	0.0476	3428	0.9546
23	610	79	0.0220	3507	0.9766
24	617	43	0.0120	3550	0.9886
25	624	2	0.0006	3552	0.9891
26	701	19	0.0053	3571	0.9944
27	708	14	0.0039	3585	0.9983
28	715	6	0.0017	3591	1.0000
29	722	0	0.0000	3591	1.0000
30	729	0	0.0000	3591	1.0000

Mean date: May 12

Table 8. Weekly jack spring chinook passage at Prosser Dam, 1988. (1) Index week number; (2) Week-ending date; (3) Weekly passage; (4) Weekly proportion; (5) Cumulative passage; (6) Cumulative proportion

(1)	(2)	(3)	(4)	(5)	(6)
17	429	2	0.0062	2	0.0062
18	506	3	0.0093	5	0.0155
19	513	24	0.0745	29	0.0901
20	520	78	0.2422	107	0.3323
21	527	106	0.3292	213	0.6615
22	603	68	0.2112	281	0.0727
23	610	29	0.0901	310	0.9627
24	617	10	0.0311	320	0.9938
25	624	1	0.0031	321	0.9969
26	701	0	0.0000	321	0.9969
27	708	0	0.0000	321	0.9969
28	715	1	0.0031	322	1.0000

Mean date: May 16

Table 9. Weekly total spring chinook passage at Prosser Dam, 1988. (1) Index week number; (2) Week-ending date; (3) Weekly passage; (4) Weekly proportion; (5) Cumulative passage; (6) Cumulative proportion

(1)	(2)	(3)	(4)	(5)	(6)
12	325	0	0.0000	0	0.0000
13	401	.0	0.0000	0	0.0000
14	408	1	0.0003	1	0.0003
15	415	20	0.0051	21	0.0054
16	422	145	0.0371	166	0.0424
17	429	392	0.1002	558	0.1426
18	506	902	0.2510	1540	0.3936
I.9	513	732	0.1871	2272	0.5806
20	520	782	0.1998	3054	0.7805
21	527	416	0.1063	3470	0.8868
22	603	239	0.0611	3709	0.9479
23	610	lo8	0.0276	3817	0.9755
24	617	53	0.0135	3870	0.9890
25	624	3	0.0008	3873	0.9898
26	701	19	0.0049	3892	0.9946
28	708	14	0.0036	3906	0.9902
29	715	7	0.0018	39J.3	1.0000
	722	0	0.0000	3913	1.0000
30	729	0	0.0000	3913	1.0000

Mean date: May 12

Table IO. YIN Yakima River spring chinook fishery, 1981 - 1988.

	Estimated	Horn Rapids		Prosser		Sunnysidc		Uapato		Total	
	chinook	harvests		harvests		harvests		harvests		harvests	
Year	run size	CH	SH	CH	SH	CH	SH	CH	SH	CH	SH
1981	1,334	0	0	49	2	137	1	30	0	216	3
1982	1,686	IO	0	78	0	241	11	105	2	434	13
1983	1,324	0	0	72	1	9	11	30		84	16
1984	2,677	3	0	116	4	122	18	48	3	289	25
1985	4,529	54	0	267	3	61	0	483	21	865	24
1986	9,442	158	3	372	2	212	0	598	0	1,340	5
1987	4,390	40	0	332	0	60	0	114	6	546	6
1988	4,247	220	0	113	0	42	0	69	0	444	0
81-88 Average	3,704	61	0	175	2	111	5	164	4	527	6

Table 11. Estimated spring chinook runs to the Yakima River basin, 1957-1988.

Year	Total redds[a] Naches	Yakima	Total	Escapement[b]	Harvest[c]	Total run
1957	764	1216	1980	4752	7913	12665
1958	284	531	815	1956	4401	6357
1959	306	255	561	1346	3464	4810
1960	126	184	310	744	3668	4412
1961	166	175	341	818	5044	5862
1962	153	76	229	550	4185	4735
1963	185		—	—	2992	
1964	50	ii	131	314	3241	3555
1965	53	90	143	343	1763	2106
1966	95	32	127	305	4800	5105
1967	58	97	155	388	3195	3583
1968	25	61	86	206	2430	2636
1969	50	309	359	862	618	1480
1970	48	23	71	170	1512	1662
1971	—	97	—	—	1232	—
1972	55	101	156	374	480	854
1973	28	41	69	166	3221	3387
1974	30	40	70	168	1748	1916
1975	—	104	—		600	—
1976	35	108	143	343	—	—
1977	10	121	131	314	—	—
1978	95	308	403	967	—	—
1979	153	86	239	574	—	—
1980	113	353	466	1118	106	1224
1981	172	294	466	1118	216	1334
1982	54	573	626	1252	434	1686
1983	83	360	443	1240	84	1324[d]
1984	220	634	854	2050	289	2677[d]
1985	427	951	1378	3582	865	4527[d]
1986	1298	1780	3078	7387	1300	8687
1987	675	956	1631	3294	546	4390
1988	480	566	1046	3242	444	4247

[a]Redd counts for 1957-1961 are total redd counts from Major and Mighell (1969). For 1962-1980 the counts are index counts from WDF or YIN coordinated surveys. Index counts in this time period were expanded by 1.8 and 2.5 for the upper Yakima and Naches systems, respectively. (Expansion factors were derived from the ratio of index counts to total counts for the respective systems. Total counts were from the Major and Mighell study and from the 1981-1987 surveys.) For 1981-1987 the counts are total redd counts from USFWS, YIN, and WDF cooperative surveys.

[b]Based on Roza Dam counts the number of fish per redd has overaged 2.4 in the upper Yakima since 1982. Historical escapement for 1958 to 1981 was therefore estimated as the total redd count multiplied by 2.4. For 1982 to 1987 the actual number of fish per redd was used to expand the total redd count.

[c]1957-1975 WDF tribal harvest estimates; 1980-1987 YIN tribal harvest estimates. All harvest estimates are for the Yakima River only.

[d]Total run estimates since 1984 are the sum of the Prosser Dam counts and the estimated harvests below Prosser Dam.

Table 12. Weekly adult spring chinook passage at Roza Dam, 1988. (1) Index week number; (2) Week-ending date; (3) Weekly passage; (4) Weekly proportion; (5) Cumulative passage; (6) Cumulative proportion

(1)	(2)	(3)	(4)	(5)	(6)
18	506	12	0.0073	12	0.0073
19	513	190	0.1164	202	0.1237
20	520	253	0.1549	455	0.2786
21	527	488	0.2988	943	0.5775
22	603	98	0.0600	1041	0.6375
23	610	90	0.0551	1131	0.6926
24	617	204	0.1249	1335	0.8175
25	624	81	0.0496	1416	0.8671
26	701	97	0.0594	1513	0.9265
27	708	20	0.0122	1533	0.9388
28	715	33	0.0202	1566	0.9590
29	722	0	0.0000	1566	0.9590
30	729	1	0.0006	1567	0.9596
31	805	13	0.0080	1580	0.9675
32	812	7	0.0043	1587	0.9718
33	819	13	0.0080	1600	0.9798
34	826	8	0.0049	1608	0.9847
35	902	10	0.0061	1618	0.9908
36	909	6	0.0037	1624	0.9945
37	916	5	0.0031	1629	0.9976
38	923	3	0.0018	1632	0.9994
39	930	1	0.0006	1633	1.0000

Mean date: May 29

Table 13. Weekly jack spring chinook passage at Roza Dam, 1988. (1) Index week number; (2) Week-ending date; (3) Weekly passage; (4) Weekly proportion; (5) Cumulative passage; (6) Cumulative proportion

(1)	(2)	(3)	(4)	(5)	(6)
19	513	0	0.0000	0	0.0000
20	520	0	0.0000	0	0.0000
21	527	5	0.0485	5	0.5224
22	603	7	0.0680	12	0.7164
23	610	11	0.1068	23	0.8060
24	617	36	0.3495	59	0.8955
25	624	13	0.1262	72	0.9104
26	701	13	0.1262	85	0.9254
27	708	1	0.0097	86	0.9254
28	715	11	0.1068	97	0.9403
29	722	0	0.0000	97	0.9403
30	729	0	0.0000	97	0.9552
31	805	1	0.0097	98	0.9552
32	812	2	0.0194	100	0.9701
33	819	2	0.0194	102	0.9701
34	826	1	0.0097	103	1.0000

Mean date: May 26

Table 14. Weekly total spring chinook passage at Roza Dam, 1987
(1) Index week number; (2) Week-ending date; (3) Weekly passage;)
(4) Weekly proportion; (5) Cumulative passage; (6) Cumulative proportion

(1)	(2)	(3)	(4)	(5)	(6)
18	506	12	0.0033	12	0.0069
19	513	190	0.0529	202	0.1164
20	520	253	0.0705	455	0.2621
21	527	493	0.1373	948	0.5461
22	603	105	0.0292	1053	0.6066
23	610	101	0.0281	1154	0.6647
24	617	240	0.0668	1394	0.8030
25	624	94	0.0262	1488	0.8571
26	701	110	0.0306	1598	0.9205
27	708	21	0.0058	1619	0.9326
28	715	44	0.0123	1663	0.9579
29	722	0	0.0000	1663	0.9579
30	729	1	0.0003	1664	
31	805	14	0.0039	1678	0.9585
32	812	9	0.0025	1687	0.9718
33	819	15	0.0042	1702	0.9804
34	826	9	0.0025	1711	0.9856
35	902	10	0.0028	1721	0.9914
36	909	6	0.0017	1727	0.9948
37	916	5	0.0014	1732	0.9977
38	923	3	0.0008	1735	0.9994
39	930	1	0.0003	1736	1.0000

Mean date: May 29

A summary of adult and jack returns to each of the dams, harvest below and above Prosser, and the number of fish available to spawn in the Yakima and Naches Rivers is presented in Table 17.

The spring chinook redd counts from 1981to 1988 are presented in Table 18. These counts were not part of the data collected on the present spring chinook study but are important for estimates of survival through various life stages and are included in this report for that reason.

Upper Yakima Surveys: A total of 566 redds were reported from surveys on the upper Yakima. A total of 539 were above Roza Dam and an additional 27 were discovered in the area between Roza Dam and Selah Bridge.

The number of chinook escaping past Roza was 1,736; the number of redds was 539. The resulting statistic was 3.11 fish per redd. There is no accounting for pre-spawning mortality by this method. Consequently, 1.82

does not necessarily reflect the average number of fish observed on a redd on the spawning grounds.

Table 15. Total spring chinook salmon return to the Yakima River and to the spawning grounds in 1987.

Return to Prosser	
Adults to Prosser Dam	3,683
Jacks to Prosser Dam	335
Total run to Prosser	4,018
Harvest below Prosser	372
Total run to the river	4,390
Return to Roza	
Adults to Roza Dam	1,610
Jacks to Roza Dam	67
Total Run to Roza available to spawn in upper Yakima	1,677
Harvest between Prosser and Roza	174
Fish spawning between Roza and Prosser[a]	253
Number of fish available to spawn in the Naches River[b]	1,914

[a] It was calculated that there are 2.02 fish per redd in the Yakima giving a total of 253 fish spawning below Roza Dam in the Yakima River.

[b] Calculated as number of fish counted at Prosser, minus the harvest between Prosser and Roza minus the fish spawning in the Yakima below Roza minus the number of fish counted at Roza ladder.

Naches Surveys: There were a total of 480 redds found on the Naches River in 1988. This represents a decline in the redds counted on the Naches system from 1986 and 1987.

Table 16. Yakima River Basin spring chinook redd counts, 1981 - 1988.

	1981	1982	1983	1984	1985	1986	1987	1988
Upper Yakima system								
Easton	126	204	104	302	322	352	270	186
Game Ramp	35	92	32	66	77	127	45	37
Freeway Bridge	30	159	77	145	137	352	211	127
S. Cle Elum Bridge	39	80	20	67	118	253	205	76
Teanaway Reach	2	8[a]		9	22[a]	118	70	20
Ellensburg Town Ditch	5	—	25	11	17		26	14
Cle Elum River	57	30	15	31	153	77	75	79
Teanaway River	0	0	0	0	3	0	-	0
Miscellaneous	—	—	—	3[b]	102	514[c]	153[d]	27
Subtotal	294	573	360	634	951	1793	1063	566
Naches system								
American River	72	11	36	72	141	464	222	239
Bumping River	20	6	11	26	74	196	133	59
Little Naches River	16	12	9	41	44	110	42	41
Rattlesnake Creek	0	2	4	24	11	17	28	17
Naches River	64	23	23	57	157	526	252	124
Subtotal	172	54	83	220	427	1313	677	480
Basin total	466	627	443	854	1378	3106	1740	1046

[a]Teanaway River to Thorp Bridge.
[b]Manastash Creek (rm 0.0-4.6).
[c]Roza Dam to Selah Bridge - 321 redds; Thorp Bridge to KOA - 110 redds; KOA to Wilson Creek - 64 redds; Wilson Creek to Burbank Creek - 18 redds; and downtown Yakima - 1 redd.
[d]Roza Dam to Selah Bridge - 140 redds; KOA to Roza Dam - 13; Selah to Ahtanum Creek confluence - 0.

6.1.5 ESTIMATES OF SURVIVAL THROUGH VARIOUS LIFE STAGES

6.1.5.1 Egg to Fry:

Survival from egg to fry was discussed extensively in the survival to emergence sections of the 1985 and 1986 annual reports. The survival from egg to emergent fry was calculated to be 59.6% which is the mean of the 62.5% estimate in 1985 and 56.7% in 1986. As discussed earlier the 1988 studies were terminated by high spring runoff and damage to the redd cap nets.

Total egg deposition in the Yakima system from 1981 to 1988 is presented in Table 17. Total egg deposition was calculated as the sum of three subareas: the upper Yakima, the American River, and the remaining Naches system due to different mean size of females in each of these areas. The mean fecundity as calculated from the length fecundity model and the mean length of females measured in each subarea in 1985 was 3,908 eggs/female in the upper Yakima, 6,198 eggs/female in the American River and 5,150 eggs/female in the rest of the Naches system.

The total number of fry produced from the egg deposition in 1981 to 1988 is reported in Table 17. This estimate is based on the current 59.6% egg to fry survival rate which is the mean of the 62.5% estimate in 1985 and the 56.7% from 1986.

Table 17. Total estimated egg deposition in the Yakima Basin for 1981 to 1988.

Brood year	Subarea	Number of redds	Eggs/redd	Total
1981	American River	72	6,198	446,256
	Naches (other)	100	5,150	515,000
	Yakima (upper)	294	3,908	1,148,952
	Total	466		2,110,208
1982	American	11	6,198	68,178
	Naches	43	5,150	221,450
	Yakima	573	3,908	2,239,284
	Total	628		2,528,912
1983	American	36		223,128
	Naches	47	6,198 5,150	242,050
	Yakima	360	3,908	1,406,880
	Total	443		1,872,058
1984	American	72	6,198	446,256
	Naches	148	5,150	762,200
	Yakima	634	3,908	2,477,672
	Total	854		3,686,128
1985	American	286	5,150	873,918
	Naches	951	3,908	1,472,900
	Yakima			
	Total	1,378		6,063,326
1986	American	464 850	6,198	2,875,872
	Naches			4,377,500
	Yakima	1,796	5,150	7,018,768
	Total	3,110		14,272,140
1987	American	222 455	6,198	1,375,956
	Naches		5,150	2,343,250
	Yakima	1,063	3,908	4,154,204
	Total	1,740		7,873,410
1988	American	239 241	6,198	1,481,322
	Naches		5,150	1,241,150
	Yakima	566	3,908	2,211,928
	Total	1,046		4,934,400

Table 18. Estimated fry production from eggs deposited in the Yakima Basin from 1981 to 1988.

Broodyear	Total egg deposition	% survival	Total fry
1981	2,110,208	59.6	1,257,684
1982	2,528,912	59.6	1,507,232
1983	1,872,058	59.6	1,115,747
1984	3,686,128	59.6	2,196,932
1985	6,063,326	59.6	3,613,742
1986	14,272,140	59.6	8,506,195
1987	7,873,410	59.6	4,692,552
1988	4,934,400	59.6	2,940,902

6.1.6.2 Egg to Smolt:

The egg to smolt (S,) survival was calculated as the number of smolts estimated to outmigrate past Prosser divided by the total egg deposition for their year class as calculated in Table 17. The egg to smolt survival from egg deposition for the brood years 1981 to 1986 and corresponding smolt outmigration years of 1983 to 1988 are presented in Table 19.

This mean percent survival from egg to smolt of 4.4% is much lower than the 10.7% (range from 5.4 to 16.4) reported by Major and Mighell (1969). Bjornn (1978) evaluated natural production of spring chinook in the Lemhi River, Idaho, and over an 8-year period found that survival from egg to migrant smolt averaged 9.8% (range

4.0% to 15.9%). This is also much higher than the six year mean of 4.4% we found. He considered the level of spawning escapments to the upper Lemhi River low during the study years, thus underseeding may have resulted in maximum survival rates for juvenile chinook in that system.

Table 19. Egg to smolt survival for 1981 to 1986 brood years in the Yakima Basin.

Brood year	Egg deposition	Outmigrating smolts	Percent survival
1981	2,110,208	136,102	6.5%
1982	2,528,912	123,732	4.9%
1983	1,872,058	83,614	4.5%
1984	3,686,128	169,077	4.6%
1985	6,063,326	251,975	4.2%
1986	14,272,140	255,407	1.8%
Mean	4,503,129	169,984	4.4%

Several other studies conducted on mid-Columbia tributaries had survival rates similar to those observed in the current study. In the Deschutes River, Oregon Johasson and Lindsay (1983) found an average egg-to-migrant survival rate of 3.5 percent (range 2.3% to 5.5%) for their spring chinook smolts. These were primarily yearling spring migrants but also included fall (age 0) migrants. An egg-to-migrant survival rate of 5.2% (range 3.6% to 6.7%) was found for spring chinook in the John

Day River, Oregon, (Lindsay et al., 1981). These percentages were based on yearling spring migrants only.

In 1986-87 and 1987-88 were we able to make estimates of the winter outmigration in the Yakima River because the new and improved screens were left in the canal due to the milder than average winter. The winter outmigration increased the total 1987 smolt outmigration from 251,975 to 330,323 smolts and the total 1988 smolt outmigration from 255,407 to 327,677. The new Chandler Canal screens will allow winter sampling to occur more regularly in the future.

6.1.6.3 Fry **to Smolt:**

An **estimate** of the survival from fry to **smolt** (S_{fs}) based on the fry production (Table 20) and **smolt** outmigration at Prosser for the brood years of 1981 to 1986 is reported in Table 20.

Table 20. Estimated survival from fry to smolt in the Yakima Basin for brood years 1981 to 1986.

Brood year	Fry produced	Smolt out-migration	Percent survival
1981	1,257,684	136,102	10.3%
1982	1,507,232	123,732	7.6%
1983	1,115,747	93,614	7.1%
1984	2,196,932	169,077	7.7%
1985	3,613,742	251,975	7.0%
1986	3,506,195	255,407	3.0%
Mean	3,032,922	169,984	7.1%

6.1.6.4 Smolt to Adult:

The smolt to adult (S,) survival based on the 1983 smolt outmigration estimated at Prosser and the 1984 return of jacks (3 year old fish), the 1985 return of four year old adults, and the 1986 return of five year old adults to the Yakima River is reported in Table 21. It was estimated.that 6,012 wild three, four, and five year old fish returned from an estimated smolt outmigration of 135,548 fish in 1983.

The smolt to adult (S,) based on the 1984 smolt outmigration estimated at Prosser and the 1985 return of jacks, the 1986 return of four year old adults and the 1987 return of five year old adults to the Yakima River is reported in Table 22.

The smolt to adult (S,) based on the 1985 smolts outmigration estimated at Prosser and the 1986 return of jacks and the 1987 return of four year old adults and the 1988 return of five year old adults to the Yakima River is reported in Table 23.

This estimated rate of survival from smolt to adult is also subject to error due to our estimation of total outmigration. We are quite confident in the smolt outmigration estimation procedure for Prosser (Section 6.1.3). However, from the recent findings at Wapatox smolt trap indicating an extensive fall outmigration, and the premliminary findings at Prosser smolt trap this

past winter (see section **6.1.3.1),** there may be a large outmigration of pre-smolt spring chinook in the months when the Chandler: Canal smolt trap is inoperable due to screen removal.

Table 21. Estimation of smolt to adult survival of the 1983 smolt outmigration from the Yakima system.

Adult (4 year old) returns	
Total adult return (4's + 5's) to Prosser	3,783
plus adult harvest below Prosser	321
Total return of adult (4's + 5's) to system	4,104
Adults to Roza [a]	2,125
plus 237 (spawning below Roza) [b]	237
plus 361 (harvest above Prosser) [c]	361
Total adults to Yakima [d]	2,723
Adults to Naches [e]	1,198
plus 183 (harvest above Prosser) [f]	183
Total adults to Naches	1,381
times 50% (4 year old fish) [g]	691
Total four year old returns to system	3,414
plus jacks that returned in 1984	248
plus five year old returns in 1986 [h]	2,440
Total 3, 4, and 5 year old returns	6,102
minus hatchery fish	90
Total wild 3, 4, and 5 year old returns	6,012
Wild smolts outmigrating in 1983	135,548
Survival (S_a) = $\frac{6,102}{135,548}$ =	4.4%

[a] Total adults counted at Roza fish ladder.
[b] Spring chinook calculated to spawn in Yakima River below Roza dam from 91 redds at 2.6 fish/redd = 237 fish.
[c] Estimate of percentage of 544 spring chinook that were harvested above Prosser and below Roza that would have gone up Yakima. Based on 66.3% of adult run returning to the Yakima and 33.7% to Naches.
[d] Estimated that 100% of the adults in the Yakima are four year old fish.
[e] Estimated as total return of adults to system minus adult count at Roza minus spawning below Roza minus harvest between Prosser and Roza.
[f] Estimate of percentage of 544 fish harvested above Prosser and below Roza that would have returned to the Naches system (33.7%)
[g] Estimated that 50% of the adults in the Naches system are four year old fish.
[h] From Table 22.

Table 22. Estimation of smolt to adult survival of the 1984 smolt outmigration from the Yakima system.

Adult (4 year old) returns	
Total adult return (4's + 5's) to Prosser	8,563
plus adult harvest below Prosser	530
Total return of adult (4's + 5's) to system	9,093
Adults to Roza [a]	2,967
plus 706 (spawning below Roza) [b]	706
plus 504 (harvest above Prosser) [c]	540
Total adults to Yakima [d]	4,213
Adults to Naches [e]	4,610
plus 270 (harvest above Prosser) [f]	270
Total adults to Naches	4,880
times 50% (4 year old fish) [g]	2,440
Total four year old returns to system	5,163
plus jacks that returned in 1984	423
plus five year old returns in 1987 [h]	1,010
Total 3,4, and 5 year old returns	6,549
minus hatchery fish	30
Total wild 3, 4, and 5 year old returns	6,519
Wild Smolts outmigrating in 1984	123,732
Survival (S_a) = $\frac{6,519}{123,732}$ =	5.3%

[a] Total adults counted at Roza fish ladder.
[b] Spring chinook calculated to spawn in Yakima River below Roza dam from 321 redds at 2.2 fish/redd = 706 fish.
[c] Estimate of percentage of 544 spring chinook that were harvested above Prosser and below Roza that would have gone up Yakima. Based on 66.7% of adult run returning to the Yakima and 33.3% to Naches.
[d] Estimated that 100% of the adults in the Yakima are four year old fish.
[e] Estimated as total return of adults to system minus adult count at Roza minus spawning below Roza minus harvest between Prosser and Roza.
[f] Estimate of percentage of 810 fish harvested above Prosser and below Roza that would have returned to the Naches system (33.3%).
[g] Estimated that 50% of the adults in the Naches system are four year old fish.
[h] From Table 23.

Table 23. Estimation of smolt to adult survival of the 1985 smolt outmigration from the Yakima system.

Adult (4 year old) returns	
Total adult return (4's + 5's) to Prosser	3,683
plus adult harvest below Prosser	222
Total return of adult (4's + 5's) to system	3,905
Adults to Roza [a]	1,610
plus 237 (spawning below Roza) [b]	253
plus 361 (harvest above Prosser) [c]	115
Total adults to Yakima [d]	1,978
Adults to Naches [e]	1,868
plus 183 (harvest above Prosser) [f]	57
Total adults to Naches	1,925
times 50% (4 year old fish) [g]	963
Total four year old returns to system	2,941
plus jacks that returned in 1984	349
plus five year old returns in 1988 [h]	1,010
Total 3, 4 and 5 year old returns	4,300
minus hatchery fish	245
Total wild 3, 4, and 5 year old returns	4,055
Wild smolts outmigrating in 1985	
Survival (S_a) = $\frac{4,055}{83,614}$ =	4.9%

[a] Total adults counted at Roza fish ladder.
[b] Spring chinook calculated to spawn in Yakima River below Roza dam from 125 redds at 2.02 fish/redd = 253 fish.
[c] Estimate of percentage of 174 spring chinook that were harvested above Prosser and below Roza that would have gone up Yakima. Based on 66.3% of adult run returning to the Yakima and 33.7% to Naches.
[d] Estimated that 100% of the adults in the Yakima are four year old fish.
[e] Estimated as total return of adults to system minus adult count at Roza minus spawning below Roza minus harvest between Prosser and Roza,
[f] Estimate of percentage of 544 fish harvested above Prosser and below Roza that would have returned to the Naches system (33.7%)
[g] Estimated that 50% of *the adults in the Naches system are four year old fish.
[h] from Table 24.

Table 24. Estimation of smolt to adult survival of the 1986 smolt outmigration from the Yakima system.

Adult (4 year old) returns	
Total adult return (4's + 5's) to Prosser	3,590
plus adult harvest below Prosser	333
Total return of adult (4's + 5's) to system	3,923
Adults to Roza [a]	1,633
plus237(spawning below Roza) [b]	46
plus361(harvest above Prosser) [c]	73
Total adults to Yakima [d]	1,752
Adults to Naches [e]	2,133
plus 183 (harvest above Prosser) [f]	38
Total adults to Naches	2,171
times 50% (4 year old fish) [g]	1,086
Total four year old returns to system	2,838
plus jacks that returned in 1984	335
Total 3 and 4 year old returns	3,173
minus hatchery fish	196
Total wild 3, 4, and 5 year old returns	2,977
Wild smolts outmigrating in 1986	
Survival (S_a) = $\frac{2,977}{169,077}$ =	1.8%

[a] Total adults counted at Roza fish ladder.
[b] Spring chinook calculated to spawn in Yakima River below Roza dam from 19 redds at 2.04 fish/redd = 46 fish.
[c] Estimate of percentage of 111 spring chinook that were harvested above Prosser and below Roza that would have gone up Yakima. Based on 66.3% of adult run returning to the Yakima and 33.7% to Naches.
[d] Estimated that 100% of the adults in the Yakima are four year old fish.
[e] Estimated as total return of adults to system minus adult count at Roza minus spawning below Roza minus harvest between Prosser and Roza.
[f] Estimate of percentage of 111 fish harvested above Prosser and below Roza that would have returned to the Naches system (33.7%)
[g] Estimated that 50% of the adults in the Naches system are four year old fish.

6.2 HATCHERY OPERATIONS

6.2.1 OUTPLANTING STUDIES

6.2.1.1 Smolt releases

Three groups of spring chinook smolts were released from Mary's pond at RM 192 on the Yakima River and a forth group was transported from Leavenworth National Fish Hatchery and scatter-planted directly into the upper Yakima River between RM 155 and 200 in 1986 and 1987, to evaluate the effectiveness of rearing and releasing hybrids and acclimating fish in earthen ponds and then allowing for a volitional release as smolts.

Similar releases were made from Nile Springs pond and the upper Yakima River in 1983 and 1984 and from Mary's pond and the upper Yakima River in 1985 to compare acclimation ponds vs. direct river releases. The 1986 release groups represented the first time the wild x wild and wild x hatchery hybrids were released. The 1987 release groups were a repetition of the 1986 releases. The 1983 release groups returned as six year old adults in 1987 and the 1984 release groups returned as four year old adults in 1986 and five year old adults in 1987. The 1985 release groups returned as four year old fish in 1987 and five year old fish in 1988. The 1986 release groups returned as four year old adults in 1988. Other release strategies tested were June fry plants and September and November parr releases in 1984 and 1985.

Their survival rates will be discussed in the Hatchery Adult Return section of this report.

6.2.2 BROOD STOCK EVALUATIONS

An experimental brood stock program was undertaken in 1984 and continued in 1985 to evaluate the effectiveness of using spring chinook adults from the Yakima River as a source of gametes for hatchery reared fish in an attempt to maintain the genetic components indigenous to the Yakima Basin. Crosses were made to obtain four different release groups; wild males and wild females, wild males and hatchery females, and two groups of hatchery males and females. The first three groups were released in acclimation ponds and the fourth group was released directly into the Yakima River and compared with survival of group three - a continuation of the acclimation pond vs. river release study. The required crosses were made in 1984 and 1985 from Yakima River brood stock adults taken from the Roza adult trap. The hybrids were reared at Leavenworth National Fish Hatchery and released as smolts. The first releases, the 1984 brood year products, were made from Mary's pond and the upper Yakima in 1986. The resulting progeny of the 1985 crosses were released at the same locations in 1987. Survival of each release group was calculated at Prosser smolt trap for smolt survival. The survival to returning

adults will be determined for each group through 1990 when the five year old adults from the 1987 smolt releases return to the river.

6.2.3 ADULT HATCHERY RETURNS

Spring chinook adults from fourteen different hatchery release groups were recovered in 1988, These fish were identified by the coded wire tags recovered in the Yakima River ceremonial dipnet fishery, from spawning ground surveys and carcass recovery surveys conducted on the Yakima and Naches River systems in August, September and October of 1988, and from the adult trap at Roza Dam. All fish passing Roza Dam were inspected for adipose clips. Any clipped fish were sacrificed to increase the the recovery of coded wire tags. Table 25 presents the release data for all hatchery groups that could possibly return to the Yakima system as three, four, five or six-year-old fish in 1988 (two six year old adults were found in 1987). The 1988 tag recoveries were from the 1985 upper Yakima release group; the 1986 upper Yakima groups; the June, September and November 1984 and 1985 fry and pre-smolt release groups and the 1985, 1986 and 1987 Mary's pond release groups. The expanded recoveries for each of the release groups is presented in Table 26. An analysis of the 1983 upper Yakima River release group indicates that 2 six-year-old adults returned in

Table 25. Tag data on all hatchery release groups that could have returned to the Yakima system in 1988.

Brood year	Tag code	Total number released	Release site	Number tagged	Mark rate (%)
1981	5-13-38	99,725	Nile Springs	94,529	94.8
1981	5-13-39	97,725	Upper Yakima	94,198	97.1
1982	5-11-47	29,636	Nile Springs	28,450	96.0
1982	5-11-48	45,552	Upper Yakima	41,573	97.7
1983	5-15-33	45,195	Marys Pond	43,297	95.8
1983	5-15-32	42,210	Upper Yakima(April)	40,436	95.8
1983	5-15-28	102,837	Upper Yakima(June)	93,064	90.5
1983	5-15-29	102,833	Upper Yakima(Sept.)	93,064	90.5
1983	5-15-30	108,305	Upper Yakima(Nov.)	102,229	94.4
1983	5-12-23	25,794	Rattlesnake	40,434	87.0
1984	5-15-45	100,750	Upper Yakima(June)	96,216	95.5
1984	5-15-46	101,724	Upper Yakima(Sept.)	95,621	94.0
1984	5-15-47	101,522	Upper Yakima(Nov.)	95,431	94.0
1984	5-15-48	50,657	Upper Yakima	46,858	92.5
1984	5-15-49	51,846	Mary's Pond(H)	47,076	90.8
1984	5-15-50	46,476	Mary's Pond(HxW)	40,434	87.0
1984	5-15-51	33,052	Mary's Pond(WxW)	29,449	89.1
1985	5-17-38 5-17-56	50,113	Upper Yakima	42,796	85.4
1985	5-17-38 5-17-56	50,519	Mary's Pond(H)	44,436	84.8
1985	5-17-55	52,392	Mary's Pond(HxW)	44,899	85.7
1985	5-14-46,47,48	56,841	Mary's Pond(WxW)	47,576	83.7

1987, 12 five-year old adults returned in 1986 and 31 four-year-old fish returned in 1985. The total estimated adult return was thus 45 fish. There were 97,725 smolts released in the upper Yakima in 1983. This gives a **"smolt-at-release"** to adult survival rate of 0.05%. It was estimated that 20,131 of these smolts survived passage to Prosser Dam in 1983. The smolt-at-Prosser to adult survival rate was thus 0.22% This compares to a **"smolt-at-release"** to adult survival rate of 0.08% and "smolt-at-Presser" rate of 0.2% for the Nile pond acclimation release group.

Survival rates for smolt-at-Prosser to adult are almost identical between the acclimated and **non-**

Table 26. Estimated expanded returns of hatchery released smolts.

Tag code	Source of recovery[a]	Number recovered	Sample rate[b,c]	Sample expanded	Mark rate	Total recovery
5-E-28	4	2	1.00	2	.905	2
5-15-29	4	21	1.00	21	.905	23
5-E-30	4	I.8	1.00	18	.944	19
5-15-32	4	22	1.00	22	.958	23
5-15-33	4	28	1.00	28	.958	29
5-15-45	4	3	1.00	3	.955	3
5-15-46	4	24	1.00	24	.940	26
5-15-47	4	27	1.00	27	.940	29
5-15-48	4	6	1.00	6	.925	6
5-15-49	4	14	1.00	14	.908	15
5-15-50	4	6	1.00	6	.870	7
5-15-51	4	3	1.00	3	.891	3
5-14-46	4	1	1.00	1	,837	1
5-17-56	4	1	1.00	1	.848	1

a Recovery code 1 = Zone 6 ceremonial and subsistence fishery; 2 = Yakima River dipnet fishery; 3 = Naches spawner and carcass surveys; 4 = Yakima River Roza fish trap; 5=Rattlesnake Creek spawner surveys.
b In the Naches system 145 fish were inspected from an estimated 1,485 spawners.
c In the Rattlesnake 10 fish were inspected from an estimated 62 spawners.

acclimated 1983 release groups. The survival rate from release site to Prosser, however, was almost twice as great for the acclimated fish (38.5%) as for the non-acclimated fish (20.6%). Thus, acclimation and volitional release apparently increased the relative fitness of acclimated smolts, perhaps by allowing recovery from the stress of handling and transportation and/or the development of adaptive behavior patterns (e.g., predator avoidance responses).

An analysis of the 1984 release group at Nile Springs pond and the 1984 upper Yakima River release group indicates that a total of 40 adults returned from from this Nile Springs release group. The survival from smolt at release (29,636 smolts) for this acclimation pond release was therefore 0.13%. It was estimated that 16,063 or 54.2% of these smolts survived to Prosser smolt trap. This gives a "smolt-at-Prosser" to adult survival rate of 0.25%.

A total of 17 adults returned from the 1984 Upper Yakima river release. A total of 45,552 smolts were released in this experimental group. That gives a "smolt-at-release" survival rate to adult of 0.04%. These smolts survived to Prosser at 32.7% rate which give 14,896 smolts and a "smolt-at-Presser" to adult survival rate of 0.11%.

An analysis of the 1985 release groups indicates

that 2 adults from the June fry release returned in 1988. The 1987 return was 25 adults so a total of 27 adults returned from this group. A total of 102,837 fry were released in June of 1984 for a return rate of 0.03%. The September parr plants yielded a total return of 58 adults (35 in 1987 and 23 in 1988) from 102,833 planted fish for a return rate of 0.06%. The November parr release had a total of 62 adults return (43 in 1987 and 19 in 1988). This return was from a parr plant of 108,305 fish for a survival rate of 0.06%. The Upper Yakima River smolt release from the 1983 brood year also yielded a total of 62 returning adults (39 in 1987 and 23 in 1988). These adults however returned from plant of only 42,210 smolts for a survival rate of 0.15%. The 45,195 smolts released from the accimiation facility at Mary's Pond returned a total of 82 adults (61 in 1987 and 21 in 1988) for a survival rate of 0.18%. Thus the June 1984 fry plants had the lowest survival rate at 0.03%, the September and November parr releases had the same return rates of 0.6% and the direct upper Yakima River smolt releases and acclimation pond fish had survival rates of 0.15% and 0.18% respectively.

The analysis of the adults returns from the June fry plants, September and November parr plants, and direct river and acclimation releases of smolts from the 1984 brood year will be presented in the 1989 annual report

when the data from the five year old returns is available.

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Appendix A.

Prosser Diversion dam trap adult counts
April, 1988--July, 1988
and
Roza diversion dam trap adult counts
April, 1988--September, 1988.

Appendix Table A.1. Prosser diversion dam adult trap count for January, 1988.

	DAILY COUNTS										CURULATIVE COUNTS									
DATE	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03-Jan	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3
04-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
05-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
06-Jan	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	5
07-Jan	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	6
08-Jan	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	8
09-Jan	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	9
10-Jan	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	10
11-Jan	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	12
12-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
13-Jan	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	14
14-Jan	0	0	0	0	0	0	0			5	0	0	0	0	0	0	0	0	0	19
15-Jan	0	0	0	0	0	0	0	0	0	136	0	0	0	0	0	0	0	0	0	155
16-Jan	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	156
17-Jan	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	166
18-Jan	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	169
19-Jan	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	171
20-Jan	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	178
21-Jan	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	195
22-Jan	0	0	0	0	0	0	0	2	0	16	0	0	0	0	0	0	0	2	0	211
23-Jan	0	0	0	0	0	0	0	0	0	26	0	0	0	0	0	0	0	2	0	237
24-Jan	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	2	0	248
25-Jan	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	2	0	255
26-Jan	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	2	0	267
27-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	267
28-Jan	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	2	0	287
29-Jan	0	0	0	0	0	0	0	3	0	58	0	0	0	0	0	0	0	5	0	345
30-Jan	0	0	0	0	0	0	0	4	0	49	0	0	0	0	0	0	0	9	0	3941
31-Jan	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	9	0	411
Total	0	0	0	0	0	0	0	9	0	411	0	0	0	0	0	0	0	9	0	411

Appendix Table A.2. Prosser diversion dam adult trap count for February 1988.

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
m-Feb	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	9	0	416
02-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	4161
03-Feb	0	0	0	0	0	0	0	0	0	3			0	0	0	0	0	9	0	419
04-Feb	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	9	0	423
05-Feb	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	9 1	0	424
06-Feb	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	91 91	0	430
07-Feb	0	0	0	0	0	0	0	0	0	6			0	0	0	0	0		0	436
08-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	436
09-Feb	0	0	0	0	0	0	0			27	0	0	0	0	0	0	0	9		
10-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	463
11-Feb	0	0	0	0	0	0	0	9	0	113	0	0	0	0	0	0	0	22	0	576
12-Feb	0	0	0	0	0	0	0		0	126	0	0	0	0	0	0	0			
13-F&	0	0	0	0	0	0	0	3	0	64	0	0	0	0	0	0	0	25	0	766
14-Feb	0	0	0	0	0	0	0	0	0	2			0	0	0	0	0			
15-Feb	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	25	0	778
16-Feb	0	0	0	0	0	0	0	0	0	6		0	0	0	0	0	0	25	0	784
17-Feb	0	0	0	0		0	0	0	0	11	0		0	0	0	0	0	25	0	795
18-Feb	0	0	0	0	0	0	0	4	0	20		0	0	0	0	0	0	29	0	815
19-Feb	0	0	0	0	0	0	0	1	0	38	0	0	0	0	0	0	0	30	0	853
20-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	853
21-Feb	0	0	0	0	0	0	0	0	0	6	0		0	0	0	0	0	30	0	859
22-Feb	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	30	0	860
23-Feb	0	0	0	0	0	0	0			2	0	0	0	0	0	0	0			
24-Feb	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	30	0	863
25-Feb	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	30	0	864
26-F&	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
27-F&	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	864
28-Feb	0	0	0	0	0	0	0			1	0	0	0	0	0	0	0	30	0	865
29-Feb	0	0	0	0	0	0	0	1	0	5	0	0	0	0	0	0	0	31	0	870
Total	0	0	0	0	0	0	0	22	0	45911	0	0	0	0	0	0	0	3'	0	870

Appendix Table A.3. P-r divasim **dam adult trap count** for **March 1988.**

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Mar	0	0	0	0	0	0	0	1	0	5	0	0	0	0	0	0	0	32	0	875
02-Mar	0	0	0	0	0	0	0	0		3	0	0	0	0	0	0	0	32	0	878
03-Mar	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	32	0	880
04-Mar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0	880
05-Mar	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	32	0	887
06-Mar	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	32	0	893
07-Mar	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	32	0	893
08-Mar	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	32	0	895
09-Mar	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	32	0	899
10-Mar	0	0	0	0	0	0	0	4	0	38	0	0	0	0	0	0	0	36	0	937
11-Mar	0	0	0	0	0	0	0	1	0	3'	0	0	0	0	0	0	0	37	0	968
12-Mar	0	0	0	0	0	0	0	1	0	28	0	0	0	0	0	0	0	38	0	996
13-Mar	0	0	0	0	0		0	0	0	20	0	0	0	0	0	0	0	38	0	1016
14-Mar	0	0	0	0	0	0	0	1	0	8	0	0	0	0	0	0	0	39	0	1024
15-W	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	39	0	1029
16-Mar	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	39	0	1032
17-Mar	0	0	0	0	0	0	0	1	0	19	0	0	0	0	0	0	0	40	0	1051
18-Mar	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	40	0	1055
19-Mar	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	40	0	1062
20-Mar	0	0	0	0	0	0	0	4	0	15	0	0	0	0	0	0	0	44	0	1077
21-Mar	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	44	0	1081
22-Mar	0	0	0	0	0	0	0	2	0	11	0	0	0	0	0	0	0	46	0	1092
23-Mar	0	0	0	0	0	0	0	8	0	34	0	0	0	0	0	0	0	54	0	1126
24-Mar	0	0	0	0	0	0	0	a			0	0	0	0	0	0	0	54	0	1133
25-Mar	0	0	0	0	0	0	0	1	0	'4	0	0	0	0	0	0	0	55	0	1147
26-Mar	0	0	0	0	0	0	0	2	0	23	0	0	0	0	0	0	0	57	0	1170
27-Mar	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	57	0	1173
28-Mar	0	0	0	0	0	0	0	1	0	'7	0	0	0	0	0	0	0	58	0	1190
29-Mar	0	0	0	0	0	0	0	4	0	22	0	0	0	0	0	0	0	62	0	1212
30-Mar	0	0	0	a	0	0	0	1	0	27	0	0	0	0	0	0	0	63	0	1239
31-M	0	0	0	a	0	0	0	1	0	15	0	0	0	0	0	0	0	64	0	1254
Total	0	0	0	0	0	0	0	33	0	384	0	0	0	0	0	0	0	64	0	1254

Appendix Table A.4. Prosser diversion dam tilt trap count for April, 1988.

	DAILY COUNTS											CUMULATIVE COUNTS									
DATE	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	H	S	J	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Apr	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	64	0	1263
02-Apr	0	0	0	0	0	0	0	0	0	2	0	12	0	0	0	0	0	0	0	66	0	1275
03-Apr	0	0	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	66	0	'293
04-Apr	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0	0	0	0	0	66	0	1317
05-Apr	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	66	0	1325
06-Apr	0	0	0	0	0	0	0	0	0	2	0	15	0	0	0	0	0	0	0	68	0	1340
07-Apr	0	1	0	0	0	0	0	0	0	0	0	4	0	1	0	0	0	0	0	68	0	'344
08-Apr	0	1	0	0	0	0	0	0	0	0	0	7	0	2	0	0	0	0	0	68	0	1351
09-Apr	0	0	0	0	0	0	0	0	0	0	0	7	0	2	0	0	0	0	0	68	0	1358
10-Apr	0	1	0	0	0	0	0	0	0	1	0	9	0	3	0	0	0	0	0	69	0	1367
11-Apr	0	0	0	0	0	0	0	0	0	0	0	4	0	3	0	0	0	0	0	69	0	1371
12-Apr	0	4	0	0	0	0	0	0	0	0	0	4	0	7	0	0	0	0	0	69	0	1375
13-Apr	0	4	0	0	0	0	0	0	0	0	0	17	0	11	0	0	0	0	0	69	0	1392
14-Apr	0	3	0	0	0	0	0	0	0	1	0	16	0	14	0	0	0	0	0	70	0	1408
15-Apr	0	6	0	0	0	0	0	0	0	0	0	23	0	20	0	0	0	0	0	70	0	1431
16-Apr	0	11	0	0	0	0	0	0	0	0	0	10	0	3'	0	0	0	0	0	70	0	1441
17-Apr	0	13	0	3	0	0	0	0	0	0	0	4	0	44	0	3	0	0	0	70	0	1445
18-Apr	0	4	0	0	0	0	0	0	0	0	0	1	0	48	0	3	0	0	0	70	0	1446
19-Apr	1	12	0	3	0	0	0	0	0	0	0	5	1	60	0	6	0	0	0	70	0	1451
20-Apr	a	28	0	6	0	0	0	0	0	0	0	10	1	88	0	12	0	0	0	70	a	1461
21-Apr	0	24	0	7	0	0	0	0	0	0	0	12	1	112	0	'9	0	0	0	70	0	1473
22-Apr	a	31	0	3	0	0	0	0	0	0	0	8	1	143	0	22	0	0	0	70	a	1481
23-Apr	a	23	0					0	a	0	0	5	1	166	0	26	0	0	0	70	a	1486
24-Apr	a	15	0	4	0	0		0	1	0	0	2	1	181	0	30	0	0	0	71	a	1488
25-Apr	0	38	0	6	0	0		0	a	0	0	10	1	219	0	36	0	0	0	71	0	1498
26-Apr	0	49	a	11	0	0		0	1	a	0	3	1	268	0	47	0	0	0	72	0	1501
27-Apr	1	77	1	7	0	0		0	a	0	0	2	2	345	1	54	0	0	0	72	0	1503
28-Apr	0	50	a	19	0	0		0	0	a	0	0	2	395	1	73	0	0	0	72	0	1503
29-Apr	0	77	a	10	0	0		0	0	0	a	0	2	472	1	83	0	0	0	72	0	1503
30-Apr	0	61	0	10	0	0		0	0	0	0	4	2	533	1	93	0	0	0	72	0	1507
Total	2	533	1	93	0	0		0	0	8	0	253	2	533	1	93	0	0	0	72	0	1507

Appendix Table A.5. Prosser divasim **dam adult** trap **count** for **May, 1988.**

	DAILY COUNTS										CUWULATIVE COUNTS									
DATE	WOKJ	WOKA	HOKJ	HOKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WOKJ	WOKA	HOKJ	HOKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-May	0	148	0	18	0	0	0	1	0	4	2	681	1	111	0	0	0	73	0	1511
02-May	0	213	0	33	0	0	0	0	0	1	2	894	1	144	0	0	0	73	0	1512
03-May	0	215	0	9	0	0	0	0	0	2	2	1109	1	153	0	0	0	73	0	1514
04-May	1	151	0	14	0	0	0	0	0	3	3	1260	1	167	0	0	0	73	0	1517
05-May	0	60	0	9	0	0	0	0	0	0	3	1320	1	176	0	0	0	73	0	1517
06-May	1	38	1	0	0	0	0	0	0	2	4	1358	2	176	0	0	0	73	0	1519
07-May	3		0	2	0	0	0	0	0	4	7	1387	2	178	0	0	0	73	0	1523
08-May	0	29	0	9	0	0	0	0	0	1	7	1448	2	187	0	0	0	73	0	1524
09-May	3	98	0	17	0	0	0	0	0	0	10	1546	2	204	0	0	0	73	0	1524
10-May	2	68	0	12	0	0	0	0	0	0	12	1614	2	216	0	0	0	73	0	1524
11-May	1	95	0	10	0	0	0	0	0	0	13	1709	2	226	0	0	0	73	0	1524
12-May	2	105	0	10	0	0	0	0	0	0	15	1814	2	236	0	0	0	73	0	1524
13-May	13	178	0	14	0	0	0	0	0	9	28	1992	2	250	0	0	0	73	0	1533
14-May	10	166	2	18	0	0	0	0	0	0	38	2158	4	268	0	0	0	73	0	1533
15-May	2	58	0	7		0	0	0	0	0	40	2216	4	275	0	0	0	73	0	1533
16-May	2	114	0			0	0	0	0	0	42	2330	4	282	0	0	0	73	0	1533
17-May	12	122	0	7		0	0	0	0	0	54	2452	4	290	0	0	0	73	0	1533
18-May	29	101	2	8	0	0	0	0	0	0	83	2553	6	298	0	0	0	73	0	1533
19-May	12	65	0	5	0	0	0	0	0	0	95	2618	6	303	0	0	0	73	0	1533
20-May	7	23	0	2	0	0	0	0	0	0	102	2641	6	305	0	0	0	73	0	1533
21-May	5	51	0	1	0	0	0	0	0	0	107	2692	6	306	0	0	0	73	0	1533
22-May	13	53	1	1		0	0	0	0	2	120	2745	7	307	0	0	0	73	0	1535
23-May	13	42	1	2	0	0	0	0	0	0	133	2787	8	309	0	0	0	73	0	1535
24-May	20		2	3	0	0	0	0	0	0	153	2837	10	312	0	0	0	73	0	1535
25-May	33	26	2	9	0	0	0	0	0	0	186	2863	12	321	0	0	0	73	0	1535
26-May	4	29	0	0		0	0	0	0	0	190	2892	12	321	0	0	0	73	0	1535
27-May	12	41	0	2	0	0	0	0	0	0	202	2933	12	323	0	0	0	73	0	1535
28-May	9	25	1	3	0	0	0	0	0	0	211	2958	13	326	0	0	0	73	0	1535
29-May	4	32	1	0	0	0	0	0	0	0	215	2990	14	326	0	0	0	73	0	1535
30-May	9	20	1	2	0	0	0	0	0	0	224	3010	15	328	0	0	0	73	0	1535
31-May	17	34	2	4	0	0	0	0	0	0	241	3044	17	332	0	0	0	73	0	1535
Total	239	2511	16	239	0	0	0	1	0	28	241	3044	17	332	0	0	0	73	0	1535

Appendix Table A.6. Prosser diversion dam adult trap count for June, 1988.

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Jun	6	15	1	1	0	0	0	0	0	0	247	3059	18	333	0	0	0	73	0	1535
02-Jun	12	19	0	0	0	0	0	0	0	0	259	3078	18	333	0	0	0	73	0	1535
03-Jun	5	14	0	2	0	0	0		0	0	264	3092	18	335	0	0	0	73	0	1535
04-Jun	5	14	0	0	0	0	0	0	0	0	269	3106	18	335	0	0	0	73	0	1535
05-Jun	12	22	0	0	0	0	0	0	0	0	281	3128	18	335	0	0	0	73	0	1535
06-Jun	4	9	0	0	0	0	0	0	0	0	285	3137	18	335	0	0	0	73	0	1535
07-Jun	0	1	0	1	0	0	0	0	0	0	285	3138	18	336	0	0	0	73	0	1535
08-Jun	0	12	0	0	0	0	0	0	0	0	285	3150	18	336	0	0	0	73	0	1535
09-Jun	4	9	0	0	0	0	0	0	0	0	289	3159	18	336	0	0	0	73	0	1535
10-Jun	4	11	0	0	0	0	0	0	0	0	293	3170	18	336	0	0	0	73	0	1535
11-Jun	1	9	1	0	0	0	0	0	0	0	294	3179	19	338	0	0	0	73	0	1535
12-Jun	1	3	0	0	0	0	0	0	0	0	295	318	19	338	0	0	0	73	0	1535
13-Jun	1	4	0	0	0	0	0	0	0	0	296	3186	19	338	0	0	0	73	0	1535
14-Jun	0	5	0	0	0	0	0	0	0	0	296	3191	19	338	0	0	0	73	0	1535
15-Jun	0	11	0	1	0	0	0	0	0	0	296	3202	19	338	0	0	0	73	0	1535
16-Jun	3	7	0		0	0	0		0	0	299	3209	19	339	0	0	0	73	0	1535
17-Jun	2	1	1	0	0	0	0	0	0	0	301	3210	20	339	0	0	0	73	0	1535
18-Jun	0	0	0	0	0	0	0	0	0	0	301	3210	20	339	0	0	0	73	0	1535
19-Jun	0	1	0	0	0	0	0	0	0	0	301	3211	20	339	0	0	0	73	0	1535
20-Jun	0	0	0		0	0	0	0	0	0	301	3211	20	339	0	0	0	73	0	1535
21-Jun	0	1	0	0	0	0	0	0	0	0	301	3212	20	339	0	0	0	73	0	1535
22-Jun	0	0	0	0	0	0	0	0	0	0	301	3212	20	339	0	0	0	73	0	1535
23-Jun	1	0	0	0		0	0	0	0	0	302	3212	20	339	0	0	0	73	0	1535
24-Jun	0	0	0	0	0	0	0	0	0	0	302	3212	20	339	0	0	0	73	0	1535
25-Jun	0	0	0	0	0	0	0	0	0	0	302	3212	20	339	0	0	0	73	0	1535
26-Jun	0	0	0	0	0	0	0		0	0	302	3212	20	339	0	0	0	73	0	1535
27-Jun	0	0	0	0	0	0	0	0	0	0	302	3212	20	339	0	0	0	73	0	1535
28-Jun	0	3	0	0	0	0	0	0	0	1	302	3215	20	339	0	0	0	73	0	1536
29-Jun	0	2	0	0	0	0	0	0	0	0	302	3217	20	339	0	0	0	73	0	1536
30-Jun	0	1	0	0	0	0	0		0	0	302	3218	20	339	0	0	0	73	0	1536
Total	61	174	3	7	0	0	0	0	0	1	302	3218	20	339	0	0	0	73	0	1536

Appendix Table **A.7. Prosser diversion dam adult** trap **count** for July, **1988.**

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Jul	0	13	0	0	0	0	0	0	0	0	302	3231	20	339	0	0	0	73	0	1536
02-Jul	0	4	0	0	0	0	0	0	0	0	302	3235	20	339	0	0	0	0	0	1536
03-Jul	0	5	0	0	0	0	0	0	0	0	302	3240	20	339	0	0	0	0	0	1536
04-Jul	0	1	0	0	0	0	0	0	0	0	302	3241	20	339	0	0	0	0	0	1536
05-Jul	0	0	0	0	0	0	0	0	0	0	302	3241	20	339	0	0	0	0	0	1536
06-Jul	0	0	0	0	0	0	0	0	0	0	302	3241	20	339	0	0	0	0	0	1536
07-Jul	0	2	0	0	0	0	0	0	0	0	302	3243	20	339	0	0	0	0	0	1536
08-Jul	0	2	0	0	0	0	0	0	0	0	302	3245	20	339	0	0	0	0	0	1536
09-Jul	0	1	0	0	0	0	0	1	0	0	302	3246	20	339	0	0	0	1	0	1536
10-Jul	1	1	0	0	0	0	0	0	0	0	303	3247	20	339	0	0	0	1	0	1536
11-Jul	0	1	0	0	0	0	0	0	0	0	303	3248	20	339	0	0	0	1	0	1536
12-Jul	0	0	0	0	0	0	0	0	0	0	303	3248	20	339	0	0	0	1	0	1536
13-Jul	0	1	0	0	0	0	0		0	0	303	3249	20	339	0	0	0	1	0	1536
14-Jul	0	0	0	0	0	0	0	0	0	0	303	3249	20	339	0	0	0	1	0	1536
15-Jul	0	2	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
16-Jul	0	0	0	0	0	0	0	0		0	303	3251	20	339	0	0	0	1	0	1536
17-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
18-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
19-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
20-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
21-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
22-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
23-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
24-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
25-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
26-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
27-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
28-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	a	1536
29-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	0	1536
30-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	a	1536
31-Jul	0	0	0	0	0	0	0	0	0	0	303	3251	20	339	0	0	0	1	a	1536
Total	1	33	0	0	0	0	0	1	0	0	303	3251	20	339	0	0	0	1	0	1536

Appendix Table A.8. Prosser diversion dam adult trap count for August, 1988.

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE	WOKJ	WOKA	HOKJ	HOKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WOKJ	WOKA	HOKJ	HOKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
02-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	a 9	0	0	0	1	0	1536
03-Aug	0	0	0	0	0	0	0		0	0	303	3253	20	339	0	0	0	1	0	1536
04-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
05-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	a 9	0	0	0	1	0	1536
06-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
07-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
08-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
09-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
10-Aug	0	0	0	0	0	0	0	0	0	0	303	323	20	339	0	0	0	1	0	1536
11-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
12-Aug	0	0	0	0		0	0	0	0	0	303	3253	20	339	0	0	0	1	0	15%
13-Aug	0	0	0		0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
14-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
15-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
16-Aug	0	0	0	0		0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
17-Aug	0	0	0		0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
18-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	a 9	0	0	0	1	0	1536
19-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
20-Aug	0	0	0		0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
21-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
22-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
23-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
24-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
25-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	15%
26-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
27-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
28-Aug	0	0	0	0	0	0	0	0	0	0	303	3253	20	339	0	0	0	1	0	1536
29-Aug	1	0	0	0	0	0	0	0	0	0	304	3253	20	339	0	0	0	1	0	1536
30-Aug	0	0	0	0	0	0	0	0	0	0	304	3253	20	339	0	0	0	1	0	1536
31-Aug	0	0	0	0	0	0	0	0	0	0	304	3253	20	339	0	0	0	1	0	1536
Total	1	0	0	0	0	0	0	0	0	0	304	3253	20	3391	0	0	0	1	0	1536

Appendix Table A.9. Prosser diversion dam adult trap count for September, 1988.

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE	WOCJ	WOCA	HOCJ	HOCA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WOCJ	WOCA	HOCJ	HOCA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Sep	0	1	0	0	0	0	0	0	0	0	304	3254	20	339	0	0	0	1	0	1536
02-Sep	0	2	0	0	0	0	0	0	0	0	304	3256	20	339	0	0	0	1	0	1536
03-Sep	0	2	0	0	0	0	0	0	0	0	304	3258	20	339	0	0	0	1	0	1536
04-Sep	0	0	0	0	0	0	0	0	0	0	304	3258	20	339	0	0	0	1	0	1536
05-Sep	0	0	0	0	0	0	0	0	0	0	304	3258	20	339	0	0	0	1	0	1536
06-Sep	0	0	0	0	0	0	0	0	0	0	304	3258	20	339	0	0	0	1	0	1536
07-Sep	0	0	0	1	0	0	0	0	0	0	304	3258	20	340	0	0	0	1	0	1536
08-Sep	0	2	0	0	0	0	0	0	0	0	304	3260	20	340	0	0	0	1	0	1536
09-Sep	0	3	0	1	0	0	0	0	0	0	304	3263	20	341	0	0	0	1	0	1536
10-Sep	1	0	0	0	0	0	0	0	0	0	305	3263	20	341	0	0	0	1	0	1536
11-Sep	0	8	0	2	0	0	0	0	0	1	305	3271	20	343	0	0	0	1	0	1537
12-Sep	0	0	0	0	0	0	0	0	0	0	305	3271	20	343	0	0	0	1	0	1537
13-Sep	0	0	0	0	0	0	0	0	0	0	305	3271	20	343	0	0	0	1	0	1537
14-Sep	0	8	0	0	0	0	0	0	0	5	305	3279	20	343	0	0	0	1	0	1542
15-Sep	0	6	0	0	0	1	0	1	0	7	305	3285	20	343	0	1	0	2	0	1549
16-Sep	0	3	0	0	0	0	0	0	0	7	305	3288	20	343	0	1	0	2	0	1556
17-Sep	0	4	0	0	0	0	0	0	0	21	305	3292	20	343	0	1	0	2	0	1577
18-Sep	2	0	0	0	0	0	0	0	0	1	307	3292	20	343	0	1	0	2	0	1578
19-Sep	0	1	0	0	0	0	0	0	0	12	307	3293	20	343	0	1	0	2	0	1590
20-Sep	0	3	0	0	0	0	0	0	0	24	307	3296	20	343	0	1	0	2	0	1614
21-Sep	1	2	0		0	0	0	3	0	9	308	3298	20	343	0	1	0	5	0	1623
22-Sep	3	0	0	pi	0	0	0	1	0	3	311	3298	20	343	0	1	0	6	0	1626
23-Sep	0	6	0		0	0	0	0	0	10	311	3304	20	343	0	1	0	6	0	1636
24-Sep	4	2	0	0	0	0	0	0	0	7	315	3306	20	343	0	1	0	6	0	1643
25-Sep	8	2	0	0	0	0	0	0	0	2	323	3308	20	343	0	1	0	6	0	1645
26-Sep	0	0	0	0	0	0	0	0	0	3	323	3308	20	343	0	1	0	6	0	1648
27-Sep	0	6	0	1	0	0	0	2	0	3	323	3314	20	344	0	1	0	8	0	1651
28-Sep	0	2	0	0	0	0	0	0	0	4	323	3316	20	344	0	1	0	8	0	1655
29-Sep	0	4	0	0	0	0	0	0	0	2	323	3320	20	344	0	1	0	8	0	1657
30-Sep	3	8	0	0	0	0	0	3	0	11	326	3328	20	344	0	1	0	11	0	1668
Total	22	75	0	5	0	1	0	10	0	132	326	3328	20	344	0	1	0	11	0	1668

Appendix Table **A.10. Prosser diversion dam** dult **trap count for October, 1988.**

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Oct	4	8	0	0	0	0	0	3	0	11	326	3328	20	344	0	1	0	11	0	1668
02-Oct	4	7	0	0	0	0	0	4	0	13	330	3335	20	344	0	1	0	15	0	1681
03-Oct	0	5	0	0	0	1	0	0	0	5	330	3335	20	344	0	2	0	15	0	16%
04-Oct	0	13	0	0	0	1	0	0	0	14	330	3335	20	344	0	3	0	15	0	1700
05-Oct	1	6	0	0	0	1	0	0	0	6	331	3335	20	344	0	4	0	15	0	1706
06-Oct	0	9	0	0	0	1	0	0	0	8	331	3335	20	344	0	5	0	15	0	1714
07-Oct	1	1	0	0	0	1	0	0	0	8	332	3335	20	344	0	6	0	15	0	1722
08-Oct	1	1	0	0	0	0	0	2	0	2	333	3335	20	344	0	6	0	'7	0	1724
09-Oct	0	1	0	0	0	0	0	2	0	4	333	3335	20	344	0	6	0	19	0	1728
10-Oct	0	0	0	0		0	0	0	0	0	333	3335	20	344	0	6	0	19	0	1728
11-Oct	0	0	0			0	0	0	0	0	333	3335	20	344			0	19	0	1728
12-Oct	1	6	0	0	0	0	0	4	0	9	334	3335	20	344	0		0	23	0	1737
13-Oct	0	2	0	0	0	'2	0	0	0	4	334	3335	20	344	0	7	0	23	0	1741
14-Oct	0	6	0	0	0		0	2	0	16	334	3335	20	344	0	9	0	25	0	1757
15-Oct	1	7	0	0	0	3	0	14	0	24	33s	3335	20	344	0	12	0	39	0	1781
16-Oct	0	8	0	0	0	3	0	1	0	11	335	3335	20	344	0	15	0	40	0	1792
17-Oct	4	6	0		0	0	0	1	0	13	339	3335	20	344	0	15	0	41	0	'KS
18-Oct	1	4	0	0	0	0	0	0	0	6	340	3335	20	344	0	15	0	41	0	1811
19-Oct	0	2	0	0	0	0	0	0	0	5	340	3335	20	344	0	15	0	4'	0	1816
20-Oct	0	3	0	0	0	2	0	3	0	1	340	3335	20	344		'7	0	44	0	1817
21-Oct	0	0	0	0	0	0	0	0	0	2	340	3335	20	344	0	17	0	44	0	1819
22-Oct	0	1	0	0	0	0	0	0	0	0	340	3335	20	344	0	17	0	44	0	1819
23-Oct	0	0	0	0	0	0	0	3	0	5	340	3335	20	344	0	17	0	47	0	1824
24-Oct	0	0	0	0	0	0	0	0	0	5	340	3335	20	344		'7	0	47	0	1829
25-Oct	0	1	0	0	0	0	0	0	0	3	340	3335	20	344	0	17	0	47	0	1832
26-Oct	0	0	0	0	0	0	0	2	0	0	340	3335	20	344	0	17	0	47	0	1832
27-Oct	0	0	0	0	0	0	0		0	15	340	3335	20	344	0	'7	0	49	a	1847
28-Oct	0	0	0	0		1	0	'	0	7	340	3335	20	344	0	18	0	50	a	18%
29-Oct	0	0	0	0	0	0	0	0	0	3	340	3335	20	344	0	18	0	50	a	1857
30-Oct	0	1	0		0	0	0	0	0	7	340	3335	20	344	0		0	50	C	1864
31-Oct	0	0	0	0	0	0	0	0	0	0	340	3335	20	344	0	1818	0	50	0	1864
Total	18	98	0	0	0	17	0	42	0	207	340	3335	20	344	0	18	0	50	0	1864

Appendix Table A.11. Prosser diversion dam adult trap count for November, 1988.

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE)	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Nov	0	0	0	0	0	0	0	0		0	340	3335	20	344	0	18	0	50	0	1864
02-Nov	0	0	0	0	0	0	0	0	0	3	340	3335	20	344	0	18	0	50	0	1867
03-Nov	0	1	0	0		0	0	1	0	5	340	3336	20	344	0	18	0	51	0	1872
04-Nov	0	1	0	0	0	0	0	1	0	6	340	3337	20	344	0	18	0	52	0	1878
05-Nov	0	1	0	0	0	0	0	1	0	7	340	3338	20	344	0	18	0	53	0	1885
06-Nov	0	0	0	1	0	0	0	1	0	3	340	3338	20	345	0	18	0	54	0	1888
07-Nov	0	0	0	0	0	0	0	0	0	0	340	3338	20	345	0	18	0	54	0	1888
08-Nov	0	0	0	0	0	0	0	0	0	3	340	3338	20	345	0	18	0	54	0	1891
09-Nov	0	0	0	0	0		0	0	0	2	340	3338	20	345	0	18	0	54	0	1893
10-Nov	0	0	0	0	0	0	0	0	0	4	340	3338	20	345	0	18			0	1897
11-Nov	0	0	0	0	0	0	0	0	0	3	340	3338	20	345	0	18	0	54	0	1900
12-Nov	0	1	0	0	0	0	0	1	0	4	340	3339	20	345	0	18	0	55	0	1904
13-Nov	0	0	0	0	0	0	0	0	0	1	340	3339	20	345	0	18	0	55	0	1905
14-Nov	0	0	0	0		0	0	0	0	3	340	3339	20	345	0	18	0	55	0	1908
15-Nov	0	0	0	0	0	0	0	0	0	9	340	3339	20	345	0	18	0	55	0	1917
16-Nov	0	0	0	0	0	0	0	0	0	4	340	3339	20	345	0	18			0	1921
17-Nov	0	0	0	0	0	0	0	0	0	5	340	3339	20	345	0	18	0		0	1926
18-Nov	0	0	0	0	0	0	0	0	0	4	340	3339	20	345	0	18	0	55	0	1930
19-Nov	0	0	0	0	0	0	0	0	0	7	340	3339	20	345	0	18	0	55	0	1937
20-Nov	0	0	0	0	0	0	0	0	0	5	340	3339	20	345	0	18	0	55	0	1942
21-Nov	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	55	0	1942
22-Nov	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0		0	1942
23-Nov	0	0	0	0	0	0	0	0	0	5	343	3339	20	345	0	18	0	55	0	1947
24-Nov	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	55	0	1947
25-Nov	0	0	0	0	0	0	0	2	0	7	340	3339	20	345	0	18	0	57	0	1954
26-Nov	0	0	0	0	0	0	0	2	0	6	340	3339	20	345	0	18	0	59	0	1960
27-Nov	0	0	0	0	0	0	0	2	0	6	340	3339	20	345	0	18	0	61	0	1966
28-Nov	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1966
29-Nov	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1966
30-Nov	0	0	0	0	0	0	0	0	0	1	340	3339	20	345	0	18	0	61	0	1967
Total	0	4	0	1	0	0	0	11	0	103	340	3339	20	345	0	18	0	61	0	1967

Appendix Table A.12. Prosser diversion dam adult trap count for December, 1988.

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE	WOCJ	WOCA	HOCJ	HOCA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WOCJ	WOCA	HOCJ	HOCA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1967
02-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1967
03-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1967
04-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1967
05-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1967
06-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1967
07-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1967
08-Dec	0	0	0	0	0	0	0	0	0	3	340	3339	20	345	0	18	0	61	0	1970
09-Dec	0	0	0	0	0	0	0	0	0	3	340	3339	20	345	0	18	0	61	0	1973
10-Dec	0	0	0	0	0	0	0	0	0	6	340	3339	20	345	0	18	0	61	0	1979
11-Dec	0	0	0	0	0	0	0	0	0	6	340	3339	20	345	0	18	0	61	0	1985
12-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1985
13-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1985
14-Dec	0	0	0	0	0	0	0	0	0	2	340	3339	20	345	0	18	0	61	0	1987
15-Dec	0	0	0	0	0	0	0	0	0	1	340	3339	20	345	0	18	0	61	0	1988
16-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
17-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
18-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
19-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
20-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
21-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
22-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
23-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
24-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
25-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
26-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
27-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
28-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
29-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1988
30-Dec	0	0	0	0	0	0	0	0	0	1	340	3339	20	345	0	18	0	61	0	1989
31-Dec	0	0	0	0	0	0	0	0	0	0	340	3339	20	345	0	18	0	61	0	1989
Total	0	0	0	0	0	0	0	0	0	22	340	3339	20	345	0	18	0	61	0	1989

Appendix Table A.13. Roza divmicn dam counts for April, 1988.

	DAILY COUNTS										CUMULATIVE COUNTS'									
DATE	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06-Apr	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0	0	0	0
07-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08-Apr	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
09-Apr	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18-Apr	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23-Apr	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	a)	0	0
25-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C)	0	0
27-Apr	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	C)	0	0
28-Apr	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	C)	0	0
29-Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-Apr	0	1	0	0	0	0	0	0	0	1	0	1	a)	0	0	0	0	C)	0	1
Apr Total	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1

Appendix Table A.14. Roza diversion dam counts for May, 1988.

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE	WOKJ	WOKA	HOKJ	HOKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WOKJ	WOKA	HOKJ	HOKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-May	0	1	0	2	0	0	0	0	0	3	0	2	0	2	0	0	0	0	0	4
02-May	0	0	0	0		0	0	0	0	0	0	2	0	2	0	0	0	0	0	4
03-May	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	4
04-May	0	2	0	6	0	0	0	0	0	1	0	4	0	8	0	0	0	0	0	5
05-May	0	0	0	0	0	0	0	0	0	0	0		0	8	0	0	0	0	0	5
06-May	0	0	0	0	0	0	0	0	0	0	0	4	0	8	0	0	0	0	0	5
07-May	0	15	0	6		0	0	0	0	0	0	19	0	14	0	0	0	0	0	5
08-May	0	26	0	3		0	0	0	0	0	0	45	0	17	0	0	0	0	0	5
09-May	0	20	0	2	0	0	0	0	0	0		65	0	19	0	0	0	0	0	5
10-May	0	10	0	3	0	0	0	0	0	0	0	75	0	22	0	0	0	0	0	5
11-May	0	37	0	6	0	0	0	0	0	0	0	112	0	28	0	0	0	0	0	5
12-May	0	19	0	5	0	0	0	0	0	0	0	131	0	33	0	0	0	0	0	5
13-May	0	33	0	5	0	0	0	0	0	0	0	164	0	38	0	0	0	0	0	5
14-May	0	45	0	19	0	0	0	0	0	0	0	209	0	57	0	0	0	0	0	5
15-May	0	66	0	16	0	0	0	0	0	0	0	275	0	73	0	0	0	0	0	5
16-May	0	32	0	3	0	0	0	0	0	0	0	307	0	76	0	0	0	0	0	5
17-May	0	3	0	2	0	0	0	0	0	0	0	310	0	78	0	0	0	0	0	5
18-May	0	20	0	6	0	0	0	0	0	0	0	330	0	84	0	0	0	0	0	5
19-May	0	9	0	5	0	0	0	0	0	0	0	339	0	89	0	0	0	0	0	5
20-May	0	24	0	3	0	0	0	0	0	0	0	363	0	92	0	0	0	0	0	5
21-May	0	86	0	7		0	0	0	0	0	0	449	0	99	0	0	0	0	0	5
22-May	0	79	0	10	0	0	0	a'	0	0	0	528	0	109	0	0	0	0	0	5
23-May	0	44	0	7	0	0	0	d	0	0	0	572	0	116	0	0	0	0	0	5
24-May	0	1	0	10	0	0	0	d	0	0	0	573	0	126	0	0	0	0	0	5
25-May	2	69	0	11	0	0	0	d	0	0	2	642	0	137	0	0	0	0	0	5
26-May	3	83	0	5	0	0	0	d	0	0	5	725	0	142	0	0	0	0	0	5
27-May	0	39	0	1	0	0	0	d	0	0	5	764	0	143	0	0	0	0	0	5
28-May	0	35	0	0	0	0	0	0	0	0	5	799	0	143	0	0	0	0	0	5
29-May	1	7	0	1	0	0	0	0	0	0	6	806	0	144	0	0	0	0	0	5
30-May	1	8	0	3	0	0	0	0	0	0	7	814	0	147	0	0	0	0	0	5
31-May	3	14	0	5	0	0	0	0	0	0	10	828	0	152	0	0	0'	0	0	5
May Total	10	827	0	152	0	0	0	0	0	4	10	828	0	152	0	0	0	0	0	5

Appendix Table A.15. Roza diversion dam counts for June, 1988.

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Jun	0	IO	0	3	0	0	0	0	0	0	10	838	0	155	0	0	0	0	0	5
02-Jun	2	5	0	0	0	0	0	0	0	0	12	a43	0	15s	0	0	0	0	0	5
03-Jun	0	7	0	0	0		0	0	0	0	12	850	0	155	0	0	0	0	0	5
04-Jun	1	16	0	3	0	0	0	0	0	0	13	866	0	158	0	0	0	0	0	5
05-Jun	1	7	0	1	0		0	0	0	0	14	a73	0	159	0	0	0	0	0	5
06-Jun	1	10	0	3	0		0	0	0	0	15	883	0	162	0	0	0	0	0	5
07-Jun	5	29	0	3	0	0	0	0	0	0	20	912	0	165	0	0	0	0	0	5
08-Jun	0	5	0	1	0	0	0	0	0	0	20	917	0	166	0	0	0	0	0	5
09-Jun	0	3	0	1	0	0	0	0	0	0	20	920	0	167	0	0	0	0	0	5
10-Jun	3	7	0	1	0	0	0	0	0	0	23	927	0	168	0	0	0	0	0	5
11-Jun	5	15	0	4	0	0	0		0	0	28	942	0	172	0	0	0	0	0	5
12-Jun	7	44	0	4	0	0	0		0	0	35	986	0	176	0	0	0	0	0	5
13-Jun	3	21	0	3	0		0	0	0	0	38	1007	0	179	0	0	0	0	0	5
14-Jun	5	28	0	1	0		0	0	0	0	43	la35	0	180	0	0	0	0	0	5
15-Jun	4	19	0	3	0	0	0	0	0	0	47	1054	0	183	0	0	0	0	0	5
16-Jun	5	19	1	4	0	0	0	0	0	0	52	1073	'	187	0	0	0	0	0	5
17-Jun	5	35	1	4			0	0	0	0	57	1108	2	191	0	0	0	0	0	5
18-Jun	0	5	0	1	0		0	0	0	0	57	1113	2	192	0	0	0	0	0	5
19-Jun	2	5	0	0	0	0	0	0	0	0	59	1118	2	192	0	0	0	0	0	5
20-Jun	4	29	0	0	0	0	0	0	0	0	63	1147	2	192	0	0	0	0	0	5
21-Jun	5	23	0	0			0	0	0	0	68	1170	2	192	0	0	0	0	0	5
22-Jun	0	8	0	0	0		0	0	0	0	68	1178	2	192	0	0	0	0	0	5
23-Jun	0	3	0	0	0	0	0	0		0	68	1181	2	192	0	0	0	0	0	5
24-Jun	2	5	0	2	0		0	0	0	0	70	1186	2	194	0	0	0	0	0	5
25-Jun	3	36	1	2	0		0	0	0	0	73	1222	3	196	0	0	0	0	0	5
26-Jun	c	8	0	0	0	0	0	0	0	0	73	1230	3	196	0	0	0	0	0	5
27-Jun	1	10	0	1	0	0	0	0	0	0	74	1240	3	197	0	0	0	0	0	5
28-Jun	2	5	0	0	0	0	0	0	0	0	76	1245	3	197	0	0	0	0	0	5
29-Jun	0	0	0	0	0	0	0	0	0	0	76	1245	3	197	0	0	0	0	0	5
30-Jun	2	17	1	2	0	0	0	0	0	0	78	1262	4	199	0	0	0	0	0	5
J-Total	68	434	4	47	0	0	0	0	0	0	78	1262	4	199	0	0	0	0	0	5

Appendix Table A.16. Roza diversion dam counts for July, 1988.

	DAILY COUNTS										CUMULATIVE COUNTS								
DATE	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Jul	3	4	0	2	0	0	0	0		0	81	1276	4	201	0	0	0	0	0	5
02-Jul	1	8	0	0	0	0	0	0		0	82	1284	4	203	0	0	0	0	0	0
03-Jul	0	2	0	0		0	0	0	0	0	82	1286	4	203	0	0	0	0	0	0
04-Jul	0	0	0	0	0	0	0	0	0	0		1286	4	203	0	0	0	0	0	0
05-Jul	0	2	0		0	0	0	0	0	0		1288	4	203	0	0	0	0	0	0
06-Jul	0	0	0			0	0	0	0	0	82	1288	4	203	0	0	0	0	0	0
07-Jul	0	2	0	1		0	0	0	0	0	82	1290	4	204	0	0	0	0	0	0
08-Jul	0	3	0	0	0	0	0	0	0	0	82	1293	4	204	0	0	0	0	0	0
W-Jul	2	3	0	1	0	0	0	0	0	0	84	12%	4	204	0	0	0	0	0	0
10-Jul	2	3	0	1	0	0	0	0	0	0	86	1299	4	205	0	0	0	0	0	0
11-Jul	6	9	0			0	0	0	0	0	92	1308	4	206	0	0	0	0	0	0
12-Jul	1	7	0	4		0	0	0	0	0	93	1315	4	210	0	0	0	0	0	0
13-Jul	0	2	0	1	0	0	0	0	0	0	93	1317	4	211	0	0	0	0	0	0
14-Jul	0	2	0	0	0	0	0	0	0	0		1319	4	211	0	0	0	0	0	0
15-Jul	0	0	0		0	0	0		0	0	93	1319	4	211	0	0	0	0	0	0
16-Jul	0	0	0	0	0	0	0		0	0	93	1319	4	211	0	0	0	0	0	0
17-Jul	0	0	0	0	0	0	0	0	0	0	93	1379	4	211	0	0	0	0	0	0
18-Jul	0	0	0		0	0	0	0	0	0	93	1319	4	211	0	0	0	0	0	0
19-Jul	0	0	0	0	0	0	0	0	0	0	93	1319	4	211	0	0	0	0	0	0
20-Jul	0	0	0	0		0	0	0	0	0	93	1319	4	211	0	0	0	0	0	0
21-Jul	0	0	0	0	0	0	0	0	0	0	93	1319	4	211	0	0	0	0	0	0
22-Jul	0	0	0	0	0	0	0		0	0	93	1319	4	211	0	0	0	0	0	0
23-Jul	0	0	0	0	0	0	0	0	0	0	93	1319	4	211	0	0	0	0	0	0
24-Jul	0	0	0	0	0	0	0	0	0	0	93	1319	4	211	0	0	0	0	0	0
25-Jul	0	0	0	0	0	0	0	0		0		1319	4	211	0	0	0	0	0	0
26-Jul	0	0	0	0	0	0	0	0	0	0		1319	4	211	0	0	0	0	0	0
27-Jul	0	0	0	0	0	0	0	0	0	0	93	1319	4	211	0	0	0	0	0	0
28-Jul	0	0	0		0	0	0	0	0	0	93	1319	4	211	0	0	0	0	0	0
29-Jul	0	1	0	0	0	0	0		0	0	93	1320	4	211	0	0	0	0	0	0
30-Jul	0	0	0	0	0	0	0	0	0	0	93	1320	4	211	0	0	0	0	0	0
31-Jul	0	0	0		0	0	0	0	0	0	93	1320	4	211	0	0	0	0	0	0
Jul Total	15	58	0	12	0	0	0	0	0	0	93	1320	4	211	0	0	0	0	0	0

Appendix Table A.17. Roza diversion dam counts for August, 1988.

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Aug	1	5	0	3	0	0	0	0	0	0	93	1322	4	212	0	0	0	0	0	0
02-Aug	0	0	0	0	0		0	0	0	0	93	1322	4	212	0	0	0	0	0	0
03-Aug	0	1	0	0	0	0	0	0		0	93	1323	4	212	0	0	0	0	0	0
04-Aug	0	1	0	0	0	0	0	0	0	0	93	1324	4	a 2	0	0	0	0	0	0
05-Aug	0	3	0	0	0	0	0	0	0	0	93	1327	4	212	0	0	0	0	0	0
06-Aug	0	0	0	0	0	0	0	0	0	0	93	1327	4	212	0	0	0	0	0	0
07-Aug	0	0	0	0	0	0	0	0		0	93	1327	4	212	0	0	0	0	0	0
08-Aug	0	0	0	0	0	0	0	0	0	0	93	1327	4	212	0	0	0	0	0	0
09-Aug	0	1	0	2	0	0	0	0	0	0	93	1328	4	214	0	0	0	0	0	0
10-Aug	2	3	0	1	0	0	0	0	0	0	95	1331	4	215	0	0	0	0	0	0
11-Aug	0	0	0	0	0	0	0	0	0	0	95	1331	4	215	0	0	0	0	0	0
12-Aug	0	0	0	0	0	0	0	0	0	0	95	1331	4	215	0	0	0	0	0	0
13-Aug	0	2	0	0	0	0	0	0	0	0	95	1333	4	215	0	0	0	0	0	0
14-Aug	0	1	0	0	0	0	0	0	0	0	95	1334	4	215	0	0	0	0	0	0
15-Aug	0	1	0	0	0	0	0	0	0	0	95	1335	4	215	0	0	0	0	0	0
16-Aug	0	2	0	0	0	0	0	0	0	0	95	1337	4	215	0	0	0	0	0	0
17-Aug	0	4	0	0	0	0	0	0	0	0	95	1341	4	215	0	0	0	0	0	0
18-Aug	2	1	0	0	0	0	0	0	0	0	97	1342	4	215	0	0	0	0	0	0
19-Aug	0	2	0	0	0	0	0	0	0	0	97	1344	4	215	0	0	0	0	0	0
20-Aug	0	2	0	1	0	0	0	0	0	0	97	1346	4	216	0	0	0	0	0	0
21-Aug	0	0	0	0	0	0	0	0	0	0	97	1346	4	216	0	0	0	0	0	0
22-Aug	0	0	0	0	0	0	0	0	0	0	97	1346	4	216	0	0	0	0	0	0
23-Aug	0	0	0	0	0	0	0	0	0	0	97	1346	4)	216	0	0	0	0	0	0
24-Aug	0	0	0	0	0	0	0	0		0	97	1345	4	216	0	0	a	0	0	0
25-Aug	0	2	0	2	0	0	0	0	0	0	97	1348	4	218	0	0	a	0	0	0
26-Aug	1	1	0	0	0	0	0	0	0	0	98	1349	4	218	0	0	0	0	0	0
27-Aug	0	1	0	0		0	0	0	0	0	98	1350	4	218	0	0	0	0	0	0
28-Aug	0	0	0	0	0	0	0	0	0	0	98	1350	4	218	0	0	0	0	0	0
29-Aug	0	1	0	1	0	0	0	0	0	0	98	1351	4	219	0	0	0	0	0	0
30-Aug	0	1	0	0	0	0	0	0	0	0	98	1352	4	219	0	0	0	0	0	0
31-Aug	1	2	0	1	0	0	0	0	0	0	99	13%	4	220	0	0	0	0	0	0
Aug Total	7	37	0	11	0	0	0	0	0	0	99	1354	4	220	0	0	0	0	0	0

Appendix Table A.18. Roza diversion dam counts for September, 1988.

	DAILY COUNTS										CUMULATIVE COUNTS									
DATE	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA	WCKJ	WCKA	HCKJ	HCKA	COHJ	COHA	HSJ	HSA	WSJ	WSA
01-Sep	0	1	0	0	0	0	0	0	0	0	99	1355	4	220	0	0	0	0	0	0
02-Sep	0	2	0	0	0	0	0	0	0	0	99	1357	4	220	0	0	0	0	0	0
03-Sep	0	2	0	0	0	0	0	0	0	0	99	1359	4	220	0	0	0	0	0	0
04-Sep	0	0	0	0	0	0	0	0	0	0	99	1359	4	220	0	0	0	0	0	0
05-Sep	0	0	0	0	0	0	0	0	0	0	99	1359	4	220	0	0	0	0	0	0
06-Sep	0	0	0	0	0	0	0	0	0	0	99	1359	4	220	0	0	0	0	0	0
07-Sep	1	0	0	1	0	0	0	0	0	0	100	1359	4	221	0	0	0	0	0	0
08-Sep	0	2	0	0	0	0	0	0	0	0	100	1361	4	221	0	0	0	0	0	0
09-Sep	0	1	0	0	0	0	0	0	0	0	100	1362	4	221	0	0	0	0	0	0
10-Sep	1	0	0	0	0	0	0	0	0	0	101	1362	4	221	0	0	0	0	0	0
11-Sep	0	2	0	0	0	0	0	0	0	0	101	1364	4	221	0	0	0	0	0	0
12-Sep	0	0	0	0	0	0	0	0	0	0	101	1364	4	221	0	0	0	0	0	0
13-Sep	0	1	0	0	0	0	0	0	0	0	101	1365	4	221	0	0	0	0	0	0
14-Sep	0	1	0	0	0	0	0	[illegible]	0	0	101	1366	4	221	0	0	0	0	0	0
15-Sep	0	1	0	0	0	0	0	0	0	0	101	1367	4	221	0	0	0	0	0	0
16-Sep	0	0	0	0	0	0	0	0	0	0	101	1367	4	221	0	0	0	0	0	0
17-Sep	0	0	0	0	0	0	0	0	0	0	101	1367	4	221	0	0	0	0	0	0
18-Sep	0	1	0	0	0	0	0	0	0	0	101	1368	4	221	0	0	0	0	0	0
19-Sep	0	1	0	0	0	0	0	0	0	0	101	1369	4	221	0	0	0	0	0	0
20-Sep	0	0	0	0	0	0	0	0	0	0	101	1369	4	221	0	0	0	0	0	0
21-Sep	0	0	0	0	0	0	0	0	0	0	101	1369	4	221	0	0	0	0	0	0
22-Sep	0	0	0	0	0	0	0	0	0	0	101	1369	4	221	0	0	0	0	0	0
23-Sep	0	1	0	0	0	0	0	[illegible]	0	0	101	1370	4	221	0	0	0	0	0	0
24-Sep	0	0	0	0	0	0	0	[illegible]	0	0	101	1370	4	221	0	0	0	0	0	0
25-Sep	0	1	0	0	0	0	0	[illegible]	0	0	101	1371	4	221	0	0	0	0	0	0
26-Sep	0	0	0	0	0	0	0	0	0	0	101	1371	4	221	0	0	0	0	0	0
27-Sep	0	0	0	0	0	0	0	0	0	0	101	1371	4	221	0	0	0	0	0	0
28-Sep	0	0	0	0	0	0	0	0	0	0	101	1371	4	221	0	0	0	0	0	0
29-Sep	0	0	0	0	0	0	0	0	0	0	101	1371	4	221	0	0	0	0	0	0
30-Sep	0	0	0	0	0	0	0	0	0	0	101	1371	4	221	0	0	0	0	0	0
Sept Total	2	17	0	1	0	0	0	0	0	0	101	1371	4 1	221	0	0	0	0	0	0

Appendix B.

Prosser emolt outmigration counts.
November, 1987--July, 1986

Appendix Table 8.1. **Rau** catches for November 1987, Prosscr.

DAY	USCHK	MORT	HFCNK	MORT	WSTH	MORT	HSTH	MORT	TROUT	COHO	MORT	KOK	MORT
1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0
a	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0
14	11	0	0	0	0	0	0	0	0	0	0	0	0
15	26	0	0	0	0	0	0	0	0	0	0	0	0
16	15	0	0	0	0	0	0	0	0	0	0	0	0
17	211	0	0	0	2	0	0	0	0	0	0	0	0
la	**801**	a	0	0	3	0	0	0	0	0	0	0	0
19	1353	4	0	0	1	1	0	0	0	0	0	0	0
20	490	4	0	0	2	0	0	0	0	0	0	0	0
21	**254**	0	0	0	0	0	0	0	0	0	0	0	0
22	93	0	0	0	0	0	0	0	0	0	0	0	0
23	62	1	0	0	0	0	0	0	0	0	0	0	0
24	24	0	0	0	1	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0
26	164	0	0	0	0	0	0	0	0	0	0	0	0
27	272	**1**	0	0	0	0	1	0	0	0	0	0	0
28	491	0	0	0	0	0	0	0	0	0	0	0	0
29	641	0	0	0	0	0	0	0	0	0	0	0	0
30	233	0	0	0	0	0	0	0	0	0	0	0	0
31													
TOTAL	5141	la	0	0	9	1	1	0	0	0	0	0	0

Appendix Table B.2. Raw catches for December 1987, Prosser.

DAY	WSCHK	MORT	HFCHK	HORT	USTH	HORT	HSTH	MORT	TROUT	COHO	MORT	KOK	MORT
1	119	0	0	0	0	0	0	0	0	0	0	0	0
2	140	0	0	0	0	0	0	0	0	0	0	0	0
3	114	0	0	0	0	0	0	0	0	0	0	0	0
4	60	1	0	0	0	0	0	0	0	0	0	0	0
5	2	0	0	0	2	0	0	0	0	0	0	0	0
6	5	0	0	0	2	0	0	0	0	0	0	0	0
7	2	0	0	0	4	0	0	0	0	0	0	0	0
a	1	0	0	0	5	0	0	0	0	0	0	0	0
9	41	0	0	0	46	0	0	0	0	0	0	0	0
10	40	3	0	0	47	0	0	0	0	0	0	0	0
11	66	0	0	0	22	1	0	0	0	0	0	0	0
12	24	0	0	0	7	0	0	0	0	0	0	0	0
13	41	0	0	0	14	0	0	0	0	0	0	0	0
14	a9	0	0	0	33	0	0	0	0	0	0	0	0
15	1774	1	0	0	.79	0	0	0	0	0	0	0	0
16	6389	22	0	0	132	0	0	0	0	0	0	0	0
17	8025	la	0	0	166	2	0	0	0	0	0	0	0
18	7041	13	0	0	193	1	0	0	0	0	0	0	0
19	5222	4	0	0	189	0	0	0	0	0	0	0	0
20	6590	3s	0	0	155	0	0	0	0	0	0	0	0
21	3032	0	0	0	67	0	0	0	0	2	0	0	0
22	2865	13	0	0	71	0	0	0	0	0	0	0	0
23	2128	21	0	0	55	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0
25	54s	182	0	0	15	7	0	0	0	0	0	0	0
26	619	0	0	0	12	0	0	0	0	0	0	0	0
27	376	0	0	0	7	0	0	0	0	0	0	0	0
28	414	0	0	0	9	0	0	0	0	0	0	0	0
29	297	0	0	0	7	0	0	0	0	0	0	0	0
30	197	3	0	0	9	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	46258	316	0	0	1348	11	0	0	0	2	0	0	0

Appendix **Table** 8.3. **Raw** catches for **January** 1988, **Prosser.**

DAY	USCHK	MORT	HFCHK	HORT	WSTH	HORT	HSTH	MORT	TROUT	COHO	MORT	KOK	MORT
1	191	1	0	0	2	0	0	0	0	0	0	**1**	**0**
2	111	53	0	0	3	0	0	0	0	0	0	**0**	**0**
3	129	0	0	0	4	0	0	0	0	0	0	**0**	**0**
4	106	0	0	0	6	0	0	0	0	0	0	4	0
5	109	0	0	0	3	0	0	0	0	0	0	2	0
6	232	0	0	0	**5**	0	0	0	0	0	0	0	0
7	103	0	0	0	7	0	0	0	0	0	0	1	0
a	73	0	0	0	1	0	0	0	0	0	0	0	0
9	a4	0	0	0	S	0	0	0	0	0	0	0	0
10	91	0	0	0	2	0	0	0	0	0	0	0	0
11	**158**	0	0	0	1	0	0	0	0	0	0	**1**	0
12	91	2	0	0	3	0	0	0	0	0	0	4	0
13	94	0	0	0	5	0	0	0	0	0	0	1	0
14	114	1	0	0	11	0	0	0	0	0	0	0	0
15	1268	3	0	0	23	0	0	0	0	0	0	1	0
16	111	1	0	0	la	0	0	0	0	0	0	0	0
17	36	6	0	0	30	0	0	0	0	0	0	1	0
la	205	0	0	0	55	0	0	0	0	0	0	1	0
19	195	**15**	0	0	113	**12**	0	0	0	0	0	12	7
20	295	0	0	0	164	0	0	0	0	0	0	4	0
21	393	la	0	0	166	**16**	0	0	0	0	0	5	0
22	323	4	0	0	**115**	**1**	0	0	0	0	0	3	0
23	**529**	3	0	0	**118**	1	0	0	0	0	0	**1**	0
24	125	2	0	0	**48**	3	0	0	0	0	0	2	0
25	360	**1**	0	0	53	0	0	0	0	0	0	0	0
26	**178**	1	0	0	32	**1**	0	0	0	0	0	0	0
27	**194**	a	0	0	9	1	0	0	0	0	0	0	0
28	**56**	0	0	0	la	0	0	0	0	0	0	0	0
29	23	0	0	0	**10**	0	0	0	0	0	0	**1**	0
30	15	0	0	0	5	0	0	0	0	0	0	0	0
31	3	0	0	0	3	0	0	0	0	0	0	0	0
TOTAL	5995	119	0	0	1038	3s	0	0	0	0	0	45	7

Appendix **Table** 8.4. **Raw catches** for February 1988, **Prosser.**

DAY	WSCHK	MORT	HFCHK	HORT	WSTH	MORT	NSTN	MORT	TROUT	COHO	MORT	KOK	MORT
1	90	1	0	0	17	0	0	0	0	0	0	1	0
2	119	0	0	0	11	0	0	0	0	0	0	0	0
3	94	0	0	0	5	0	0	0	0	0	0	2	0
4	14	0	0	0	4	0	0	0	0	0	0	1	0
5	88	0	0	0	a	1	0	0	0	0	0	3	0
6	36	0	0	0	2	0	0	0	0	0	0	4	0
7	17	0	0	0	1	0	0	0	0	0	0	0	0
a	247	173	0	0	24	6	0	0	0	0	0	3	0
9	41	0	0	0	11	0	0	0	0	0	0	1	0
IO	39	0	0	0	11	0	0	0	0	0	0	0	0
11	35	2	0	0	20	0	0	0	0	0	0	0	0
12	58	2	0	0	17	1	0	0	0	0	0	1	0
13	62	2	0	0	17	1	0	0	0	0	0	0	0
14	6	0	0	0	6	0	0	0	0	0	0	0	0
15	7	1	0	0	2	0	0	0	0	0	0	0	0
16	11	0	0	0	3	0	0	0	0	0	0	2	0
17	9	0	0	0	4	0	0	0	0	0	0	2	0
la	a	0	0	0	2	0	0	0	0	0	0	0	0
19	12	0	0	0	1	0	0	0	0	0	0	1	0
20	23	0	0	0	1	0	0	0	0	0	0	0	0
21	31	0	0	0	0	0	0	0	0	0	0	0	0
22	24	0	0	0	1	0	0	0	0	0	0	0	0
23	13	0	0	0	2	0	0	0	0	0	0	0	0
24	28	0	0	0	7	0	0	0	0	0	0	0	0
2s	21	0	0	0	2	0	0	0	0	0	0	1	0
26	21	0	0	0	0	0	0	0	0	0	0	0	0
27	29	0	0	0	0	0	0	0	0	0	0	0	0
28	58	0	0	0	2	0	0	0	0	0	0	0	0
29	448	0	0	0	4	0	0	0	1	0	0	0	0
30													
31													
TOTAL	1689	181	0	0	185	9	0	0	1	0	0	22	0

Appendix Table B.5. Raw catches for March 1988, Prosser.

DAY	USCHK	HORT	NFCHK	HORT	WSTH	HORT	HSTH	HORT	TROUT	COHO	HORT	KOK	HORT
1	126	0	0	0	6	0	0	0	0	0	0	0	0
2	21	0	0	0	3	0	0	0	0	0	0	0	0
3	3s	0	0	0	0	0	0	0	0	0	0	0	0
4	62	0	0	0	5	0	0	0	0	0	0	0	0
5	a7	1	0	0	4	0	0	0’	0	0	0	0	0
6	88	0	0	0	2	0	0	0	0	0	0	0	0
7	49	0	0	0	1	0	0	0	0	0	0	0	0
a	S	0	0	0	1	0	0	0	0	0	0	0	0
9	1	0	0	0	3	0	0	0	0	0	0	0	0
10	5	0	0	0	1	0	0	0	0	0	0	0	0
11	10	0	0	0	2	0	0	0	0	0	0	1	0
12	10	0	0	0	2	0	0	0	0	0	0	1	0
13	IO	0	0	0	2	1	0	0	0	0	0	0	0
14	16	0	0	0	7	0	0	0	0	0	0	0	0
15	14	0	0	0	6	0	0	0	0	0	0	0	0
16	7	0	0	0	2	0	0	0	0	0	0	0	0
If	19	0	0	0	6	0	0	0	0	0	0	0	0
la	16	1	0	0	S	0	0	0	0	0	0	0	0
19	la	0	0	0	6	0	0	0	0	0	0	0	0
20	45	3	0	0	7	0	0	0	0	0	0	0	0
21	36	0	0	0	6	0	0	0	0	0	0	1	0
22	5	1	‘0	0	6	0	0	0	0	0	0	0	0
23	29	0	0	0	12	0	0	0	0	0	0	1	0
24	47	2	0	0	15	0	0	0	0	0	0	0	0
25	31	1	0	0	9	0	0	0	0	0	0	0	0
26	93	59	0	0	13	2	0	0	0	0	0	0	0
27	68	0	0	0	20	1	0	0	0	0	0	0	0
28	47	0	0	0	31	0	0	0	0	0	0	1	0
29	39	0	0	0	52	0	0	0	0	0	0	0	0
30	69	0	0	0	67	0	0	0	0	0	0	1	0
31	155	0	0	0	68	0	0	0	0	0	0	1	0
TOTAL	1263	68	0	0	370	4	0	0	0	0	0	7	0

Appendix Table 8.6. **Raw** catches for April 1988, **Prosser.**

DAY	USCHK	MORT	HFCHK	MORT	USTN	MORT	HSTH	MORT	TROUT	COHO	HORT	KOK	HORT
1	402	4	0	0	58	1	0	0	0	0	0	0	0
2	1058	13	0	0	7s	0	0	0	0	0	0	1	0
3	976	4s	0	0	a2	0	0	0	0	0	0	0	0
4	522	101	0	0	90	6	0	0	0	0	0	0	0
S	330	60	0	0	88	3	0	0	0	0	0	0	0
6	759	38	0	0	109	2	0	0	0	0	0	0	0
7	1896	44	0	0	171	0	0	0	0	0	0	0	0
a	841	a	0	0	86	4	0	0	0	0	0	0	0
9	755	9	0	0	160	2	0	0	0	0	0	0	0
10	3877	3	0	0	180	1	0	0	0	0	0	0	0
11	6315	41	2	0	155	3	0	0	0	0	0	0	0
12	5631	2s	0	0	191	1	1	0	0	5	0	0	0
13	2712	0	0	0	76	0	0	0	0	0	0	0	0
14	3369	56	0	0	131	0	0	0	0	6	0	0	0
15	2873	133	0	0	387	41	0	0	0	39	12	0	0
16	2138	270	0	0	320	10	49	0	0	159	4	0	0
17	900	21	0	0	128	0	41	1	0	166	7	0	0
la	563	43	0	0	139	6	37	3	0	255	4	0	0
19	452	33	0	0	214	4	91	3	0	253	12	0	0
20	544	S	0	0	291	4	171	1	0	280	0	0	0
21	666	4	0	0	452	0	144	0	0	405	1	0	0
22	2838	24	0	0	666	1	304	0	0	820	1	0	0
23	1954	9	0	0	187	0	173	1	0	1273	2	0	0
24	1375	2	0	0	485	4	166	0	0	643	1	0	0
2s	1029	7	0	0	457	1	188	0	0	339	1	0	0
26	1149	31	0	0	444	12	87	3	0	486	9	0	0
27	3580	30	0	0	616	4	202	0	0	872	6	0	0
28	1760	0	0	0	124	0	147	0	0	707	0	0	0
29	880	9	0	0	150	0	66	0	0	610	1	0	0
30	765	21	0	0	243	3	65	0	0	674	5	0	0
31													
TOTAL	52909	1089	2	0	6955	113	1932	12	0	7992	66	1	0

Appendix Table 8.7. Raw catches for Hay 1988, Prosser.

DAY	USCHK	MORT	HFCHK	MORT	WSTH	MORT	HSTH	MORT	TROUT	COHO	HORT	KOK	HORT
1	625	0	0	0	256	0	107	0	0	421	0	4	0
2	494	10	0	0	250	1	71	0	0	194	0	9	1
3	799	7	0	0	238	1	47	0	0	238	1	3	1
4	601	3	0	0	185	1	67	1	0	310	2	4	0
5	697	12	0	0	260	3	111	0	0	695	3	3	0
6	825	12	0	0	197	6	125	0	0	1303	16	8	0
7	2136	5	0	0	52	0	102	0	0	3413	5	0	0
a	1190	38	0	0	294	26	63	0	0	3333	42	5	0
9	1463	la	0	0	310	7	97	4	0	4229	14	3	0
10	1329	1	0	0	465	3	129	0	3	5400	18	3s	0
11	741	1	0	0	219	3	57	0	0	2857	24	7	0
12	682	4s	0	0	283	19	91	0	0	1948	57	0	0
13	543	33	0	0	278	17	58	3	0	2371	34	13	0
14	5208	a9	0	0	97	7	26	3	0	2128	786	0	0
15	753	4	0	0	192	2	159	0	0	3512	7	3	0
16	881	5	0	0	340	0	171	0	0	3902	13	1	0
17	335	0	0	0	286	2	119	0	0	1709	6	3	0
la	587	4	0	0	401	4	203	1	2	1787	7	4	0
19	348	13	0	0	266	a	59	0	0	828	11	12	0
20	248	0	0	0	70	0	27	0	0	581	0	11	0
21	278	4	0	0	a4	4	20	0	1	1655	20	0	0
22	388	28	0	0	52	a	11	0	0	1372	39	0	0
23	172	12	0	0	90	7	31	3	1	964	54	0	0
24	244	3	0	0	47	5	16	0	0	456	9	0	0
2s	118	2	0	0	97	3	23	0	0	301	2	0	0
26	127	0	0	0	32	0	5	0	0	300	2	0	0
27	122	S	0	0	33	3	9	0	0	130	2	0	0
28	75	0	0	0	28	1	21	1	0	215	0	0	0
29	116	4	0	0	72	3	28	0	1	202	0	0	0
30	184	1	15	0	104	0	13	0	1	208	1	0	0
31	236	5	66	0	240	3	51	0	23	367	0	3	0
TOTAL	22545	364	81	0	5818	147	2117	16	32	47329	1175	131	2

Appendix Table 8.8. Raw catches for June 1988, Prosser.

DAY	USCHK	MORT	HFCHK	MORT	WSTH	RORT	HSTH	MORT	TROUT	COHO	WORT	KOK	MORT
1	214		58	0	86	2	30	0	0	212	0	0	0
2	326		161	0	57	2	37	0	0	155	1	0	0
3	270		357	4	454	4	105	0	0	346	0	0	0
4	204		131	0	55	1	12	0	0	82	0	0	0
5	159		148	0	43	1	25	0	0	83	5	0	0
6	393		212	0	75	2	44	0	0	85	0	0	0
7	342		119	3	33	1	9	0	0	24	1	0	0
8	168		97	0	66	0	13	0	0	38	0	0	0
9	135		111	0	18	0	1	0	0	16	0	0	0
10	135		396	0	30	0	7	0	0	38	0	0	0
11	297		588	0	19	0	15	0	0	50	0	0	0
12	240		1208	4	15	3	3	0	0	19	0	0	0
13	15		1323	0	14	0	5	0	0	11	0	0	0
14	261		2351	9	23	1	6	0	0	26	0	0	0
15	122		3297	1690	25	13	4	4	0	33	13	0	0
16	36		767	7	5	0	3	0	0	8	0	0	0
17	111		1483	453	2	0	8	0	0	6	1	0	0
18	51		771	5	7	3	13	0	0	8	1	0	0
19	34		937	77	18	3	8	0	0	7	0	0	0
20	15		460	43	8	1	2	1	0	2	0	0	0
21	0		459	5	3	0	1	0	0	0	0	0	0
22	15		1891	159	20	10	8	3	0	6	0	0	0
23	15		1435	3	7	0	7	2	0	9	0	0	0
24	0		678	6	4	0	11	0	0	0	0	0	0
25	3		750	6	6	2	7	0	0	10	0	0	0
26	0		93	9	0	0	1	0	0	1	0	0	0
27	0		89	0	1	0	3	0	0	2	0	0	0
28	1		122	13	1	0	0	0	0	4	0	0	0
29	6		231	7	3	0	2	0	0	3	0	0	0
30	4		225	13	3	0	3	0	0	2	2	0	0
31													
TOTAL	3574	0	20948	2516	1101	49	393	10	0	1286	24	0	0

Appendix C.

Survival of wild spring chinook smolt releases.

Appendix Table C.I. **Survival** to **Prosser smolt** trap of wild **Naches River spring** chinook **smolts released below Wapatox smolt** trap in the spring of **1988.**

	ESTIMATED PASSAGE						
RECAPTURE DATE	Release of 3/9-3/15 (N=1063)	Release of 3/17-3/19 (N=116)	Release of 3/17-3/19 (N=122)	Release of 3/17-3/19 (N-120)	Release of 4/1-4/5 (N=332)	Release of 4/1-4/5 (N=334)	Release Of 4/1-4/5 (N=333)
4/09	1	0	0	0	0	0	0
4/10	0	0	0	0	0	0	0
4/11	2	0	0	0	0	0	0
4/12	0	0	0	0	0	0	0
4/13	3	0	3	0	0	0	0
4/14	0	0	0	0	0	0	0
4/15	43	0	5	0	0	5	0
4/16	11	11	0	0	22	22	11
4/17	52	0	0	0	52	17	0
4/18	0	0	0	0	24	0	0
4/19	24	0	0	0	0	0	0
4/20	0	0	0	0	0	0	0
4/21	0	0	0	0	0	0	0
4/22	8	3	3	0	0	3	3
4/23	I2	4	4	0	4	4	4
4/24	27	0	0	0	8	4	0
4/25	9	0	0	0	0	3	3
4/26	0	2	2	4	0	9	0
4/27	27	7	2	8	7	8	7
4/28	30	4	17	4	I7	9	I7
4/29	I6	0	4	0	8	I6	I2
4/30	20	0	0	5	3	3	5
5/01	I4	0	0	0	0	3	I7
5/02	8	5	0	5	3	0	3
5/03	7	5	0	0	2	2	5
5/04	5	0	0	5	0	2	7
5/05	9	0	0	0	7	0	0
5/06	2	0	0	0	0	13	9
5/07	0	4	2	0	7	6	11
5/08	4	4	4	0	2	6	4
5/09	8	0	0	0	4	2	0
5/10	4	0	0	0	1	0	0
5/11	6	0	0	0	3	0	3
5/12	2	0	0	0	0	0	6
5/13	0	0	2	0	0	0	0
5/14	0	0	0	0	0	0	0
5/15	0	9	0	0	0	0	0
5/16	0	0	0	0	0	0	0
5/17	0	4	0	0	4	0	0
5/18	0	0	0	0	2	2	0
5/19	0	0	0	0	0	0	0
Mean Group Survival	**0.33**	0.53	0.39	0.26	0.53	0.42	0.38

Appendix Table C.2. **Survival** to **Prosser smolt trap** of **wild spring chinook smolts released at various** pointr In **the Yakima River** an **April** 13, **1988.**

	ESTIMATED PASSAGE															
	Above Roza				Above Sunnyside				Below Sunnyside				Below Wapatox			
DATE	# 1	# 2	# 3	84	#I	# 2	# 3	# 4	# 1	# 2	13	# 4	# 1	# 2	# 3	# 4
4/13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4/15	5	0	0	0	37	38	21	0	32	27	37	64	0	0	0	0
4116	56	0	Im	11	78	67	22	56	34	45	89	0	0	0	0	0
4117	70	35	70	0	0	52	17	35	17	70	52	I7	0	0	I7	0
4/18	12	24	24	0	I2	24	0	24	24	12	0	12	0	0	0	0
4/19	9	28	0	0	37	46	0	18	18	37	0	0	9	0	9	0
4/20	7	20	IO	IO	0	10	20	27	0	0	20	3	0	0	0	0
4/21	3	a	II	0	11	5	0	3	3	5	3	0	0	0	0	0
4/22	22	5	I9	5	a	3	I9	I4	24	11	I9	3	0	0	3	0
4/23	16	4	4	a	4	0	4	0	4	4	4	I2	0	0	0	4
4/24	0	a	a	4	0	4	0	0	4	0.4		a	0	0	0	4
4/25	18	6	9	3	12	3	0	I2	0	3	0	6	0	3	0	0
4/26	9	7	0	0	2	2	4	0	2	7	0	0	0	0	0	0
4/27	IO	12	7	8	a	a	7	8	7	5	7	5	0	0	2	3
4/28	22	13	0	9	4	13	9	13	13	22	0	0	4	0	0	9
4/29	4	0	4	0	0	4	0	8	0	0	0	0	4	0	0	0
4no	0	5	3	0	0	0	8	0	3	0	0	0	0	0	5	3
5/01	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	6
5/02	0	0	0	0	0	0	0	0	0	0	0	3	5	0	3	5
5/03	0	0	0	0	0	2	2	0	0	2	0	2	0	0	7	0
5/04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5
5/05	0	4	2	0	0	0	0	2	0	4	0	0	4	II	13	2
5/06	7	0	0	0	0	0	0	0	0	0	0	0	4	0	4	2
5/07	0	0	0	0	0	0	0	0	0	0	0	0	8	2	8	6
5/08	0	0	2	0	0	0	4	0	0	0	0	0	IO	0	8	IO
5/09	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	IO
5/10	0	0	0	0	0	0	0	0	0	0	0	0	6	0	3	4
5111	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	6
5/12	0	0	0	0	0	0	0	0	0	0	0	0	6	6	4	8
5/13	0	0	0	0	0	0	0	0	0	0	0	0	2	2	7	2
5/14	a	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0
5/16	0	a	0	0	0	0	0'0		0	0	0	0	5	0	IO	0
sn7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/18	0	0	0	0	0	0	0	0	0	0	0	0	5	0	2	2
5/19	0	0	0	0	0	0	0	0	0	0	0	0	4	0	7	0
5/20	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
5/21	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
5122	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
5/23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/25	0	0	0	0	0	0	0	0	0	0	0	0	7	0	11	0
5/26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
5/27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5/29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
sno	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
5/31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	I
6/01	0	0	0	0	0	0	0	0	D	0	0	0	0	0	4	0
Total	268	180	273	59	215	283	141	221	la5	253	236	135	99	29	I52	95
Mean Group Survival			0.56				0.61				0.54				0.39	

Appendix Table C.3. Survival to Mc Nary Dam of wild Yakima River rpring chinook smolts released at various points in the Yakrma River on April 13, 1988.

Survival estimated by (McNary Passage Index)/(Release number).

	Above Roza				Above Sunnyside				Below Sunnyside				Below Wapatox			
	# 1	# 2	# 3	# 4	#I	# 2	# 3	# 4	#I	# 2	# 3	# 4	#I	# 2	# 3	# 4
Survival	0.49	0.41	0.29	0.42	0.41	0.44	0.32	0.40	0.44	0.47	0.31	0.48	0.26	0.00	**0.17**	0.07
Mean Group Survival			0.40				0.39				0.42				0.12	

RELEASE VARIABLES:
Above Roza: #1 = RAA(1), N=352; #2 = RAA(2), N=349; #3 = RAA(3), N=347; #4 = RAA(4), N=352.
Above Sunnyside: #1 = RAB(1), N=351; #2 = RAB(2), N=360; #3 = LAB(1), N=335; #4 = LAB(2), N=358.
Below Sunnyside: #1 = RA9I(1), N=345; #2 = RA9I(2), N=409; #3 = RA9I(3), N=357; #4 = RA9I(4), N=409.
Below Wapatox: #1 = RA+F(1), N=245; #2 = RA+F(2), N=245; #3 = RA+F(3), N=238; #4 = RA+F(4), N=245.