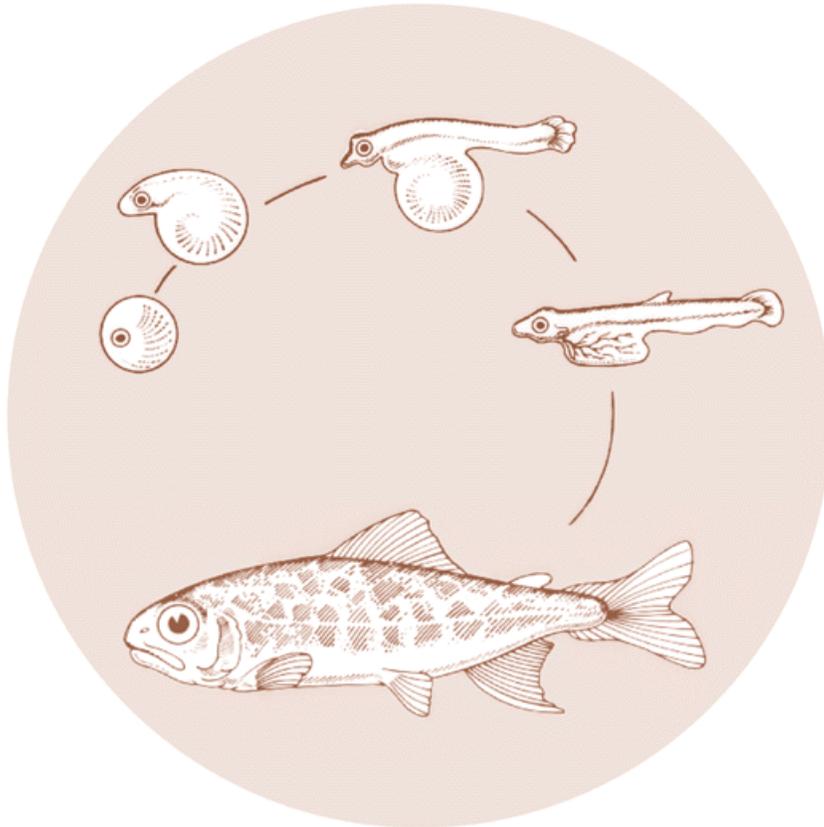


June 1992

# **MINTHORN SPRINGS CREEK SUMMER JUVENILE RELEASE AND ADULT COLLECTION FACILITY**

(Operation, Maintenance and Evaluation of the Bonifer  
and Minthorn Springs Juvenile Release and Adult  
Collection Facilities)

Annual Report 1991



DOE/BP-17622-6



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(Operation, Maintenance and Evaluation of the Bonifer and  
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Collection Facilities)

Annual Report 1991

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## ABSTRACT

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and Oregon Department of Fish and Wildlife (ODFW) are cooperating in a joint effort to supplement steelhead and re-establish salmon runs in the Umatilla River Basin. As part of this program, Bonifer and Minthorn Acclimation Facilities are operated for holding and spawning adult steelhead and fall chinook salmon and acclimation and release of juvenile salmon and steelhead.

Regularly-scheduled maintenance of pumps, equipment and facilities was performed in 1991. Major repairs to one Minthorn pump were required and flood damage at Minthorn necessitated the replacement of rock and gravel around the pump house and steelhead brood holding area. Several modifications to the steelhead brood holding pond were also made to help reduce mortality. These changes appeared to be successful as evidenced by the reduced number of mortalities. Total prespawn mortality in 1990-91 was 10.4%. This compares to 20.0 to 39.0% for the previous three years at Minthorn.

A total of 202 adult steelhead were collected for broodstock at Threemile Dam from November, 1990 through April, 1991 and held at Minthorn. Utilizing a 3 x 3 spawning matrix, a total of 410,356 eggs were taken from 64 females. The eggs were transferred to Irrigon Hatchery for incubation and initial rearing. The fish were then transferred to Umatilla Hatchery for further rearing and later release into the Umatilla River.

A total of 347 fall chinook salmon were also collected for broodstock at Threemile Dam and held at Minthorn. Using a 1:1 spawning ratio, a total of 601,548 eggs were taken from 159 females. They were transferred to Umatilla Hatchery for incubation, rearing and later release into the Umatilla River.

Acclimation of 100,505 spring chinook salmon and 42,610 summer steelhead was completed at Bonifer in the spring of 1991. At Minthorn, 152,974 coho and 79,672 fall chinook salmon were acclimated and released. In the fall, 81,144 spring chinook salmon were held at Bonifer for a three-day post-transport recovery period.

Control groups of spring and fall chinook salmon and summer steelhead were released instream concurrent with the acclimated releases to evaluate the effects of acclimation on adult returns to the Umatilla River.

Test and control groups were tagged by ODFW for acclimation studies to be performed at the Bonifer and Minthorn facilities in 1991 and 1992. Each group received three separate coded-wire tag codes. One experiment for fall chinook salmon and two experiments for spring chinook salmon were tagged.

The progress of outmigration for acclimated releases was monitored at the Westland Canal fish trapping facility by CTUIR and ODFW personnel. Because of high spring flows

in the Umatilla River however, the trap was not opened until mid-June and few fish were trapped, suggesting most had already migrated downriver.

Personnel from the ODFW Eastern Oregon Fish Pathology Laboratory in La Grande took samples of tissues and reproductive fluids from Umatilla River summer steelhead and fall chinook salmon broodstock for monitoring and evaluation purposes.

## ACKNOWLEDGEMENTS

This study was funded by Bonneville Power Administration (BPA). The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) thanks Jerry Bauer, Jay Marcotte and other BPA personnel for their assistance. Thanks are extended to Susan Whelan of Stanfield-Westland Irrigation District for her assistance in collecting data at Threemile Dam and to Jack Hurst, Randy Winters, Warren Groberg, Sam Onjukka and other Oregon Department of Fish and Wildlife (ODFW) personnel for providing assistance in the spawning of summer steelhead and fall chinook salmon and for monitoring the fish for the presence of fish pathogens. Bill Duke and other ODFW staff assisted in the collection of data at Threemile Dam and **Westland** Canal. Dennis **Issac** and Bill Murray (ODFW) retrieved and decoded coded-wire tags from adult fish snouts and Bob Becker (ODFW) supervised and coordinated fish transfers to the acclimation facilities. Thanks are extended to Ray Hill, Dan Barrett, Wayne Stredonsky, and Randy **Robart** (ODFW hatchery managers) and their staff for rearing the fish used in the acclimation experiments. We thank the landowners, Rosemary and Wes Gladow, and Richard Kaye for their cooperation and the Union Pacific Railroad for providing access to the acclimation facilities and assisting in fish transfers into the Bonifer facility.

Thanks go to the CTUIR staff for their cooperation and contributions to this report. Brian Zimmerman, Paul Kissner, Larry Cowapoo, Clif **Picard** and Gene Shippentower collected much of the data from adults returning to Threemile Dam and migration data for juvenile salmonids captured at the **Westland** Canal fish trapping facility. Other biologists and technicians assisted in field sampling. Joe Richards provided the administration of the agreement and Julie Burke and Celeste Reves provided secretarial services. Gary James provided technical oversight and critical review of this report and Peter Lofy and Paul Kissner also provided critical review.

Thanks go to Gene Shippentower, Dave McKay and Mike **McCloud** for the long hours and weekends spent running the acclimation facilities and for collecting much of the data.

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## INTRODUCTION

### Background

The Umatilla River Basin historically supported large runs of anadromous salmonids, including summer steelhead (*Oncorhynchus mykiss*), fall and spring chinook salmon (*O. tshawytscha*) and coho salmon (*O. kisutch*). The runs of chinook and coho salmon were essentially eliminated in the early 1900's. Forestry, agriculture, irrigation and hydropower are among the developments that have impacted all stocks in the Umatilla River Basin. The single naturally spawning anadromous stock left in the basin is a run of approximately 1,000 to 3,000 summer steelhead. This steelhead run has been supplemented with fish from Washington (Skamania) and Idaho (Oxbow) stocks from 1967 through 1970. Fish of Umatilla River stock were used in 1975 and from 1981 to the present (Table 1). The run has varied from 6.7% hatchery fish in 1987-88 (the first season that fin-clipped fish were differentiated), to 34.8% in the 1990-91 season. The natural run in 1990-91 however, was one of the lowest on record. Runs of salmon species have been rebuilt from stocks of various sources (Tables 2, 3 and 4).

A comprehensive plan developed by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and Oregon Department of Fish and Wildlife (ODFW) was implemented to supplement steelhead and re-establish salmon runs in the Umatilla River Basin. Among the initial steps in the plan was construction of two acclimation facilities completed on the Umatilla Indian Reservation. Both facilities were constructed and are operated under the Fish and Wildlife Program of the Northwest Power Planning Council, and funded by Bonneville Power Administration (BPA).

### Facility Descriptions and Operations

The Bonifer Pond Facility (Bonifer) is located adjacent to Meacham Creek at rivermile (RM) 2 (Figure 1). The pond spills into Boston Canyon Creek which flows about 20 yards before entering Meacham Creek. Meacham Creek flows into the Umatilla River at RM 79. A water control structure was completed at the outlet of an existing pond and operations began in 1984. The 1.75-acre pond has 4.5 acre-feet of water (Fish Management Consultants, Inc. 1989). It is fed by three springs that originate from 1/8 to 1/2 mile away. A concrete fishway which can be used as an adult trap, and a parallel underground culvert which was added later, are the two release structures that drain the pond.

The Minthorn Springs Facility (Minthorn) is located about four miles east of Mission, Oregon (Figure 1). Minthorn Springs Creek is formed from the inflow of several springheads located immediately south of the Umatilla River and east of the facility. The creek is about one mile long, with the facility located near the mouth at Umatilla RM 63. Minthorn was completed in 1985 and first operated in 1986. Two concrete raceways (120 x 12 feet) were constructed for acclimation of juvenile salmonids. Water is pumped about 40 feet from the creek to the raceways. Water depth is usually held at three feet with a

Table 1. Hatchery releases of summer steelhead in the Umatilla River.

Year of Release	Hatchery	No. Released	No./lb.	Stock
1967	Gnat Creek	109,805	75.0	Skamania
1967	Oak Springs	238,020	117.0	Idaho (Oxbow)
1967	Wallowa	142,240	240.0	Idaho (Oxbow)
1968	Gnat Creek	23,100	66.0	Skamania
1968	Gnat Creek	150,000	Eggs	Skamania
1969	Oak Springs	174,341	145.0	Skamania
1970	Carson	23,400	9.0	Skamania
1970	Carson	16,089	8.0	Skamania
1975	Wizard Falls	11,094	9.0	Umatilla River
1981	Oak Springs	17,558	6-9	Umatilla River
1981	Oak Springs	9,400	145.0	Umatilla River
1982	Oak Springs	59,494	7-8	Umatilla River
1982	Oak Springs	67,940	124.0	Umatilla River
1983	Oak Springs	60,500	11.0	Umatilla River
1983	Oak Springs	52,700	62.0	Umatilla River
1984	Oak Springs	57,939	6.5	Umatilla River
1984	Oak Springs	22,000	135.0	Umatilla River
1985	Oak Springs	53,850	7.0	Umatilla River
1985	Oak Springs	39,134	150.0	Umatilla River
1986	Oak Springs	54,137	8.4	Umatilla River
1987	Oak Springs	1,485	5.5	Umatilla River
1988	Oak Springs	95,290	6.5-10.3	Umatilla River
1988	Oak Springs	10,033	57.5	Umatilla River
1988	Irrigon	24,618	3200.0	Umatilla River
1989	Oak Springs	29,852	6.6	Umatilla River
1989	Oak Springs	29,586	5.6	Umatilla River
1989	Oak Springs	22,274	5.5	Umatilla River
1990	Oak Springs	29,522	7.7	Umatilla River
1990	Oak Springs	30,225	5.9	Umatilla River
1990	Oak Springs	29,446	5.5	Umatilla River
1991	Oak Springs	30,221	6.2	Umatilla River
1991	Oak Springs	29,325	8.7	Umatilla River
1991	Oak Springs	12,389	7.5	Umatilla River
1991	Oak Springs	3,998	12.5	Umatilla River

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Table 2. Hatchery releases of fall chinook in the Umatilla River.

Year of Release	Hatchery	No. Released	No./lb.	Stock
1982	Bonneville	978,336	79.0	Tule
1982	Bonneville	2,828,835	92.0	Tule
1982	Bonneville	290,680	130.0	Tule
1983	Bonneville	100,564	5.9	Bonneville URB
1984	Bonneville	228,412	8.6	Bonneville URB
1984	Bonneville	996,250	85.1	Bonneville URB
1985	Bonneville	3,223,172	92.3	Bonneville URB
1985	Bonneville	198,162	7.8	Bonneville URB
1985	Bonneville	51,000	16.2	Bonneville URB
1986	Irrigon	91,036	5.0	Bonneville URB
1986	Irrigon	115,779	4.7	Bonneville URB
1986	Irrigon	2,029,602	86.0	Bonneville URB
1986	Irrigon	35,574	11.6	Bonneville URB
1987	Irrigon	1,476,830	60.4	Priest Rapids URB
1987	Bonneville	109,143	8.1	Bonneville URB
1987	Bonneville	102,363	8.6	Bonneville URB
1987	Irrigon	2,000	20.0	Priest Rapids URB
1988	Irrigon	1,886,757	68.3	Priest Rapids URB
1988	Irrigon	1,429,250	93.1	Bonneville URB
1988	Irrigon	14,408	9.8	Priest Rapids URB
1988	Irrigon	79,681	8.6	Priest Rapids URB
1988	Bonneville	99,550	10.2	Bonneville URB
1988	Bonneville	100,791	8.8	Bonneville URB
1989	Bonneville	217,443	8.6	Bonneville URB
1989	Irrigon	2,393,710	66.6	Priest Rapids URB
1989	Irrigon	156,957	10.9-11.1	Priest Rapids URB
1989	Irrigon	638,305	76.2	Bonneville URB
1990	Bonneville	255,614	8.2	Bonneville URB
1990	Bonneville	2,425,681	87.5	Bonneville URB
1990	Irrigon	629,800	82.4	Priest Rapids URB
1990	Irrigon	71,864	9.2	Bonneville URB
1990	Irrigon	76,646	8.8	Bonneville URB
1991	Bonneville	194,847	7.8	Upriver Brights
1991	Irrigon	3,198,673	73.0-83.0	Upriver Brights
1991	Irrigon	2,774	194.0	Upriver Brights
1991	Irrigon	7,688	80.0	Upriver Brights
1991	Irrigon	79,672	80.5	Upriver Brights
1991	Irrigon	74,865	86.0	Upriver Brights

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Table 3. Hatchery releases of spring chinook in the Umatilla River.

Year of Release	Hatchery	No. Released	No./lb.	Stock
1986	Carson	99,970	22.8	Carson
1986	Irrigon	300,438	87.0	Carson
1986	Irrigon	75,000	15.0	Carson
1987	Carson	99,897	10.4	Carson
1987	Oxbow	169,100	199.0	Carson
1988	Bonneville	1,196	21.4	Carson
1988	Carson	99,895	20.6	Carson
1988	Bonneville	297,377	8.3-10.3	Carson
1988	Bonneville	75,767	11.1	Carson
1989	Bonneville	160,917	10.6	Carson
1989	Bonneville	164,603	12.0	Carson
1990	Carson	99,775	18.6	Carson
1990	Bonneville	231,772	9.0-9.6	Carson
1990	Bonneville	80,438	11.5	Carson
1990	Bonneville	77,998	13.4	Carson
1991	Carson	90,796	20.6	Carson
1991	Carson	5,937	16.9	Carson
1991	Bonneville	100,505	10.1	Lookingglass
1991	Bonneville	96,152	11.8	Lookingglass
1991	Bonneville	81,114	16.5	Carson
1991	Bonneville	78,480	16.8	Carson

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Table 4. Hatchery releases of coho salmon in the Umatilla River.

Year of Release	Hatchery	No. Released	No./lb.	Stock
1966	Little White Salmon	500,000	1312.0	Little White Salmon
1967	Little White Salmon	200,000	1087.0	Little White Salmon
1967	Cascade	500,000	Eggs	Tanner Creek
1968	Little White Salmon	750,000	Eggs	Little White Salmon
1969	Carson	200,040	23.0	Little White Salmon
1987	Cascade	948,549	13.5-14.0	Tanner Creek
1988	Cascade	996,433	16.6	Tanner Creek
1989	Cascade	753,637	15.3-19.7	Tanner Creek
1989	Cascade	233,269	17.2-19.1	Tanner Creek
1990	Cascade	796,842	14.7	Tanner Creek
1990	Cascade	192,086	11.2-13.5	Tanner Creek
1991	Cascade	152,974	15.4	Tanner Creek
1991	Cascade	228,293	16.5	Tanner Creek
1991	Cascade	221,385	16.6	Tanner Creek
1991	Cascade	143,054	16.4	Tanner Creek
1991	Cascade	209,923	17.1	Tanner Creek

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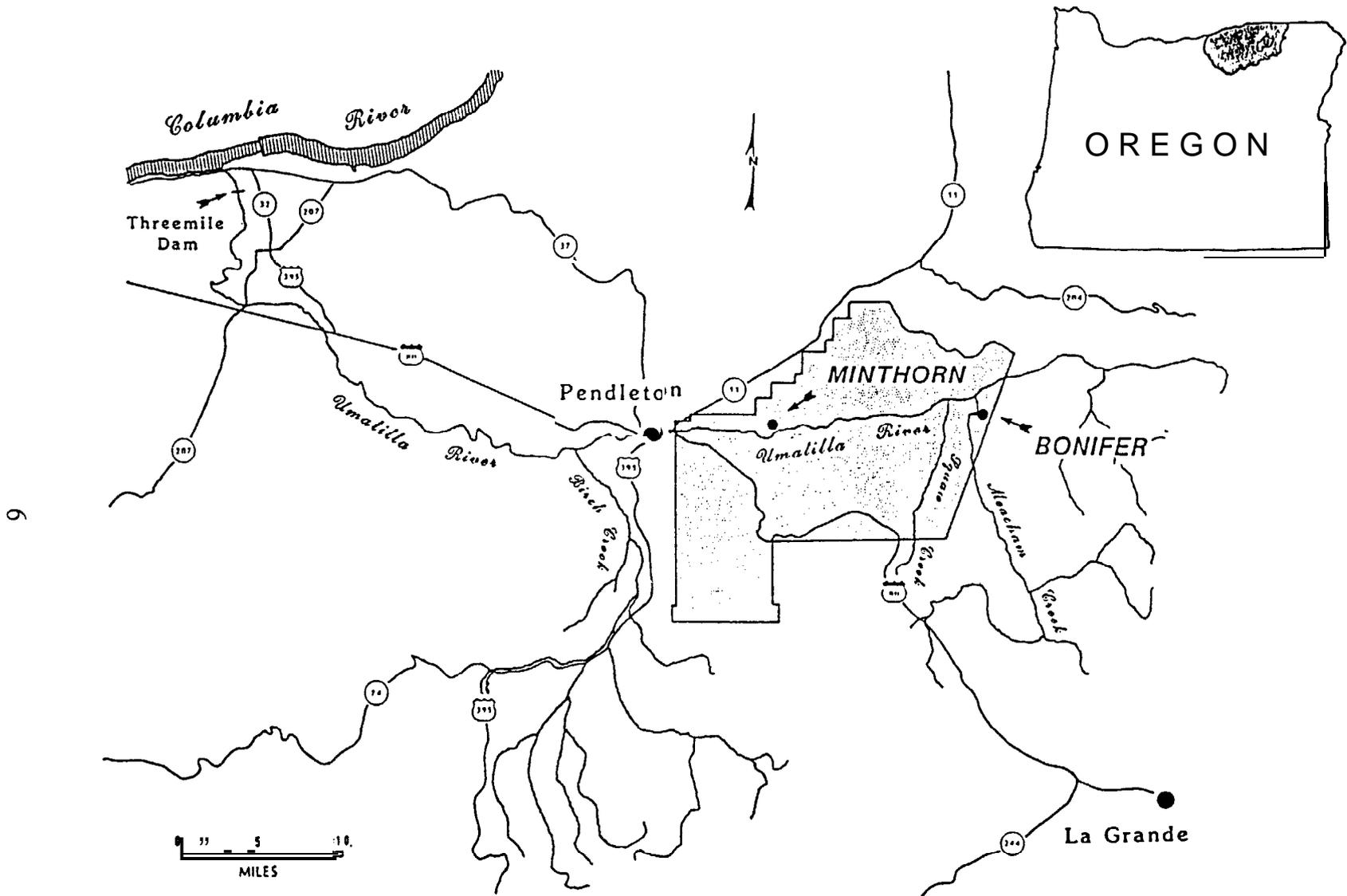


Figure 1. Confederated Tribes of the Umatilla Indian Reservation and Bonifer and Minthorn Acclimation Facilities.

single-pass water pumping rate of 800 gallons per minute through each raceway. Two valves control the effluent water to allow for either recycling of flows into the intake pond or discharge downstream of the intake and the adult holding area.

The Bonifer and Minthorn Acclimation facilities are operated by CTUIR in cooperation from ODFW. The facilities are used for holding and spawning adult summer steelhead and fall chinook salmon and for acclimation and release of juvenile fall and spring chinook and coho salmon and summer steelhead. The main goal of acclimation is to reduce stress from trucking prior to release and improve imprinting of juvenile salmonids in Umatilla River water sources in order to increase returns. The Umatilla Hatchery will eventually be the source hatchery for Bonifer and Minthorn and other satellite facilities slated to acclimate juvenile salmonids. Until that time, fish are being acquired from various sources. This report details activities associated with operation, maintenance and evaluation of the Bonifer and Minthorn Acclimation Facilities in 1991.

### **Project Objectives**

The following specific project objectives for 1991 are part of overall objectives to operate, maintain and evaluate Bonifer and Minthorn Acclimation Facilities:

1. Tag groups of juvenile salmon for acclimation studies (subcontract).
2. Acclimate and release groups of coded-wire tagged juvenile salmon and steelhead.
3. Monitor temperature, dissolved oxygen and flows daily during acclimation and weekly during non-acclimation periods.
4. Monitor physical data and health of juveniles prior to release.
5. Operate, maintain and repair all equipment, buildings and grounds.
6. Monitor physical data of juveniles at downstream migrant traps and compare this data to data taken at release to give an indication of outmigration timing and size.
7. Collect a spectrum of the run of adult summer steelhead returning to the trap at Threemile Dam and transport them to holding facilities.
8. Collect fall chinook salmon returning to the trap at Threemile Dam and transport them to holding facilities.
9. Spawn adult summer steelhead and provide eggs to ODFW for rearing and later release in the Umatilla River.
10. Spawn fall chinook salmon and provide eggs to ODFW for rearing and later release in the Umatilla River.
11. Monitor adult mortality and fish spawned for physical data and disease analysis.
12. Collect data and snouts from coded-wire tagged fish and send the snouts to ODFW for tag retrieval and decoding.

13. Access coded-wire tag recovery information from the Pacific States Marine Fisheries Commission and other appropriate sources and determine the contribution of Umatilla River releases to the ocean, Columbia River and Umatilla River fisheries and survival to adulthood of all tagged groups of acclimated and control fish.

## **MATERIALS AND METHODS**

### **Collection and Spawning of Summer Steelhead**

Adult summer steelhead were collected for broodstock through the cooperative efforts of CTUIR, ODFW and Stanfield-Westland Irrigation District. Fish were collected from the trap at Threemile Falls Dam, located three miles upstream from the mouth of the Umatilla River, during the period November 2, 1990 through April 22, 1991. Because of a low natural fish run and an agreement between CTUIR and ODFW to take no more than 15% of the natural run for broodstock (Umatilla Basin Artificial Fish Production Plan 1990), hatchery fish were also collected to insure meeting the broodstock goal of 212 fish. Adults were differentially marked during each time period in which they were collected and were transported to Minthorn using a trailer with a 370 gallon, aerated tank.

Modifications to the brood holding pond prior to the 1990-91 season were necessitated because of past problems with fungus infections and high mortality. Plastic pipes were placed over some of the divider screen slots to reduce rough edges and a sheet of plywood was installed at the intake to provide a more uniform water flow distribution. Floating pond covers were also installed to help prevent the fish from jumping.

Beginning on February 14, the fish were treated weekly with formalin (Paracide-F, Argent Chemical Laboratories) at 1:6,000 for one hour to help control fungus. After spawning began, treatments were increased to twice each week for the next three weeks and then to three times per week through the end of the spawning season.

Beginning on April 1, the fish were sorted weekly for maturation. The ripe fish were spawned by Irrigon Hatchery and CTUIR personnel using standard hatchery practices. A 3 x 3 spawning matrix was utilized whenever possible and all crosses were either hatchery x wild or wild x wild. No hatchery x hatchery crosses were made. The eggs from each family group were water hardened in iodophor at 75 ppm and transferred to Irrigon Hatchery for incubation and initial rearing. The fish were then transferred to Umatilla Hatchery for further rearing and later release into the Umatilla River.

### **Collection and Spawning of Fall Chinook Salmon**

Fall chinook salmon were also collected at Threemile Dam and transported to Minthorn for broodstock. Fish were collected from October 24 to November 22 and were transported in a 3,000 gallon, aerated tanker.

The fish were put into a raceway which was covered with nylon netting to prevent the fish from jumping out. The fish were treated three times per week with formalin at 1:6,000 for one hour.

From November 6 to November 26, the fish were sorted and spawned on five occasions by CTUIR and Umatilla Hatchery personnel. A spawning ratio of 1:1 was utilized, but after fertilization, the eggs from four females were pooled to form one family group. The eggs were water hardened in iodophor at 75 ppm and transferred to Umatilla Hatchery for incubation, rearing and later release into the Umatilla River.

### **Disease Sampling of Summer Steelhead Broodstock**

Spawned adult steelhead were sampled for the presence of selected pathogens by ODFW Northeast Oregon Fish Pathology Laboratory (NOFPL) in La Grande for monitoring and evaluation purposes. Additional sampling as part of the Fish Health Monitoring Program for BPA was also performed on spawned fish and prespawn mortalities.

All 127 spawned fish were sampled for replicating viral agents. The reproductive fluid (ovarian fluid from females or milt from males), pyloric caeca, kidney and spleen were sampled for infectious hematopoietic necrosis virus (IHNV) and infectious pancreatic necrosis virus (IPNV). Kidney smears from 60 spawned fish were sampled for bacterial kidney disease (BKD) and 60 blood samples were taken to examine for erythrocytic inclusion body syndrome (EIBS).

Nineteen steelhead that died during holding were frozen and sampled later at the end of the spawning season. Kidney smears were taken to test for BKD and samples of the lower intestine were examined for Ceratomyxa shasta. Cultures from the kidney were also taken to test for typical bacterial pathogens.

### **Disease Sampling of Fall Chinook Salmon Broodstock**

All 318 spawned fall chinook were sampled for IHNV and 61 were sampled for IPNV. Kidney smears from 303 spawned fish were sampled for BKD and 86 blood samples were taken to examine for EIBS. One mortality was sampled for BKD, Ceratomyxa shasta, and other bacterial pathogens.

### **Adult Returns to Minthorn**

Two hatchery summer steelhead were captured at Minthorn while the trap was in operation from October 24, 1990 to September 6, 1991. Three other fish were observed in the ladder but did not enter the trap. At least one was observed to be missing an adipose fin. Two steelhead redds were also observed in Minthorn Springs Creek below the facility.

### **Adult Returns to Bonifer**

One adult spring chinook was captured at Bonifer while the trap was in operation from March 4 to September 3, 1991. One other adult was observed in Boston Canyon Creek downstream of the facility.

## **Acclimation and Release of Juvenile Salmonids**

Juvenile salmonids were transported by ODFW from hatcheries using 1,000 to 5,000 gallon tankers and transfers were completed in one to two days. Juveniles were fed 1.5 or 3.0 mm Biomoist Feed (Bioproducts Inc., Warrenton, Oregon) twice each day.

Mortalities were removed daily at both facilities. Transfer mortality (immediate and delayed mortality) was defined as all fish that died within five days of the last transfer date. ODFW pathology personnel were available for specific disease problems should they become apparent in mortalities or live fish.

Total number of fish at release was estimated using ODFW Fish Liberation Reports and acclimation mortality records. Number of fish reported as tagged was estimated using ODFW Coded-Wire Tagging Operation Summaries, tag retention sampling just prior to release, and information on the total number of fish released.

Samples for length frequency data and weight of fish were taken using standard ODFW techniques. The descaling index was completed in general accordance with the techniques of Scully et al. (1984). For the criterion of severe descaling, ten potential descaled areas were identified, five from each side of the fish. These scaled sections are above a line extending from the vent to the insertion of the pectoral fin. Severe descaling is defined as loss of greater than 40.0% of the scales in at least two of these ten sections. Partial descaling addresses loss in scaled areas on the right and left sides of the fish. Partial descaling was defined as loss of greater than 3.0% of the scales on at least one side of the fish.

Temperatures reported associated with specific acclimation periods are data from hourly readings that correspond to the date of first transfer to the last date of release. Percent body weight of food to feed was determined using Bioproducts Inc. feed charts.

## **Outmigration Monitoring**

Juvenile salmonids were collected in the trapping facility at Westland Canal (RM 27) from June 14 to August 14. The trap is approximately 36 and 54 rivermiles downstream from Minthorn and Bonifer, respectively, and is operated by CTUIR and ODFW Trap and Haul personnel.

Species, marks and descaling indices were recorded on an enumerated subsample of fish. The fish were loaded by dip net into 370 gallon, aerated tanks and total pounds loaded was determined by water displacement. Using standard hatchery practices, several weight samples were taken to determine the average size of the fish. The number of fish loaded was then calculated by multiplying the number of fish per pound by the number of pounds loaded.

## **Assessment of Acclimation Facilities**

Automatic temperature recorders (RyanTempmentors) recorded hourly temperatures at both facilities in 1991. One was installed at the Bonifer outlet and the other at the pump intake at Minthorn. Temperature and dissolved oxygen (DO) were taken at the facilities daily during acclimation periods and weekly during non-acclimation periods. Additional DO and temperature data at adjacent and upstream areas of the springheads were also recorded weekly to provide a profile of the water source for both Minthorn and the largest spring at Bonifer.

## **Acclimation Research**

A research program was initiated in 1987 to determine the benefits of acclimation. In 1991, juvenile salmonids were tagged and marked by ODFW under subcontract for both 1991 and 1992 releases. Three replicate tag codes were used for each test (acclimated) and control (non-acclimated) group. Chinook salmon were coded-wire tagged and adipose fin clipped.

The snouts and associated biological data from adult salmonids marked to indicate the presence of coded-wire tags were collected at Threemile Dam and Minthorn. Snouts were also collected from Umatilla River creel and spawning ground surveys conducted through other CTUIR programs. The snouts were sent to ODFW for tag removal and decoding.

## **Adult Survival and Umatilla River Returns**

Data available from the Pacific States Marine Fisheries Commission, ODFW and the Washington Department of Fisheries were accessed to compile adult survival and return information for all past releases of coded-wire tagged fish released in the Umatilla River.

## RESULTS AND DISCUSSION

### Facility Maintenance

Repair and maintenance were performed at Minthorn in 1991. One of the turbine pumps required major repair because of a bent shaft and worn bearings. Flood damage necessitated the replacement of rock and gravel around the pump intake and brood pond holding area. Grates and screens at the pump intake and the head and outlet of the raceways were cleaned daily while fish were being acclimated. Weed abatement constituted much of the normally-scheduled maintenance.

Routine maintenance work at Bonifer consisted mostly of weed abatement in the work area around the outlet and maintenance of the electric fence.

### Collection and Spawning of Summer Steelhead

A total of 202 adult steelhead were captured at Threemile Dam between November 2, 1990 and April 22, 1991 and transported to Minthorn (Table 5). This included 103 hatchery and 99 unmarked fish (Appendix A).

Table 5. Summer steelhead broodstock collection, spawning, and mortality in 1990-91. /1

Period	No. Collected			No. Spawned /2				Mortality /3							
	Males	Females	Total	Males	% Females	% Total	% Hales	% Females	% Total	%					
Nov.-Dec.	11 /4	11	22	4	36	8	73	12	55	1	9	1	9	2	9
Jan.-Feb.	52	66	118	11	21	43	65	54	46	9	17	1	2	10	8
Mar.-Apr.	30	32	62	4	13	17	53	21	34	7	23	2	6	9	15
TOTALS	93	109	202 /5	19	20	68	62	87	43	17	18	4	4	21	10

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/1 All broodstock were collected at Threemile Dam and transported to Minthorn Acclimation Facility. 103 hatchery as well as 99 wild fish were collected (Appendix A).

/2 The numbers in the table indicate fish sacrificed for spawning and include four green females and three green males (Appendix B). Most wild males were spawned live.

/3 The number of male mortalities would have been lower had the wild males not been live spawned.

/4 The sex of one hatchery fish collected in November was not recorded, but was assumed to be a male.

/5 Twenty-two hatchery females and 28 hatchery males were not spawned, but were sacrificed for coded-wire tag recovery. Fourteen wild females, 26 wild males, and three hatchery males were released back into the Umatilla River. Ten males (four hatchery and six wild) and one wild female were unaccounted for at the end of the spawn season.

Fungus infections on broodstock held at **Minthorn** have been a problem in previous years, but treatments were not feasible due to the poor water flow circulation in the holding pond. Modifications to the pond were made prior to the 1990-1991 run year and beginning in February, the fish were treated with **formalin** to help control fungus.

These changes appeared to be successful as evidenced by the low number of mortalities. Total prespawn mortality of brood during the adult holding period was 10.4% (Table 5). This compares to 20.0 to 39.0% for the last three years at **Minthorn (Rowan 1991)**. A total of 21 adults died prior to completion of spawning in 1991 and mortality was higher in males (18.3%) than it was in females (3.7%) (Table 5).

A total of 64 females and 63 males were spawned (Appendix B). Because of a relatively small spawning population, a 3 x 3 spawning matrix was utilized whenever possible and all crosses were either hatchery x wild **or** wild x wild. No hatchery x hatchery crosses were made. Of the 63 males spawned, 47 were spawned live. These were held through the end of the spawn season and four were used a second time. Had these fish been sacrificed for spawning as in previous years, the number of male mortalities would have been lower. A total of 410,356 eggs were taken with a mean fecundity of 6,412.

Fifty excess marked broodstock were sacrificed prior to the end of the spawn season for coded-wire tag recovery. After the egg goal was met, 30 wild and three hatchery (Adipose fin-clipped only) fish were released back into the Umatilla River.

Unmarked broodstock were selected throughout the entire run to provide a representative cross-section of the population (Figure 2). Marked brood were collected from November 2 to March 20 only, when it appeared that the broodstock goal would be met. Of the females collected during the period November and December, 73.0% were spawned (Table 5). Of the females collected during the periods January through February and March through April, 65.0 and 53.0%, respectively, were spawned.

### **Collection and Spawning of Fall Chinook Salmon Broodstock**

A total of 347 fall chinook salmon were captured at Threemile Dam between October 24 and November 22, 1991 and transported to **Minthorn** (Table 6). This included 176 females and 171 males.

Eight fish died prior to being spawned and mortality was higher in males (4.1%) than it was in females (0.6%) (Table 6).

A total of 159 females and 159 males were spawned (Appendix C). The mean fecundity was 3,783 and a total of 601,548 green eggs were taken.

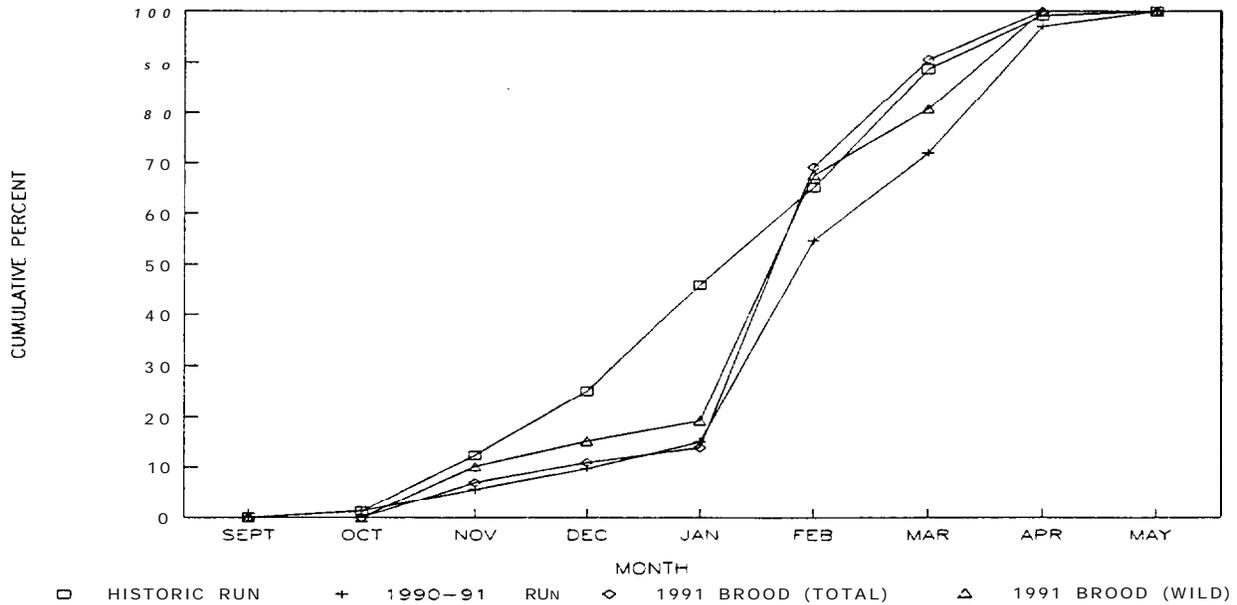


Figure 2. Historical and 1990-91 runs of summer steelhead in the Umatilla River versus 1990-91 broodstock collection.

Table 6. Fall chinook salmon broodstock collection, spawning, and mortality in 1991.

No. Collected /1			No. Spawned				Mortality							
Males	females	Total	Males	%	Females	%	Total	%	Hales	%	Females	%	Total	%
/2	/2		/3		/3									
171	176	347	150	87.7	165	93.8	315	90.8	7	4.1	1	0.6	8	2.3

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/1 Broodstock were collected from October 24 to November 22, 1991.

/2 After spawning was terminated on November 26, four male and four female marked fish were sacrificed for coded-wire tag recovery and 10 unmarked males and six unmarked females were returned to the Umatilla River.

/3 Because of a shortage of males, several were live spawned and used a second time. Six females were either green or discarded because of bloody eggs.

Spawning was terminated on November 26 because only 10 females remained and they appeared to be weeks away from maturity. At this time, eight marked broodstock were sacrificed for coded-wire tag recovery and 16 unmarked fish were released back into the Umatilla River.

### **Disease Sampling of Summer Steelhead Broodstock**

Tests for IHNV, IPNV and EIBS on spawned steelhead were negative (Table 7). Results for BKD on spawned fish and prespawn mortalities are pending. Eighteen out of 19 prespawn mortalities tested positive for aeromonad/pseudomonad bacteria and spores of C. shasta were found at low to moderate levels in six of the same 19 fish.

### **Disease Sampling of Fall Chinook Salmon Broodstock**

Tests for IHNV, IPNV and EIBS on spawned fish were negative (Table 7). An unknown replicating agent was detected from one tissue sample pool from two females however. The affected family group was isolated as much as practical at Umatilla Hatchery to lessen the risk of contamination to other groups. ODFW pathologists recommended that the fry be sampled for several weeks after buttoning up to further characterize and identify the agent. All fish in this family group would then be destroyed. Further results are pending.

One mortality was sampled. Results for BKD are pending and tests for C. shasta were negative. Aeromonad/pseudomonad bacteria were found at low levels.

### **Adult Returns to Minthorn**

An estimated 387 adult hatchery steelhead returned to the Umatilla River in 1990-1991 (based on Threemile Dam trap counts and estimated harvest below Threemile Dam) and 234 were released upriver. Of these, at least three returned to Minthorn. Two other steelhead were observed in the ladder but it is unknown whether they were hatchery fish. Two redds were also observed in Minthorn Springs Creek just below the facility.

### **Adult Returns to Bonifer**

In 1991, 1,330 spring chinook returned to the Umatilla River (based on Threemile Dam trap counts; none were harvested below Threemile Dam) and 1,096 were released upstream. One fish was captured at Bonifer and a second fish was observed in Boston Canyon Creek at the mouth of the ladder.

### **Acclimation and Release of Juvenile Salmonids**

Six groups of acclimated juvenile salmonids (456,905 fish) were among the \$043,095 salmon and steelhead released into the Umatilla River in 1991 (Table 8). Included in these were one coho group and one group of non-tagged summer steelhead. The other four groups were tagged with funding from BPA and are part of the formal facility evaluations.

Fall chinook salmon have been released in the Umatilla River every year since 1982 and from acclimation facilities since 1983 (Table 9). In 1982, this release was of tule stock. Since then, all releases have been of upriver bright stock (Table 2). This is the sixth year

Table 7. Results of disease sampling of Umatilla River summer steelhead and fall chinook salmon broodstock in 1991. /1

Species	Test	Incidence	Comments
<u>Summer Steelhead</u>			
Spawned	IHNV	0/127	
	IPNV	0/127	
	EIBS	0/60	
Mortality	BKD	unknown/60	Results pending
	BKD	unknown/19	Results pending
	Aeromonus/ Pseudomonas	18/19	
	Ceratomyxa shasta	6/19	Low to moderate levels
<u>Fall Chinook /2</u>			
Spawned	IHNV	0/318	
	IPNV	0/61	
	EIBS	0/86	
	BKD	unknown/303	Results pending
Mortality	BKD	unknown/1	Results pending
	Aeromonus/ Pseudomonas	1/1	
	Ceratomyxa shasta	0/1	

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/1 Data provided by ODFW Eastern Oregon Fish Pathology Laboratory.

All broodstock were held and spawned at Minthorn Acclimation Facility.

/2 An unknown replicating agent was detected in one tissue sample from two females (n = 61).

**Table 8. Juvenile salmon and steelhead releases in the Umatilla River Basin in 1991.**

Species	Brood	Stock	Hatchery	Number	#/lb.	Location	In Facility	In River	Fish Mark /1	# Marked
Fall. Chin.	89	Columbia R /2	Bonneville	<b>194847</b>	7.8	Uma. RM 56-79	-----	March 16-20	RV only	194847
Fall. Chin.	S O	Columbia R /2	Irrigon	105032	82.0	Uma. RM 70	-----	May 8	CWT	104258
Fall. Chin.	S O	Columbia R /2	Irrigon	107455	82.0	Uma. RM 70	-----	May 8	CWT + RV	103980
Fall. Chin.	S O	Columbia R /2	Irrigon	150275	73.0	Uma. RM 70	-----	May 10	CWT + BT	145048
Fall. Chin.	S O	Columbia R /2	Irrigon	2888353	83.0	Uma. RM 70-79	-----	May 6-10	RV only	2525922
Fall. Chin.	S O	Columbia R /2	Irrigon	149554	73.0	Uma. RM 70	-----	May 10	BT only	147588
Fall. Chin. /3	S O	Columbia R /2	Irrigon	2774	<b>194.0</b>	Uma. RM 3	April 1	Apr 5-May 2	RV only	2774
Fall. Chin. /4	S O	Columbia R /2	Irrigon	7888	80.0	Uma. RM 3	May 2	May 6-31	RV + CB	7888
Fall. Chin. /5	SO	Columbia R /2	Irrigon	79872	80.5	Minthorn(RM 83)	April 29	May 13	CWT	78411
Fall chin. /5	SO	Columbia R /2	Irrigon	74885	88.0	Nr Min.(RM 83)	-----	May 13	CWT	73454
<b>Subtotal</b>				<b>3558519</b>						
Spring Chin.	89	Carson	Carson	<b>90796</b>	20.8	Uma. RM 89	-----	April 9	CWT	22338
Spring Chin. /6	8 9	Carson	Carson	5937	18.9	Urns. RM 3	April 9	Apr 28-May 15	CWT + CB	<b>1461</b>
Spring Chin. /5	8 9	Lookingglass	Bonneville	100505	10.1	Bonifer(RM 2)/7	March 5-8	March 28	CWT	<b>77907</b>
Spring Chin /5	89	Lookingglass	Bonneville	<b>86152</b>	<b>11.6</b>	Nr Bon (RM 2)/7	-----	March 27-28	CWT	73388
Spring Chin. /8	so	Carson /9	Bonneville	81144	18.5	Bonifer(RM 2)/7	November 5	November 8	CWT	80333
Spring Chin. /8	s o	Carson /9	Bonneville	78480	18.8	Nr.Bon.(RM 2)/7	-----	November 8	CWT	78010
<b>Subtotal</b>				<b>453014</b>						
Coho	89	Tanner Creek	Cascade	152874	15.4	Minthorn(RM 83)	March 5-8	March 25	CWT	24584
Coho	89	Tanner Creek	Cascade	228203	18.5	Uma. RM 58	-----	March 21-28	CWT	25905
Coho	89	Tanner Creek	Cascade	221385	18.8	Uma. RM 80	-----	March 22	None	0
Coho	89	Tanner Creek	Cascade	143054	18.4	Uma. RM 83	-----	March 25-26	None	0
Coho	<b>89</b>	Tanner Creek	Cascade	209923	17.1	Uma RM 70	-----	March 21-23	CWT	24851
<b>Subtotal</b>				<b>955829</b>						
Sum. Sthd. /5	SO	Umatilla R.	Oak Springs	30221	8.2	Bonifer(RM 2)/7	April 2-3	May 2	CWT + LV	<b>29467</b>
Sum. Sthd.15	SO	Umatilla R.	Oak Springs	29325	8.7	Nr.Bon.(RM 2)/7	-----	May 2-3	CWT + LV	28357
Sum. Sthd.	SO	Umatilla R.	Oak Springs	12380	7.5	Bonifer(RM 2)/7	April 3	May 2	Ad only	12380
Sum. Sthd. /10	SO	Umatilla R.	Oak Springs	3998	12.5	Uma. RM 3	April 2	April 16-30	Ad only+CB	<b>3998</b>
<b>Subtotal</b>				<b>75933</b>						
<b>TOTAL</b>				<b>5043095</b>						

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- /1 Coded-wire tagged fish are given an adipose fin clip unless additional clips are indicated (BT = Body Tag. CB = Cold Branded)
- /2 Upriver stocks.
- /3 These fish were transferred from Irrigon Hatchery to Threemik Dam on April 1 They were held from 4 to 31 days and released as part of an ODFW passage evaluation study.
- /4 These fish were transferred from Irrigon Hatchery to Threemik Dam on May 2. They were held from 4 to 29 days and released as part of an ODFW passage evaluation study. All 7,888 released were RV clipped, but only 7,158 were cold-branded.
- 15 Acclimation evaluation (an unacclimated conbol release occurred instream near facilities at time of acclimated release).
- /6 These fish were held at Minthorn Acclimation Facility from April 9 to May 9 Some were transferred to Threemile Dam on April 25while the remainder were transferred on May 9. They were held from 4 to 15 days and released as part of an ODFW evaluation study. Of the 5,937 released, 5,880 were cold branded and 1,461 were coded-wire tagged.
- /7 RM 2 of Meacham Creek or 81 rivermiles from the mouthofthe Umatilla River.
- /8 One group of fish was held at Bonifer for a 3-day post-transport recovery period, then was released at the same time as the control group.
- /9 Carson stock via Umatilla R., Lookingglass Hatchery, and Big Canyon Facility.
- /10 These fish were held at Minthorn Acclimation Facility from April 2 to April 11 when they were transferred to Threemile Dam They were held from 5 to 19 days and released as part of an ODFW passage evaluation study. All fish released were Ad clipped, but only 3,958 were cold bran&d.

Table 9. Juvenile fall and spring chinook salmon releases in the Umatilla River Basin (1982-1991). [1]

Species	Fall Chinook				Spring Chinook		
	Lower Umatilla	Upper Umatilla	Bonifer	Minthorn	Lower Umatilla	Upper Umatilla	Bonifer
Year							
1982	3,807,171 (sy) [2]	0	0	0	0	0	0
1983	0	80,564 (y)	20,000 (y)	0	0	0	0
1984	667,190 (sy) [3]	175,104 (y)	53,308 (y)	0	0	0	0
1985	3,223,172 I (sy) [3]	60,507 (y)	137,655 (y)	0	0	0	0
			51,000 (sy) [4]				
1986	2,029,602 I (sy) [3]	0	115,779 (y)	91,036 (y)	0	300,438 (sy)	99,970 (y)
			35,574 (sy) [4]				75,000 (sy) [4]
1987	1,476,830 (sy) [5]	0	102,363 (y)	111,143 161	0	169,100 (sy)	99, a97 (y)
1988	3,316,007 (sy) [5&7]	79,681 (sy) [8]	99,550 (y)	115,199 [9]	156,312 (y) [7]	210,496 [9]	107,427 [9]
1989	3,052,015 (sy)	295,575 [9]	0	78,825 (sy) [8]	0	164,786 [9]	160,734 [9]
1990	0	255,614 (y)	0	71,864 (sy) [a]	99,775 (y)	195,425 [9]	194,783 [9]
		3,132,127 (sy) [10]					
1991	10,462 (sy)	194,847 (y)	0	79,672 (sy)	5,937 (y)	265,428 [9]	181,649 191
		3,273,538 (sy)					

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- [1] y = yearling releases; sy = subyearling releases
- [2] Releases in 1982 were Tule stock; all others have been upriver brights.
- [3] Subyearlings released below Threemile Dam to avoid loss in irrigation diversions.
- [4] Subyearlings acclimated in summer and released as yearlings in fall.
- [5] Released at Steelhead Park near Hermiston.
- [6] Includes yearling spring and approximately 2,000 subyearling summer releases.
- [7] Released below Westland Dam.
- [8] Released in the fall.
- [9] Includes yearling spring and subyearling fall releases.
- [10] 76,646 were released in the fall.

that spring chinook salmon of Carson-via-Lookingglass stock have been acclimated and released (Tables 3 and 9). Summer steelhead of Skamania and Oxbow stocks were released from 1967 through 1970. In 1975, one release of Umatilla stock steelhead occurred and fish releases every year since 1981 have been from this stock (Table 1). Summer steelhead have been released from acclimation facilities since 1984 (Table 10). Coho salmon have been released since 1987, and a portion have been acclimated when the facilities and the fish were available (Tables 4 and 10).

### **Acclimation at Minthorn**

#### Coho salmon - 3/5 to 3/25

A group of 152,974 coho salmon was acclimated at Minthorn for 20 days and released on March 25 at 15.4/lb. (Table 8). Included were 24,584 coded-wire tagged fish (Table 11). The fish were fed 1.02% body weight per day (BWD) during acclimation and total mortality was 0.86% (Table 12). Most of this mortality (1,298) was a result of problems with the transport truck and the fish were either dead on the truck or died within minutes after unloading. The mean temperature and D.O. during acclimation was 8.1 degrees C and 7.7 mg/l, respectively (Table 12).

The length frequency distributions for both coded-wire tagged and non-tagged fish were similar (Figure 3). None of the fish sampled at release were totally descaled and only 4.8% were partially descaled (Table 13).

#### Fall chinook salmon - 4/29 to 5/13

On May 13, a group of 79,672 fall chinook salmon at 80.5/lb. was released from Minthorn after being acclimated for 14 days (Table 8). Included were 76,411 coded-wire tagged fish (Table 14). The fish were fed 2.94% BWD and total mortality was 0.23% (Table 12). The mean temperature and D.O. during acclimation was 10.7 degrees C and 9.2 mg/l, respectively (Table 12).

A control group of 74,865 fish at 86.0/lb. was also released on May 13 (Table 8). They were unloaded into the lower Minthorn pond with the acclimated fish and crowded out immediately. Included were 73,454 coded-wire tagged fish (Table 14).

The length frequency distributions of both groups (all fish) were similar (Figure 4). Descaling indices for both groups were also similar with very little scale loss (Table 13). Only 0.8 and 1.2% of the acclimated and control groups, respectively, were partially descaled. No totally descaled fish were observed in either group.

Table 10. Juvenile steelhead and coho salmon releases in the Umatilla River Basin (1981-1991) [1].

Species	Summer Steelhead				Coho		
	Lower Umatilla	Upper Umatilla	Minthorn	Bonifer	Lower Umatilla	Upper Umatilla	Minthorn
Year							
1981	0	17,558 (y) 9,400 (sy)	0	0	0	0	0
1982	0	59,494 (y) 67,940 (sy)	0	0	0	0	0
1983	0	60,500 (y) 52,700 (sy)	0	0	0	0	0
1984	0	0	0	57,939 (y) 22,000 (sy)	0	0	0
1985	0	0	0	53,850 (y) 39,134 (sy)	0	0	0
1986	0	0	0	54,137 (y)	0	0	0
1987	0	1,485 (y) [2]	0	0	786,660 (y) [3]	0	161,889 (y)
1988	33,984 (y) [3]	40,790 [4&5]	30,549 (y)	0	996,433 (y) [3]	0	0
1989	0	29,586 (y)	29,852 (y)	22,274 (y)	0	829,607 (y)	157,299 (y)
1990	0	29,446 (y)	0	59,747 (y)	202,315 (y)	654,209 (y)	132,404 (y)
1991	3,998 (y)	29,325 (y)	0	42,610 (y)	0	802,655 (y)	152,974 (y)

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[1] y = yearling releases; sy = subyearling releases

[2] Small release due to IHN & IPN problems in eggs.

[3] Fish released below Westland Dam.

[4] Includes both experimental control group and gradeouts from 88 brood year.

[5] Does not include any unfed fry that were released.

Table 11. Liberation information for **coho** salmon coded-wire tagged and released in the Umatilla River Basin.

Brood	Total number	Release time	Size #/lb.)	Number tagged	CWT code	Release location
85	37,245	April 87	13.5	13,440	073617	Minthorn
85	53,754	April 87	13.5	19,879	073624	Minthorn
85	70,890	April 87	13.5	26,740	073625	Minthorn
	=====			=====		
	161,889			60,059		
86	68,208	March 88	16.8	20,592	074356	L Uma R
86	73,650	March 88	17.3	18,963	074357	L Uma R
86	61,606	March 88	15.7	18,513	074358	L Uma R
	=====			=====		
	203,464			58,068		
87	75,970	March 89	17.2	27,062	074609	Nr Minthorn
87	72,627	March 89	17.3	26,416	074610	Minthorn
87	84,672	March 89	19.1	26,739	074611	Minthorn
	=====			=====		
	233,269			80,217		
88	67,309	March 90	13.5	28,033	074814	Minthorn
88	59,682	March 90	13.3	26,881	074813	Nr Minthorn
88	65,095	April 90	11.2	27,226	074815	Minthorn
	=====			=====		
	192,086			82,140		
89	152,974	March 91	15.4	24,584	075535	Minthorn
89	449,678	March 91	16.5	25,905	075534	Uma RM 56-60
89	352,977	March 91	16.8	24,851	075533	Uma RM 63-70
	=====			=====		
	955,629			75,340		

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Table 12. Food rations, mortalities, temperatures, and D.O. concentrations during acclimation of juvenile salmonids in 1991.

Species	Test	Release Location	Release Date	Food Fed (%/day)	Mortality		Temperature (C)			D.O. (mg/l)		
					5 Day	Total	Min.	Max.	Ave.	Min.	Max.	Ave.
Fall Chinook	Accl.	Minthorn	May 13	2.94	166	184	8.0	14.5	10.7	7.7	10.4	9.2
Spring Chinook	Accl.	Bonifer	Mar 26	0.97	15	115	5.0	10.1	7.3	7.2	10.5	8.7
Spring Chinook	Accl.	Bonifer	Nov 8	0.00	24	24	7.5	10.8	9.4	5.8	6.0	5.9
Coho	Accl.	Minthorn	Mar 25	1.02	1298	1320	6.0	11.1	8.1	6.4	9.5	7.7
Summer Steelhead	Accl.	Bonifer	May 2	0.98	4	271	6.2	14.7	9.2	7.3	11.2	9.7
Summer Steelhead	Ad Only	Bonifer	May 2	1.29	1	111	6.2	14.7	9.2	7.3	11.2	9.7

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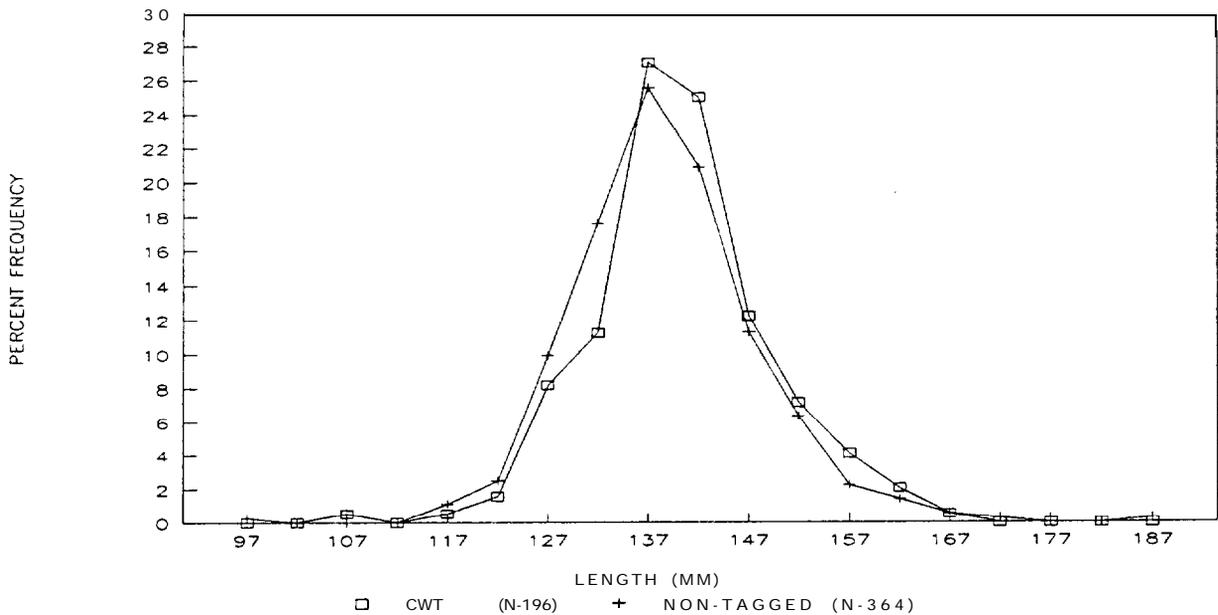


Figure 3. Length frequencies of experimental group of coho salmon released at Minthorn Acclimation Facility on 3-25-91 (coded-wire tagged and non-tagged fish).

Table 13. Size and descaling data for juvenile salmonids released in the Umatilla River Basin in 1991.

Species	Group	Release Location	Release Date	No./lb.			Fork Ln. (mm)			Descaling (%)			N
				Min.	Max.	Ave.	Min.	Max.	Ave.	Total	Partial	None	
Fall Chinook	Test	Minthorn	May 13	216.2	52.8	80.5	57	91	80	0	0.8	99.2	260
	Control	Nr. Minthorn	May 13	252.2	57.5	86	58	92	81	0	1.2	98.8	260
Spring Chinook	Test	Bonifer	Mar 26	26.4	3.0	10.1	115	229	154	4.8	24.5	70.7	400
	Control	Nr. Bonifer	Mar 27-28	24.3	3.5	11.8	118	222	148	0	1.3	98.7	400
Spring Chinook	Test	Bonifer	Nov 8	105.6	4.7	16.5	76	204	130	0	3.0	97.0	300
	Control	Nr. Bonifer	Nov 8	57.7	4.8	16.8	87	195	128	0	7.7	92.3	300
Coho	Acct.	Minthorn	Mar 25	49.3	7.3	15.4	96	185	139	0	4.8	95.2	560
Summer Steelhead	Test	Bonifer	May 2	26.5	3.2	6.2	122	238	194	2	20.9	77.1	201
	Control	Nr. Bonifer	May 2-3	35.7	2.9	8.7	108	244	166	0	42.6	57.4	303
Summer Steelhead	Ad Only	Bonifer	May 2	31.5	4.4	7.5	108	214	183	1.7	28.8	69.5	59

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### Acclimation at Bonifer

#### Spring chinook salmon - 3/5 to 3/26

On March 26, a group of 100,505 spring chinook salmon at 10.1/lb. was released from Bonifer after a 21-day acclimation period (Table 8). Of these, 77,907 were coded-wire tagged (Table 15). The fish were fed 0.97% BWD and total mortality was 0.11% (Table 12). The mean temperature and D.O. during acclimation was 7.3 degrees C and 8.7 mg/l, respectively (Table 12).

A control group of 96,152 fish at 11.8/lb. was released into Meacham Creek on March 27 and 28 (Table 8). Included were 73,366 coded-wire tagged fish (Table 15).

The length frequency distributions of both groups (all fish and coded-wire tagged fish only) were similar (Figures 5 and 6). Descaling was more severe in the acclimated group than in the control group (Table 13). The percentage of acclimated fish with partial descaling was 24.5%, while that of the control fish was only 1.3%. The percentage of the

Table 14. Liberation information for fall chinook salmon coded-wire tagged and released in the Umatilla River Basin.

Brood	Total number	Release time	Size (#/lb.)	Number tagged	CWT code	Release location
86	52,317	Mar 88	8.8	42,068	074038	Minthorn
86	48,474	Mar 88	8.8	38,978	074039	Minthorn
	=====			=====		
	100,791			81,046		
86	50,480	Mar 88	10.2	39,509	074036	Bonifer
86	49,070	Mar 88	10.2	38,405	074037	Bonifer
	=====			=====		
	99,550			77,914		
87	1,886,757	May 88	68.3	198,285	075007	Uma RM 23
87	4,823	Nov 88	9.8	4,438	074539	Minthorn
87	4,660	Nov 88	9.8	4,289	074540	Minthorn
87	4,925	Nov 88	9.8	4,533	074541	Minthorn
	=====			=====		
	14,408			13,260		
87	26,858	Nov 88	8.6	24,656	074536	Nr Minthorn
87	25,493	Nov 88	8.6	23,403	074537	Nr Minthorn
87	27,330	Nov 88	8.6	25,089	074538	Nr Minthorn
	=====			=====		
	79,681			73,148		
88	797,904	May 89	66.6	52,228	074646	Uma RM 23
88	797,903	May 89	66.6	49,771	074647	Uma RM 23
88	797,903	May 89	66.6	52,244	074648	Uma RM 23
	=====			=====		
	2,393,710			154,243		
88	26,770	Oct 89	10.9	26,358	074753	Minthorn
88	26,617	Oct 89	10.9	25,028	074754	Minthorn
88	25,438	Oct 89	10.9	25,438	074757	Minthorn
	=====			=====		
	78,825			76,824		
88	27,071	Oct 89	11.1	26,790	074758	Nr Minthorn
88	25,428	Oct 89	11.1	24,285	074760	Nr Minthorn
88	25,633	Oct 89	11.1	25,350	074763	Nr Minthorn
	=====			=====		
	78,132			76,425		

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Table 14. (cont.)

Brood	Total number	Release time	Size (#/lb.)	Number tagged	CWT code	Release location
89	808,560	May-Jun 90	87.5	52,965	075403	Uma RM 70-79
89	808,560	May-Jun 90	87.5	52,965	075404	Uma RM 70-79
89	808,561	May-Jun 90	87.5	52,965	075405	Uma RM 70-79
	=====			=====		
	2,425,681			158,895		
89	25,311	Oct 90	9.2	23,396	075325	Minthorn
89	23,724	Oct 90	9.2	21,929	075326	Minthorn
89	22,828	Oct 90	9.2	21,101	075327	Minthorn
	=====			=====		
	71,863			66,426		
89	25,472	Oct 90	8.8	23,413	075322	Nr Minthorn
89	25,694	Oct 90	8.8	23,617	075323	Nr Minthorn
89	25,480	Oct 90	8.8	23,420	075324	Nr Minthorn
	-----			-----		
	76,646			70,450		
90	53,864	May 91	82.0	52,252	075225	Uma RM 70
90	53,595	May 91	82.0	51,728	075226	Uma RM 70
90	50,442	May 91	73.0	48,266	075328	Uma RM 70
90	50,101	May 91	73.0	48,481	075449	Uma RM 70
90	49,732	May 91	73.0	48,301	070016	Uma RM 70
90	52,326	May 91	82.0	51,814	075450	Uma RM 70
90	52,706	May 91	82.0	52,444	075451	Uma RM 70
	-----			-----		
	362,766			353,286		
90	26,481	May 91	80.5	26,173	075563	Minthorn
90	26,585	May 91	80.5	24,762	075601	Minthorn
90	26,606	May 91	80.5	25,476	075602	Minthorn
	=====			=====		
	79,672			76,411		
90	25,862	May 91	86.0	25,720	075560	Nr Minthorn
90	25,708	May 91	86.0	25,425	075561	Nr Minthorn
90	23,295	May 91	86.0	22,309	075562	Nr Minthorn
	=====			=====		
	74,865			73,454		

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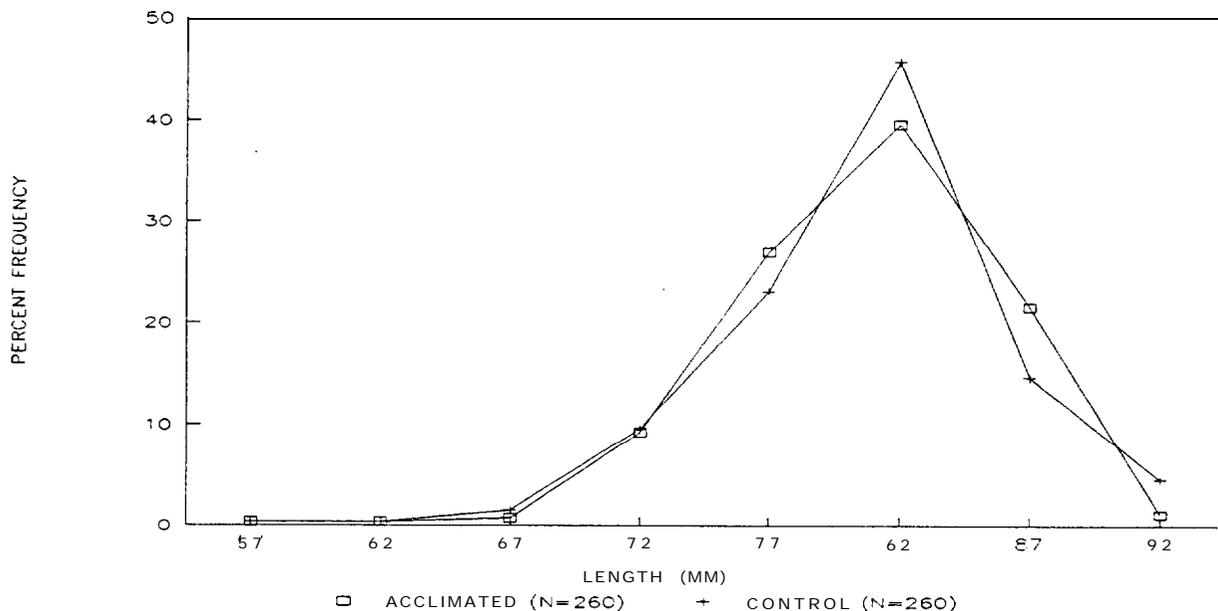


Figure 4. Length frequencies of experimental groups of fall chinook salmon released at Minthorn Acclimation Facility on 5-13-91 (acclimated versus control group - all fish).

Table 15. Liberation information for spring chinook salmon coded-wire tagged and released in the Umatilla River Basin.

Brood	Total number	Release time	Size (#/lb.)	Number tagged	CWT code	Release location
86	35,946	Mar-Apr 88	10.1	26,640	074325	Bonifer
86	35,148	Mar-Apr 88	10.1	25,863	074326	Bonifer
86	35,137	Mar-Apr 88	10.1	25,853	074327	Bonifer
	=====			=====		
	106,231			78,356		
86	34,187	Apr 88	8.6	26,319	074328	Uma RM 23-81
86	33,573	Apr 88	8.6	25,722	074329	Uma RM 23-81
86	34,118	Apr 88	8.6	26,252	074330	Uma RM 23-81
	=====			=====		
	101,878			78,293		
87	416	Nov 88	21.4	410	074420	Bonifer
87	399	Nov 88	21.4	393	074423	Bonifer
87	381	Nov 88	21.4	376	074424	Bonifer
	=====			=====		
	1,196			1,179		

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Table 15. (cont.).

Brood	Total number	Release time	Size (#/lb.)	Number tagged	CWT code	Release location
87	26,109	Nov 88	11.1	25,987	074427	Uma RM 89
87	24,183	Nov 88	11.1	24,070	074429	Uma RM 89
87	25,475	Nov 88	11.1	25,356	074430	Uma RM 89
	<u>75,767</u>			<u>75,413</u>		
87	26,135	Mar-May 89	10.6	25,427	074433	Bonifer
87	27,756	Mar-May 89	10.6	27,004	074434	Bonifer
87	26,093	Mar-May 89	10.6	25,386	074436	Bonifer
	<u>79,984</u>			<u>77,817</u>		
87	28,153	Mar 89	10.6	27,585	074439	Nr. Bonifer
87	28,116	Mar 89	10.6	27,550	074440	Nr. Bonifer
87	24,663	Mar 89	10.6	24,165	074443	Nr. Bonifer
	<u>80,932</u>			<u>79,300</u>		
88	24,968	Oct 89	12.0	24,801	075063	Bonifer
88	28,299	Oct 89	12.0	28,109	075101	Bonifer
88	27,483	Oct 89	12.0	27,299	075102	Bonifer
	<u>80,750</u>			<u>80,209</u>		
88	27,287	Oct 89	12.0	27,137	075103	Nr. Bonifer
88	28,718	Oct 89	12.0	28,560	075104	Nr. Bonifer
88	27,848	Oct 89	12.0	27,695	075105	Nr. Bonifer
	<u>83,853</u>			<u>83,392</u>		
88	38,224	March 90	9.0	26,638	075106	Bonifer
88	37,538	March 90	9.0	26,160	075107	Bonifer
88	38,583	March 90	9.0	26,888	075108	Bonifer
	<u>114,345</u>			<u>79,686</u>		
88	39,012	March 90	9.6	25,611	075109	Nr. Bonifer
88	40,072	March 90	9.6	26,307	075110	Nr. Bonifer
88	38,343	March 90	9.6	25,172	075111	Nr. Bonifer
	<u>117,427</u>			<u>77,090</u>		

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acclimated fish that were totally descaled was 4.8%, while none of the control fish were totally descaled.

#### Summer steelhead - 4/2 to 5/2

A group of 30,221 summer steelhead was acclimated at Bonifer for 30 days and released on May 2 at 6.2/lb. (Table 8). Included were 29,467 coded-wire tagged fish (Table 16). They were fed 0.89% BWD and total mortality was 271 or 0.89% (Table 12). An estimated 213 of these were trapped in the pond after release. The mean temperature and D.O. was 9.2 degrees C and 9.7 mg/l, respectively (Table 12).

On May 2, a control group of 29,325 fish at 8.7/lb. was released into Meacham Creek (Table 8). Of these, 28,357 were coded-wire tagged (Table 16).

The length frequency distribution of the control group, when compared to the acclimated group, is shifted to the left as would be expected due to their smaller size at release (Figure 7). The severity of descaling was higher in the control group than in the acclimated group (Table 13). The percentage of the control fish with partial descaling was twice that of the acclimated fish (42.6 versus 20.9%, respectively).

#### Summer steelhead - 4/3 to 5/2

Acclimated with the coded-wire tagged summer steelhead was a group of summer steelhead with adipose fin clips only. They were also released on May 2 but at 7.5/lb. (Table 8). These fish were gradeouts from the yearling fish used in the acclimation evaluation experiment. They were fed 1.29% BWD (Table 12). Total mortality was 111 or 0.89% (Table 12) and an estimated 87 of these were trapped in the pond after release.

The length frequency distribution of this group, when compared to the coded-wire tagged group, was shifted slightly to the left as would be expected due to their smaller size at release (Figure 8). The amount of descaling in the adipose only group was a little higher than in the coded-wire tagged group (Table 13). The percentage of coded-wire tagged fish with partial descaling was 20.9%, while that of the control fish was 28.8%. The percentage of the fish that were totally descaled was similar for both groups (Table 13).

#### Spring chinook salmon - 11/5 to 11/8

On November 8, 81,144 spring chinook salmon at 16.5/lb. were released from Bonifer after a three-day post-transport recovery period (Table 8). Included were 80,333 coded-wire tagged fish (Table 15). The fish were not fed and the mortality was 0.03% (Table 12). The mean temperature and D.O. during acclimation was 9.4 degrees C and 5.9 mg/l, respectively (Table 12).

Table 16. Liberation information for summer steelhead coded-wire tagged and released in the Umatilla River Basin.

Brood	Total number	Release time	Size (#/lb.)	Number tagged	CWT code	Release location
87	10,187	Apr 88	7.4	9,829	073859	Minthorn
87	10,075	Apr 88	7.4	9,721	073860	Minthorn
a7	10,287	Apr 88	7.4	9,925	073861	Minthorn
	=====			=====		
	30,549			29,475		
87	10,423	Apr 88	6.5	9,689	073856	Nr. Minthorn
a7	10,171	Apr 88	6.5	9,455	073857	Nr. Minthorn
a7	10,163	Apr 88	6.5	9,448	073858	Nr. Minthorn
	=====			=====		
	30,757			28,592		
88	9,949	May a9	6.6	8,784	074720	Minthorn
88	9,954	May 89	6.6	8,789	074723	Minthorn
88	9,949	May 89	6.6	8,784	074724	Minthorn
	=====			=====		
	29,852			26,357		
88	9,873	May 89	5.6	8,800	074715	Nr. Minthorn
88	9,864	May 89	5.6	8,791	074717	Nr. Minthorn
88	9,849	May 89	5.6	8,778	074718	Nr. Minthorn
	=====			=====		
	29,586			26,369		
a9	10,239	May 90	5.9	9,331	075212	Bonifer
a9	10,022	May 90	5.9	9,133	075213	Bonifer
89	9,964	May 90	5.9	9,080	075214	Bonifer
	=====			=====		
	30,225			27,544		
89	9,830	May 90	5.5	9,511	075215	Nr. Bonifer
89	9,845	May 90	5.5	9,525	075216	Nr. Bonifer
a9	9,771	May 90	5.5	9,454	075217	Nr. Bonifer
	=====			=====		
	29,446			28,490		
90	10,086	May 91	6.2	9,835	075340	Bonifer
90	10,070	May 91	6.2	9,819	075341	Bonifer
90	10,065	May 91	6.2	9,814	075342	Bonifer
	=====			=====		
	30,221			29,468		

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Table 16 (cont.)

Brood	Total number	Release time	Size (#/lb.)	Number tagged	CWT code	Release location
90	9,754	May 91	8.7	9,432	075343	Nr. Bonifer
90	9,790	May 91	8.7	9,467	075344	Nr. Bonifer
90	9,781	May 91	8.7	9,458	075345	Nr. Bonifer
	=====			-----		
	29,325			28,357		

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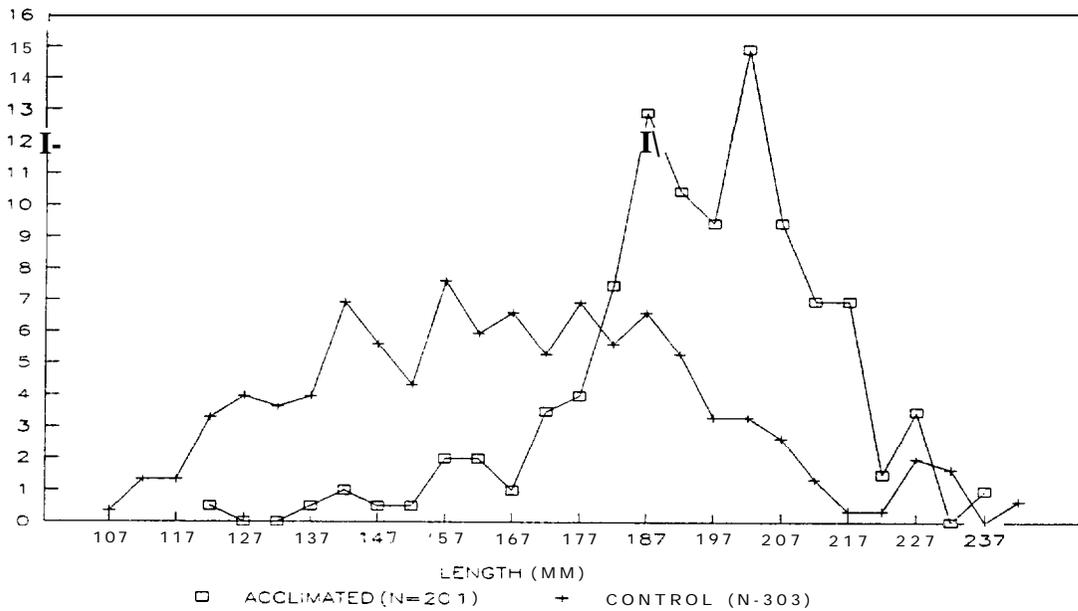


Figure 7. Length frequencies of experimental groups of summer steelhead released at Bonifer Acclimation Facility on 5-2-91 (acclimated versus control group - all fish).

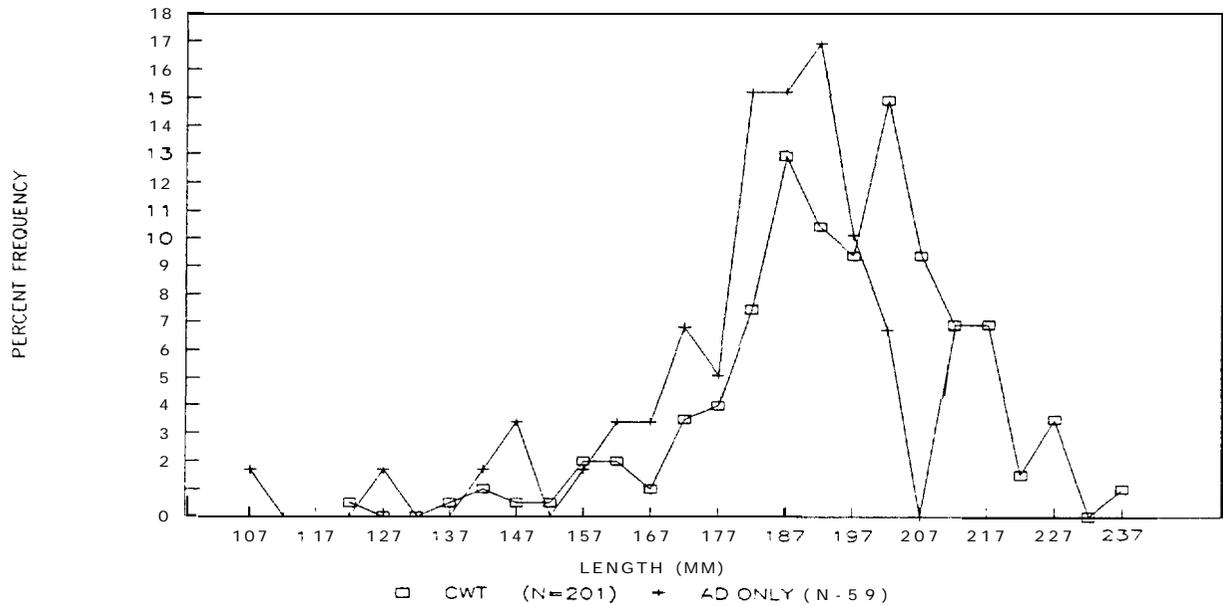


Figure 8. Length frequencies of experimental groups of summer steelhead released at Bonifer Acclimation Facility on 5-2-91 (coded-wire tagged versus Ad only fish).

The fish were held for three days only because of low water flows and oxygen levels in the Bonifer pond during the fall months. Extended holding would stress the fish unnecessarily.

A control group of 78,480 fish at 16.8/lb. was also released on November 8 (Table 8). They were unloaded into Bonifer pond because of low water flows in Meacham Creek and then were crowded out immediately along with the acclimated group. Included were 76,910 coded-wire tagged fish (Table 15).

The length frequency distributions of both groups (all fish) were similar (Figure 9). Descaling indices for both groups were also similar with minimal scale loss (Table 13). Approximately 3.0 and 7.7% of the acclimated and control groups, respectively, were partially descaled. None of the fish in either group were totally descaled.

**Outmigration Monitoring**

Juvenile salmonids were sampled at the Westland Canal fish trapping facility from June 14 to August 14. Until then, the fish were allowed to voluntarily migrate downstream because of high spring flows in the Umatilla River. Data were recorded for comparison with release data to give an indication of outmigration timing and size.

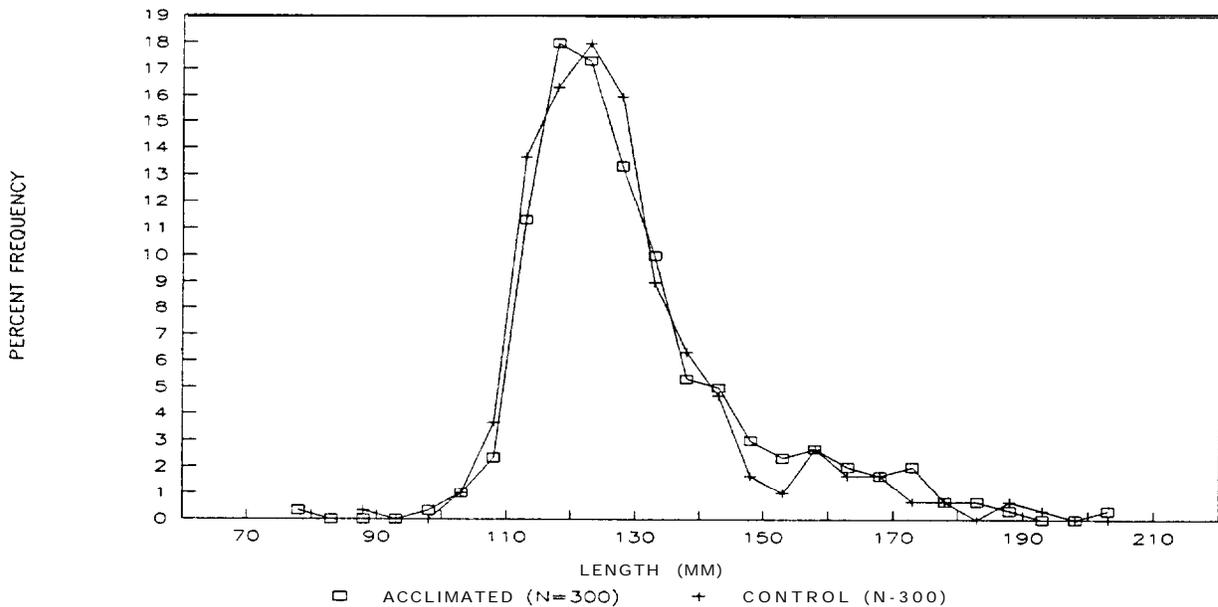


Figure 9. Length frequencies of experimental groups of spring chinook salmon released at Bonifer Acclimation Facility on 11-8-91 (acclimated versus control group - all fish).

Few fish were trapped, suggesting most had already migrated past the facility. Yearling chinook were released into the upper Umatilla River from March 18 to April 9, but none were observed at Westland (Table 17). Coho yearlings were released from March 21 to 26, but only four fish were sampled (Appendix D). Summer steelhead were released on May 2 and 3 but only 20 were sampled (Appendix D). The last observed marked summer steelhead was on June 26, while the last unmarked summer steelhead was observed on July 1 (Table 17). Fall chinook subyearlings were released from May 8 to May 13 and a relatively small number were trapped at Westland. The numbers fell off considerably in early July but some were still being observed when the last fish were sampled on August 14 (Table 17).

Yearling chinook smolts were first observed at Threemile Dam on March 27 and large numbers of chinook as well as coho yearling smolts were seen by the first week in April.

Naturally produced chinook and coho subyearlings were also observed at Westland (Table 17). Fin marks and size were used to distinguish naturally produced chinook from hatchery releases. An estimated 94.6% of the fall chinook subyearling hatchery releases were fin clipped and the mean fork length at release in May was approximately 80.0mm.

Table 17. Estimated number of fish captured at the Westland Canal fish trapping facility in 1991 /1.

Date	Salmonids												Hatchery Releases Only
	All Species /2			Hatchery				Natural Production				Total Salmonids	
	Lbs.	No./lb.	Number	Coho (Y)	Chinook (Y)	Chinook (SY)	STS (Y)	STS (Y)	Coho (SY)	Chinook (SY)	STS (SY)		
6-17	110	33.2	3652	7	0	3420	20	41	7	14	0	3509	3447
6-19	100	1a.2	1a20	0	0	1673	6	23	23	6	0	1729	1678
6-21	90	7.59	683	0	0	546	0	13	0	4	0	563	546
6-24	75	21.7	1628	0	0	1501	9	9	0	23	0	1542	1510
6-26	60	29.3	1758	0	0	1659	10	16	0	31	0	1717	1670
6-28	30	22.8	684	0	0	638	0	0	0	1a	0	656	638
7-1 /3	190	23.8	4522	0	0	4257	0	1a	0	44	0	4318	4257
7-3	105	31.6	3318	32	0	2821	0	0	0	391	0	3244	2853
7-a	110	26.4	2904	0	0	1191	0	0	0	1458	12	2661	1191
7-15	25	11.7	293	0	0	55	0	0	6	159	2	221	55
7-18	12.6	5.2	65 /4	0	0	30	0	0	0	0	0	30	30
7-25			50 /5	0	0	45	0	0	0	5	0	50	45
a-1			22 /6	0	0	21	0	0	0	1	0	22	21
a-7			57 /6	0	0	49	0	0	0	a	0	57	49
a-14			26 /6	0	0	23	0	0	0	2	0	26	23
<b>Total</b>			<b>21481</b>	<b>39</b>	<b>0</b>	<b>17928</b>	<b>46</b>	<b>119</b>	<b>36</b>	<b>2163</b>	<b>14</b>	<b>20345</b>	<b>1a012</b>

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/1 Y = yearling; SY = subyearling

/2 Includes non-game and warmwater game fish.

/3 The river flow increased on 6-29 due to heavy rains.

/4 The numbers of fish are estimates. Samples were not taken.

/5 The numbers of fish are estimates. Samples were not taken and non-salmonid species were not hauled.

/6 Actual counts. Non-salmonid species were not hauled.

By July, when the majority of the naturally produced chinook were observed at Westland, the hatchery fish had grown to approximately 90.0 to 100.0mm. In contrast, the naturally produced chinook were considerably smaller and had a mean fork length of 60.5mm. None of these smaller fish were fin clipped. No coho subyearlings were released.

### **Assessment of Acclimation Facilities**

Temperature and D.O. measurements that were recorded at the facilities during acclimation are reported in association with each particular acclimation. Detailed data for the year are presented in Appendices E, F, G and H.

In 1989, an extensive temperature and D.O. monitoring program at both facilities was initiated to collect baseline data to help determine if potential benefits of lowering water temperature and increasing dissolved oxygen levels could be obtained by piping the water directly from the spring source (Lofy and Rowan 1990). This monitoring program was continued in 1990 (Rowan 1991) and 1991.

Data collected in 1991 is similar to previous data and also suggests there would be little if any advantage in obtaining water directly from the spring source at either facility. Water temperatures at Minthorn were lower at the present intake during April and May and again in November and December (Appendix F). During the period June through October however, temperatures were lower at the spring source. Dissolved oxygen levels were generally higher at the present intake during the period April through July but higher at the spring source from August through October. In November and December, D.O. levels were again higher at the present intake.

At Bonifer, water temperatures and D.O. levels in the upper reaches of the largest spring were compared with measurements taken at the two largest springs just prior to entry into Bonifer (Appendix H). In March and April, temperatures were generally lower in the lower spring reaches than in the upper reaches of the largest spring. This trend was reversed from May through August when temperatures were lower nearer the spring source. From September through December, the temperatures were again lower in the lower reaches of the springs. Dissolved oxygen levels were generally higher from March through April in the lower spring reaches. In May, D.O. measurements at all locations were similar. From June through October, D.O. levels were generally higher in the upper reaches of the largest spring. In November and December, the levels were again higher in the lower reaches of the springs.

At both facilities, temperature differences between the present intakes and spring sources were usually within one to two degrees C throughout the year.

## **Acclimation Research**

### Tagging-Subcontract

Six groups of salmon were tagged in 1991 for release in 1991-92 (Table 18). Each test or control group consisted of three replicates. Numbers reported are fish tagged. Numbers released differ due to mortality.

A test group of fall chinook subyearlings was tagged in April. The fish were acclimated and released at Minthorn in May. A control group was tagged in May and released along with the acclimated group.

Four groups of spring chinook were tagged in August. One group was held at Bonifer for three days in November and released. A control group was released at the same time as the acclimated group. A third group will be acclimated and released at Bonifer in the spring of 1992. The last group will be released directly into the stream at the time of the acclimation release.

### Collection of snouts from coded-wire tagged fish

The snouts from adipose-clipped fall chinook salmon were collected at Threemile Dam in the 1991 season. Included were the snouts from two subjacks, 24 jacks and 26 adults. Additional snouts were collected from spawning ground surveys below and above Threemile Dam and from creel surveys below Threemile Dam conducted through funds provided by Bureau of Indian Affairs. Snouts were collected from five adults. Size categories were defined as < 406mm for subjacks, 406-609mm for jacks and > 609mm for adults. The arbitrary cutoff for subjack size was determined by CTUIR biologists who examined age and length data from coded-wire tag recoveries (CTUIR data files). The cutoff between jacks and adults is that used in the fishing regulations for the State of Oregon (24 inches).

Snouts from 28 spring chinook jacks and 203 adults were collected at Threemile Dam. Additional snouts from 136 spring chinook adults were collected on spawning ground and creel surveys. The snouts from 48 summer steelhead, 166 coho adults and 12 coho jacks were also collected at Threemile Dam. Snouts from 90 steelhead and 91 fall chinook salmon broodstock were also collected.

All snouts were delivered to ODFW in Clackamas, OR. for code identification.

## **Adult Survival and Umatilla River Returns**

Data presented for coded-wire tagged recoveries from 1983 to 1991 were retrieved from the Pacific States Marine Fisheries Commission (Ken Johnson, Regional Mark Processing Center). Additional Oregon and Washington freshwater recoveries from 1988

Table 18. Coded-uire tagging of juvenile salmonids in 1991 for release in the Umatilla River.

Species	Brood	Hatchery	Mark	Size (#/lb.)	Month Tagged	Release Month	Release Site	No. Tagged	CUT Code
Fall chinook	90	Irrigon	AD	125	April 1991	May 1991	Minthorn	26,544	075563
								26,648	075601
								26,669	075602
								-----	
								79,861	
Fall chinook	90	Irrigon	AD	125	May 1991	May 1991	Nr. Minthorn	26,715	075560
								26,556	075561
								26,064	075562
								-----	
								77,335	
Spring chinook	90	Bonneville	AD	25	August 1991	November 1991	Bonifer	27,090	075826
								27,057	075827
								27,148	075828
								-----	
								81,295	
Spring chinook	90	Bonneville	AD	25	August 1991	November 1991	Nr. Bonifer	26,089	075829
								26,970	075830
								26,632	075831
								-----	
								78,691	
Spring chinook	90	Bonneville	AD	25	August 1991	April 1992	Bonifer	27,715	075835
								27,565	075836
								27,903	075837
								-----	
								83,183	
Spring chinook	90	Bonneville	AD	25	August 1991	April 1992	Nr. Bonifer	27,100	075832
								27,067	075833
								27,089	075834
								-----	
								81,256	

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through 1991 were obtained from ODFW (Charlie Corrarino) and the Washington Department of Fisheries (Susan Markey). Some data are incomplete and should be considered as such. All fish reported are included in this report. When no expansion factor was available, the observed number was used.

Expanded numbers for recoveries in the ocean, Columbia River and Umatilla River are calculated. In instances where tagged fish were not treated the same as untagged fish (eg. tagged fish were released at a different area or time than the untagged fish), expansions were calculated only for those fish treated similarly. Releases of fall chinook salmon occurred as subyearling and yearling fish and for discussion of recoveries from these releases, fish recovered in the same year as release were not considered. Detailed information on recoveries is presented in Appendices I, J, K and L.

### Summer Steelhead

Since 1975, all Umatilla River summer steelhead releases have been from Umatilla River broodstock. The first coded-wire tagged releases were in April of 1988 (Table 19). An acclimated group was released from Minthorn while a control group was released into the Umatilla River near Minthorn. The purpose of the experiment was to evaluate the effects of acclimation on adult survival and returns to the Umatilla River.

The estimated recovery of adults from the acclimated release was higher than from the control release (0.61 versus 0.45%, respectively) despite the larger size of the non-acclimated group at release (Table 19). Carmichael et al. (1988) have shown that survival of steelhead released in the Snake River basin may be higher for fish released at a larger size. Returns of acclimated and control fish to the Umatilla River however, were similar (0.37 and 0.33%, respectively).

An estimated 65.5% of the adults recovered from both releases were captured at Threemile Dam on the Umatilla River and 28.4% were recovered in the Columbia River gillnet fishery. An estimated 5.5% were caught in the Columbia River sport fishery. An estimated 37.8% of the fish recovered from the acclimated release and only 15.7% of the recoveries from the non-acclimated release were captured in the Columbia River gillnet fishery.

A second group of acclimated fish was released from Minthorn in May of 1989 and a control group was released instream near Minthorn at the same time as the acclimated release (Table 19). Although no apparent problems were encountered with these releases, (Lofy and Rowan 1990), recoveries have been poor. Estimated preliminary adult recoveries from the acclimated and control groups are 0.01 and 0.03%, respectively.

Summer steelhead releases in 1990 were also made in May (Table 19). An acclimated group was released from Bonifer and a control group was released into Meacham Creek concurrent with the acclimated group. Preliminary recoveries from the acclimated group (0.28%) are similar to the control group (0.29%), even though the control group was slightly larger at release (Table 19). Umatilla River recoveries from the acclimated and control groups are also similar (0.16 and 0.15%, respectively). An estimated 53.8% of the recoveries from both releases have been from the Umatilla River, while an estimated 21.6 and 24.6%

Table 19. Liberation and survival information for summer steelhead released in the Umatilla River.

Brood	Number Released	Date of Release	Size at Release	Number Tagged	CUT Code	Release Location	Estimated Adult Survival %	----- Estimated Adult Survival -----				
								----- Oregon -----				
							Total	Canada Ocean	Col.R. Net	FW Sport	Fish Trap	
87	10187	Apr 88	7.4	9829	073859	Minthorn	0.47	48	0	12	0	36
87	10075	Apr 88	7.4	9721	073860	Minthorn	0.73	74	0	36	0	38
87	10287	Apt 88	7.4	9925	073861	Minthorn	0.64	66	0	23	3 /1	40
	-----			-----			-----	---	---	---	---	---
Total	30549			29475			0.61	188	0	71	3	114
87	10423	Apr 88	6.5	9689	073856	Nr. Minthorn	0.68	71	2	14	12 /2	43
87	10171	Apr 88	6.5	9455	073857	Nr. Minthorn	0.40	41	0	8	0	33
87	10163	Apr 88	6.5	9448	073858	Nr. Minthorn	0.27	28	0	0	3 /1	25
	-----			-----			-----	---	---	---	---	---
Total	30757			28592			0.45	140	2	22	15	101
88	9949	May 89	6.6	8784	074720	Minthorn	0.02	2	0	0	1 / 1	1
88	9954	May a9	6.6	8789	074723	Minthorn	0.00	0	0	0	0	0
88	9949	May 89	6.6	8784	074724	Minthorn	0.02	2	0	0	0	2
	-----			-----			-----	---	---	---	---	---
Total	29852			26357			0.01	4	0	0	1	3
88	9873	May 89	5.6	8800	074715	Nr. Minthorn	0.06	6	0	0	0	6
88	9864	May 89	5.6	8791	074717	Nr. Minthorn	0.02	2	0	0	0	2
88	9849	May 89	5.6	8778	074718	Nr. Minthorn	0.01	1	0	0	0	1
	-----			-----			-----	---	---	---	---	---
Total	29586			26369			0.03	9	0	0	0	9
89	10239	May 90	5.9	9331	075212	Bonifer	0.33	34	0	8	10	16
89	10022	May 90	5.9	9133	075213	Bonifer	0.25	26	0	7	1 /1	18
89	9964	May 90	5.9	9080	075214	Bonifer	0.25	25	0	8	3 /1	14
	-----			-----			-----	---	---	---	---	---
Total	30225			27544			0.28	85	0	23	14	48
89	9830	May 90	5.5	9511	075215	Nr. Bonifer	0.22	22	0	8	2 /1	12
89	9845	May 90	5.5	9525	075216	Nr. Bonifer	0.25	25	0	6	1 /1	18
89	9771	May 90	5.5	9454	075217	Nr. Bonifer	0.39	39	0	0	25 /3	14
	-----			-----			-----	---	---	---	---	---
Total	29446			28490			0.29	86	0	14	28	44

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- /1 Caught at mouth of Deschutes River.
- /2 Three caught at mouth of Deschutes River.
- /3 One caught at mouth of Deschutes River.

of the recoveries have been from the Columbia River gillnet and Columbia River sport fisheries, respectively. Columbia River gillnet recoveries from the acclimated release have been higher than recoveries from the control release (27.1 versus 16.3%, respectively).

#### Fall Chinook - Tule Stock

Initial releases in 1982 of fall chinook salmon in the Umatilla River were subyearling Tule stock (Table 20). The fish with tagcodes 050851 and 051057 were tagged by the National Marine Fisheries Service and were reared at Spring Creek National Fish Hatchery (NFH). The fish with tagcode 072663 were tagged by ODFW and were reared at Bonneville State Fish Hatchery (SFH). All the fish were from eggs collected at Spring Creek NFH. They were released at 79.0 and 92.0/lb., respectively, in April, 1982, at RM 1.5 and 51.5 (Table 20).

Survival rates ranged from 0.44 to 0.52% (Table 20). These rates are at the lower end of the range experienced by Spring Creek NFH (0-2.1%), but higher than many other releases of Tule stock from Spring Creek NFH released at other locations. Most fish were recovered as age-3 fish, similar to reports for fish from the 1978 and 1979 brood years released elsewhere (Howell et al. 1985).

Exploitation (commercial, sport and treaty catches) of Tule stock was 98.9% for all releases. Ocean commercial and Columbia River gillnet catches were 48.4 and 39.7%, respectively. Sport and treaty exploitation rates were 8.3 and 2.5%.

#### Fall Chinook - Bonneville Stock

All releases since 1982 have been of Bonneville and Priest Rapids upriver bright stock (Table 20). The first liberations of fish from Bonneville stock were from adult returns to Bonneville SFH with some fish taken from Bonneville Dam. All yearling fish have been released in the upper river from Minthorn (RM 63) up to RM 87 on the Umatilla River and up to RM 30 of Meacham Creek (28 RM above Bonifer and 109 RM from the mouth of the Umatilla River) (Table 21). Three releases were made in April, while all others were made in March. The yearling fish ranged from 4.8 to 10.2/lb. at release from 1983 to 1988.

Prior to 1990, all but one release of subyearling fish was near the mouth of the river because of potential for fish loss due to unscreened or partially screened irrigation diversions (Table 22). One group of fish was released in October, 1985, after being reared at Bonifer over the summer. Beginning in 1990, all subyearling releases have been in the upper river. One group of fish was acclimated at Minthorn in October of 1990 and released, while a control group was released into Meacham Creek at the same time as the acclimated group. Subyearling fish released in the spring have ranged from 85.1 to 92.3/lb., while fish released in the fall have ranged from 8.8 to 16.2/lb.

Table 20. Liberation and survival information for fall chinook salmon released in the Umatilla River. /1

Br. Stock/2	Yr. Released	Number	Date of Release	Size at Release	Number lagged	CWT Code	Release Location	%	Total	Ocean	Col.R.	Adult Survivals /3	Uma.R.
81 T	306279	Apr 82	79.0	46707	050851	Umatilla R. /4	0.45	1377	721	656	0		
81 T	672057	Apr 82	79.0	102331	051057	Umatilla R. /4	0.52	3481	1905	1576	0		
				-----	-----		----	----	----	----	----	----	
Total	978336			149038			0.49	4858	2626	2232	0		
81 T	2828835	Apr 82	92.0	102386	072663	Umatilla R.(RM 1.5)	0.44	12350	6935	5415	0		
81 B	100564	Apr 83	5.9	99570	072741	Bonifer & Meacham Cr.	0.16	/5 159	86	73	0		
82 B	228412	Apr 84	8.6	96448	072829	Bonifer & Meacham Cr.	0.08	138 /6	98	40	0		
83 B	996250	Jun 84	85.1	210441	073124	Uma.R.(RM 1.5) & Col.R.	0.77	/5 5161	/7 1592.	3570	0		
83 B	198162	Mar 85	7.8	88306	073127	Uma.R.(RM 87) 8 Bonifer	0.78	/5 1544	891	651	2		
84 B	3223172	Jun 85	92.3	206756	073326	Umatilla R.(RM 1.5)	0.87	27983	10881	17055	47		
84 B	51000	Oct 85	16.2	30838	073162	Bonifer	0.67	342	147	192	3		
84 B	206815	Mar 86	4.8	88396	073327	Bonifer & Minthorn	3.01	/5 2744	/8 1521	1162	61		
85 B	197432	Jun 86	86.0	20636	073833	Umatilla R.(RM 1.5)	0.63	1253	507	746	0		
85 B	198153	Jun 86	86.0	21335	073834	Umatilla R.(RM 1.5)	0.35	697	353	344	0		
85 B	197488	Jun 86	86.0	20690	073835	Umatilla R.(RM 1.5)	0.31	620	248	372	0		
85 B	196952	Jun 86	86.0	20170	073836	Umatilla R.(RM 1.5)	0.50	986	254	732	0		
85 B	197788	Jun 86	86.0	20982	073837	Umatilla R.(RM 1.5)	0.45	895	226	669	0		
85 B	208103	Jun 86	86.0	20815	073838	Umatilla R.(RM 1.5)	0.37	760	290	470	0		
85 B	208958	Jun 86	86.0	21659	073839	Umatilla R.(RM 1.5)	0.53	1100	251	849	0		
85 B	207550	Jun 86	86.0	20269	073840	Umatilla R.(RM 1.5)	0.57	1188	625	563	0		
85 B	208184	Jun 86	86.0	20895	073841	Umatilla R.(RM 1.5)	0.45	947	120	827	0		
85 B	208994	Jun 86	86.0	21694	073842	Umatilla R.(RM 1.5)	0.46	963	289	674	0		
				-----	-----		----	----	----	----	----	----	
Total	2029602			209145			0.46	9409	3163	6246	0		
85 B	22216	Mar 87	8.1	10103	073823	Minthorn	2.02	/5 449	209	189	51		
85 B	22523	Mar 87	8.1	10243	073824	Minthorn	2.01	/5 454	207	218	29		
85 B	21807	Mar 87	8.1	9917	073825	Minthorn	2.02	/5 441	205	183	53		
85 B	20881	Mar 87	8.1	9496	073826	Minthorn	1.90	/5 396	158	207	31		
85 B	21716	Mar 87	8.1	9876	073827	Minthorn	1.60	/5 348	183	128	37		
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Total	109143			49635			1.91	2088	962	925	201		

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Table 20. (cont.)

Br. Yr. Stock	Number Released	Date of Release	Size at Release	Number Tagged	CWT Code	Release Location	Estimated Adult Survivals				
							%	Total	Ocean	Col. R.	Uma. R.
85 B	20786	Mar 87	8.6	10253	073828	Bonifer	2.21	460	213	233	14
85 B	20212	Mar a7	8.6	9970	073829	Bonifer	2.30	464	231	219	14
85 B	20546	Mar 87	8.6	10135	073830	Bonifer	2.62 /5	539	217	298	24
85 B	20381	Mar a7	8.6	10053	073831	Bonifer	2.08	424	193	195	36
a5 B	20438	Mar a7	8.6	10081	073832	Bonifer	2.25 /5	460	207	229	24
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Total	102363			50492			2.29	2347	1061	1174	112
86 P	497572	May a7	60.4	40793	073912	Umatilla R.(RM 1.5)	0.68	3366	1378	1915	73
86 P	501266	May a7	60.4	41096	073913	Umatilla R.(RM 1.5)	0.73	3647	1573	2025	49
86 P	477992	May a7	60.4	39187	073914	Umatilla R.(RM 1.5)	0.76	3647	1854	1671	122
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Total	1476830			121076			0.72	10660	4805	5611	244
86 P	670	Jul 87	20.0	643	073915	Minthorn					
86 P	672	Jul 87	20.0	645	073916	Minthorn					
86 P	658	Jul 87	20.0	632	074035	Minthorn	0.79	5	0	5	0
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Total	2000			1920			0.25	5	0	5	0
86 B	52317	Mar 88	8.8	42068	074038	Minthorn	2.36 /5	1235	653	439	143
86 B	48474	Mar 88	8.8	38978	074039	Minthorn	2.24 /5	1085	575	381	129
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Total	100791			81046			2.30	2320	1228	820	272
86 B	50480	Apr 88	10.2	39509	074036	Bonifer	1.76 /5	887	477	310	100
86 B	49070	Apr 88	10.2	38405	074037	Bonifer	1.90 /5	933	450	378	105
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Total	99550			77914			1.82	1820	927	688	205
a7 P	1886757	May 88	68.3	198285	075007	Umatilla R.(RM 23)	0.04	838	314	381	143
87 P	4823	Nov 88	9.8	4438	074539	Minthorn	0.14	6	1	4	1
87 P	4660	Nov 88	9.8	4289	074540	Minthorn	0.14	6	0	4	2
a7 P	4925	Nov 88	9.8	4533	074541	Minthorn	0.22	11	7	4	0
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Total	14408			13260			0.15	23	a	12	3
a7 P	26858	Nov 88	8.6	24656	074536	Nr. Minthorn	0.21	55	2	41	12
a7 P	25493	NOV 88	8.6	23403	074537	Nr. Minthorn	0.33	a3	29	39	15
a7 P	27330	Nov 88	8.6	25089	074538	Nr. Minthorn	0.30	a1	28	36	17
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Total	79681			73148			0.27	219	59	116	44

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Table 20. (cont.)

Br. Stock	Yr. Released	Number	Date of Release	Size at Release	Number Tagged	CWT Code	Release Location	%	Estimated Adult Survivals			
									Total	Ocean	Col.R.	Uma.R.
88 P	797904	May 89	66.6	52228	074646	Umatilla R.(RM 23)	0.02	198	15	107	76	
88 P	797903	May 89	66.6	49771	074647	Umatilla R.(RM 23)	0.02	128	16	64	48	
88 P	797904	May 89	66.6	52244	074648	Umatilla R.(RM 23)	0.02	199	31	168	0	
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Total	2393711			154243			0.02	525	62	339	124	
88 P	26770	Oct 89	10.9	26358	074753	Minthorn	0.03	9	5	3	1	
88 P	26617	Oct 89	10.9	25028	074754	Minthorn	0.03	8	0	4	4	
88 P	25438	Oct 89	10.9	25438	074757	Minthorn	0.02	5	0	2	3	
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Total	78825			76824			0.03	22	5	9	a	
88 P	27071	Oct a9	11.1	26790	074758	Nr. Minthorn	0.00	1	0	0	1	
88 P	25428	Oct 89	11.1	24285	074760	Nr. Minthorn	0.00	0	0	0	0	
88 P	25633	Oct 89	11.1	25350	074763	Nr. Minthorn	0.01	2	0	0	2	
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Total	78132			76425			0.00	3	0	0	3	
89 B	808560	May-Jun 90	87.5	52965	075403	Uma RM 70-79	0.02	122	0	46	76	
a9 B	808560	May-Jun 90	87.5	52965	075404	Uma RM 70-79	0.02	138	0	92	46	
89 B	808560	May-Jun 90	87.5	52965	075405	Uma RM 70-79	0.01	107	0	0	107	
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Total	2425680			158895			0.02	367	0	138	229	
89 B	25311	Oct 90	9.2	23396	075325	Minthorn	0.00	0	0	0	0	
89 B	23724	Oct 90	9.2	21929	075326	Minthorn	0.00	0	0	0	0	
89 B	22828	Oct 90	9.2	21101	075327	Minthorn	0.00	1	0	0	1	
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Total	71863			66426			0.00	1	0	0	1	
a9 B	25472	Oct 90	8.8	23413	075322	Nr. Minthorn	0.00	0	0	0	0	
a9 B	25694	Oct 90	8.8	23617	075323	Nr. Minthorn	0.00	0	0	0	0	
89 B	25480	Oct 90	8.8	23420	075324	Nr. Minthorn	0.00	0	0	0	0	
-----				-----				----	---	---	---	---
Total	76646			70450			0.00	0	0	0	0	

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- /1 Adult returns from the 1985-89 brood are incomplete. /2 T=Tule stock, B=Bonneville URB, P=Priest Rapids URB.
- /3 The data reported in the table are expanded numbers.
- /4 Approximately 48.7% of the fish were released at RM 1.5 and 51.3% at RM 51.5.
- /5 Sub-jack recoveries were not used in estimating expanded survival numbers.
- /6 The expanded survival data is based on a release of 175,104 fish in Meacham Cr. (RM 30). It does not include 53,308 fish released at Bonifer (RM 2 of Meacham Cr.).
- /7 The expanded survival data is based on a release of 667,190 fish in the Umatilla River (RM 1.5). It does not include 329,060 fish released at Rock Cr. State Park in the Columbia River.
- /8 The expanded survival data is based on a release of 91,036 fish at Minthorn. It does not include 115,779 fish released at Bonifer.

Table 21. Liberation and survival information for Bonneville stock yearling fall chinook salmon released in the Umatilla River.

Br. Stock	Yr. Released	Number	Date of Release	Size at Release	Number Tagged	CWT Code	Release Location	Estimated Adult Survivals				
								%	Total	Ocean	Col.R. Uma.R.	
81 B	100564	Apr 83	5.9	99570	072741	Bonifer & Meacham Cr.	0.16	/5 159	86	73	0	
82 B	228412	Apr 84	8.6	96448	072829	Bonifer & Meacham Cr.	0.08	138	/6 98	40	0	
a3 B	198162	Mar a5	7.8	88306	073127	Uma.R.(RM 87) & Bonifer	0.78	/5 1544	891	651	2	
84 B	206815	Mar 86	4.8	88396	073327	Bonifer & Minthorn	3.01	/5 2744	/8 1521	1162	61	
85 B	22216	Mar 87	a.1	10103	073823	Minthorn	2.02	/5 449	209	189	51	
a5 B	22523	Mar 87	a.1	10243	073824	Minthorn	2.01	/5 454	207	218	29	
85 B	21807	Mar 87	8.1	9917	073825	Minthorn	2.02	/5 441	205	183	53	
a5 B	20881	Mar 87	8.1	9496	073826	Minthorn	1.90	/5 396	158	207	31	
a5 B	21716	Mar 87	8.1	9876	073827	Minthorn	1.60	/5 348	183	128	37	
-----				-----				----	----	---	---	---
Total	109143			49635			1.91	2088	962	925	201	
85 B	20786	Mar 87	8.6	10253	073828	Bonifer	2.21	460	213	233	14	
85 B	20212	Mar 87	8.6	9970	073829	Bonifer	2.30	464	231	219	14	
85 B	20546	Mar 87	8.6	10135	073830	Bonifer	2.62	/5 539	217	298	24	
85 B	20381	Mar 87	8.6	10053	073831	Bonifer	2.08	424	193	195	36	
a5 B	20438	Mar 87	8.6	10081	073832	Bonifer	2.25	/5 460	207	229	24	
-----				-----				----	----	----	----	---
Total	102363			50492			2.29	2347	1061	1174	112	
86 B	52317	Mar 88	8.8	42068	074038	Minthorn	2.36	/5 1235	653	439	143	
86 B	48474	Mar 88	8.8	38978	074039	Minthorn	2.24	/5 1085	575	381	129	
-----				-----				----	----	----	----	---
Total	100791			81046			2.30	2320	1228	820	272	
86 B	50480	Apr 88	10.2	39509	074036	Bonifer	1.76	/5 887	477	310	100	
86 B	49070	Apr 88	10.2	38405	074037	Bonifer	1.90	/5 933	450	378	105	
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Total	99550			77914			1.82	1820	927	688	205	

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Table 22. Liberation and survival information for Bonneville stock subyearling fall chinook salmon released in the Umatilla River.

Br. Yr. stock	Number Released	Date of Release	Size at Release	Number Tagged	CUT Code	Release Location	Estimated Adult Survivals				
							%	Total	Ocean	Col.R. Uma.R.	
a3 B	996250	Jun 84	85.1	210441	073124	Uma.R.(RM 1.5) & Col.R.	0.77	/5 5162	/7 1592	3570	0
84 B	3223172	Jun 85	92.3	206756	073326	Umatilla R.(RM 1.5)	0.87	27983	10881	17055	47
84 B	51000	Oct 85	16.2	30838	073162	Bonifer	0.67	342	147	192	3
85 B	197432	Jun 86	86.0	20636	073833	Umatilla R.(RM 1.5)	0.63	1253	507	746	0
85 B	198153	Jun 86	86.0	21335	073834	Umatilla R.(RM 1.5)	0.35	697	353	344	0
85 B	197488	Jun 86	86.0	20690	073835	Umatilla R.(RM 1.5)	0.31	620	248	372	0
85 B	196952	Jun 86	86.0	20170	073836	Umatilla R.(RM 1.5)	0.50	986	254	732	0
a5 B	197788	Jun 86	86.0	20982	073837	Umatilla R.(RM 1.5)	0.45	895	226	669	0
85 B	208103	Jun 86	86.0	20815	073838	Umatilla R.(RM 1.5)	0.37	760	290	470	0
85 B	208958	Jun 86	86.0	21659	073839	Umatilla R.(RM 1.5)	0.53	1100	251	849	0
85 B	207550	Jun 86	86.0	20269	073840	Umatilla R.(RM 1.5)	0.57	1188	625	563	0
85 B	208184	Jun 86	86.0	20895	073841	Umatilla R.(RM 1.5)	0.45	947	120	a27	0
85 B	208994	Jun 86	86.0	21694	073842	Umatilla R.(RM 1.5)	0.46	963	289	674	0
				-----			----	----	----	----	----
Total	2029602			209145			0.46	9409	3163	6246	0
89 B	808560	May-Jun 90	87.5	52965	075403	Umatilla R.(RM 70-79)	0.02	122	0	46	76
a9 B	808560	May-Jun 90	87.5	52965	075404	Umatilla R.(RM 70-79)	0.02	138	0	92	46
a9 B	808561	May-Jun 90	87.5	52965	075405	Umatilla R.(RM 70-79)	0.01	107	0	0	107
				-----			----	----	----	----	----
Total	2425681			158895			0.01	367	0	138	229
a9 B	25311	Oct 90	9.2	23396	075325	Minthorn	0.00	0	0	0	0
89 B	23724	Oct 90	9.2	21929	075326	Minthorn	0.00	0	0	0	0
89 B	22828	Oct 90	9.2	21101	075327	Minthorn	0.00	1	0	0	1
				-----			----	----	----	----	----
Total	71863			66426			0.00	1	0	0	1
a9 B	25472	Oct 90	8.8	23413	075322	Nr. Minthorn	0.00	0	0	0	0
a9 B	25694	Oct 90	8.8	23617	075323	Nr. Minthorn	0.00	0	0	0	0
a9 B	25480	Oct 90	8.8	23420	075324	Nr. Minthorn	0.00	0	0	0	0
				-----			----	----	----	----	----
Total	76646			70450			0.00	0	0	0	0

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For discussion of survival, releases are grouped by age at release, time of release (spring versus fall releases), and release location (lower Umatilla River and upper Umatilla River and tributaries). Releases in the upper river include those made at the Minthorn and Bonifer Acclimation Facilities.

The estimated survival rates (through age-6 fish) from yearling releases made from 1983 to 1986 (1981 to 1984 brood years) have ranged from 0.08 to 3.01% (Table 21). Releases made in 1983 and 1984 survived poorly (0.16 and 0.08%, respectively). Survival increased to 0.78% for 1985 releases and 3.01% for 1986 releases. Survival (through age-6 fish; preliminary data) of the 1987 releases from acclimation facilities is 2.10%. Through age-5 fish, the survival rate is 2.07% for all groups released in 1988 from acclimation facilities. In comparison, the survival of the 1986 releases through age-5 fish was 2.92%.

All releases in the lower river have been made with subyearling fish (Table 22). Fish were released near the mouth (RM 1.5), below all major diversions, and releases were made later in the season (June) than yearling releases (March and April) to get the fish to a larger size at release (85.1 to 92.3/lb).

Survival of the 1984 and 1985 June releases (through age-6 fish) was 0.77 and 0.87%, respectively (Table 22). Preliminary recoveries (through age-6 fish) from the 1986 releases vary from 0.31 to 0.63% with an average of 0.46%.

Survival of the subyearling fish released in October of 1985 was 0.67% (Table 22). This is lower than the survival from the same brood released near the mouth in June (0.87%), and much lower than the survival of the fish held longer at the hatchery and released the following March (3.01%). Recovery data from 1990 releases (1989 brood) includes age-2 fish only (Table 22) and are not discussed in this report.

Data from early releases (1986 brood and earlier) of yearling and subyearling fish show that most of these fish were recovered as age-4 fish, similar to results from this stock released elsewhere (Howell et al. 1985).

Exploitation of adults of the Bonneville stock of upriver bright fish (all releases) was 88.4%. Although the overall average exploitation rate was similar for releases of yearlings (91.3%) as for releases of subyearlings (87.6%), distribution of the catch differed. Adults from subyearling releases were recovered more frequently in the Columbia River gillnet fishery (55.9%) than in the ocean commercial fishery (40.5%), whereas adults from yearling releases were recovered more often in the ocean commercial catch (47.7%) than in the Columbia River gillnet fishery (39.1%). Sport catch averaged 3.4% of the recoveries of adults from subyearling releases and 10.5% of adults from yearling releases. Likewise, 0.2% of the recoveries of adults from subyearling releases were from the treaty fisheries, while 2.7% were from adults from the yearling releases.

### Fall Chinook - Priest Rapids stock

Beginning with releases in 1987, upriver bright stock of upriver origin was available for release in the Umatilla River (Table 23). These juveniles were from adults returning to Priest Rapids Dam (1986 brood).

Preliminary recovery data (through age-5 fish) shows that estimated adult recovery rates (0.68 to 0.76%) from subyearling releases made in May of 1987 near the mouth of the Umatilla River, are similar to adult recovery rates (at the same age) from Bonneville stock released in 1984 and 1985 (0.77 and 0.86%, respectively) but higher than the recovery rates for 1986 releases (0.31 to 0.63%). The Priest Rapids stock however, were released at a larger size (60.4/lb. versus 85.1 to 92.3/lb. for the Bonneville stock) and they were released in May instead of June.

A second group of subyearling fish was acclimated at Minthorn and released in July (Table 23). However, due to low dissolved oxygen levels and pump failure (Lofy et al. 1988), very few fish were released and adult recoveries have been minimal.

In 1988, one group of subyearlings (1987 brood) was released in May at Umatilla RM 23. Preliminary survival through age-4 fish is 0.04%. This compares to 0.70% at the same age for the 1987 May release. The size at release for both groups was similar.

Two groups of fish (1987 brood) were released in November of 1988 (Table 23). One group was acclimated at Minthorn and released while a control group was released near Minthorn at the same time as the acclimated group. The acclimated group suffered severe losses due to "Ich" and a relatively small number of fish were released (Lofy 1989). Through age-4 fish, the survival of the acclimated and control groups are 0.15 and 0.27%, respectively. The increase in survival of the control group might be explained by their larger size at release (8.6 versus 9.8/lb. for the acclimated group) and the poor health of the acclimated fish.

In May of 1989, a group of subyearlings was released at Umatilla RM 23. They were released at 66.6/lb., similar to releases made in 1987 and 1988. The recovery rate (through age-3 fish; preliminary data) is 0.02%. The recovery rates of the 1987 and 1988 May releases (at the same age) were 0.27 and 0.03%, respectively. In comparison, recovery rates (through age-3 fish) from Bonneville stock subyearling releases in 1984, 1985, and 1986, were 0.27, 0.18, and 0.14%, respectively. As mentioned, the Priest Rapids stock was released in May at 66.6/lb., while the Bonneville stock was released in June at 85.1 to 92.3/lb.

A second acclimation experiment was conducted in October of 1989. One group of fish was acclimated at Minthorn prior to release, and a control group was released instream concurrent with the acclimated group (Table 23). Preliminary recoveries through age-3 fish have been minimal.

Table 23. Liberation and survival information for Priest Rapids stock fall chinook salmon released in the Umatilla River.

Br. Stock	Yr. Released	Number	Date of Release	Size at Release	Number Tagged	CUT Code	Release Location	%	Estimated Adult Survivals			
									Total	Ocean	Col.R.	Uma.R.
86 P	497572	May 87	60.4	40793	073912	Umatilla R.(RM 1.5)	0.68	3366	1378	1915	73	
86 P	501266	May 87	60.4	41096	073913	Umatilla R.(RM 1.5)	0.73	3647	1573	2025	49	
86 P	477992	May 87	60.4	39187	073914	Umatilla R.(RM 1.5)	0.76	3647	1854	1671	122	
	-----			-----			----	----	----	----	---	
Total	1476830			121076			0.72	10660	4805	5611	244	
86 P	670	Jul 87	20.0	643	073915	Minthorn						
86 P	672	Jul 87	20.0	645	073916	Minthorn						
86 P	658	Jul 87	20.0	632	074035	Minthorn	0.79	5	0	5	0	
	-----			-----			----	----	----	----	---	
Total	2000			1920			0.25	5	0	5	0	
87 P	1886757	May 88	68.3	198285	075007	Umatilla R.(RM 23)	0.04	838	314	381	143	
87 P	4823	Nov 88	9.8	4438	074539	Minthorn	0.14	6	1	4	1	
87 P	4660	Nov 88	9.8	4289	074540	Minthorn	0.14	6	0	4	2	
87 P	4925	Nov 88	9.8	4533	074541	Minthorn	0.22	11	7	4	0	
	-----			-----			----	----	----	----	---	
Total	14408			13260			0.15	23	8	12	3	
87 P	26858	Nov 88	8.6	24656	074536	Nr. Minthorn	0.21	55	2	41	12	
87 P	25493	Nov 88	8.6	23403	074537	Nr. Minthorn	0.33	83	29	39	15	
87 P	27330	Nov 88	8.6	25089	074538	Nr. Minthorn	0.30	81	28	36	17	
	-----			-----			----	----	----	----	---	
Total	79681			73148			0.27	279	59	116	44	
88 P	797904	May 89	66.6	52228	074646	Umatilla R.(RM 23)	0.02	198	15	107	76	
88 P	797903	May 89	66.6	49771	074647	Umatilla R.(RM 23)	0.02	128	16	64	48	
88 P	797904	May 89	66.6	52244	074648	Umatilla R.(RM 23)	0.02	199	31	168	0	
	-----			-----			----	----	----	----	---	
Total	2393711			154243			0.02	525	62	339	124	
88 P	26770	Oct 89	10.9	26358	074753	Minthorn	0.03	9	5	3	1	
88 P	26617	Oct 89	10.9	25028	074754	Minthorn	0.03	8	0	4	4	
88 P	25438	Oct 89	10.9	25438	074757	Minthorn	0.02	5	0	2	3	
	-----			-----			----	----	----	----	---	
Total	78825			76824			0.03	22	5	9	8	
88 P	27071	Oct 89	11.1	26790	074758	Nr. Minthorn	0.00	1	0	0	1	
88 P	25428	Oct 89	11.1	24285	074760	Nr. Minthorn	0.00	0	0	0	0	
88 P	25633	Oct 89	11.1	25350	074763	Nr. Minthorn	0.01	2	0	0	2	
	-----			-----			----	----	----	----	---	
Total	78132			76425			0.00	3	0	0	3	

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The estimated exploitation rate (through 1988 releases; preliminary data) on subyearling Priest Rapids stock is 86.7%, similar to the exploitation rate on subyearling Bonneville stock (88.4%). The ocean commercial and Columbia River gillnet exploitation rates are similar (39.0 and 42.5%, respectively). The sport and treaty exploitation rates are 4.2 and 1.1%, respectively.

### Fall Chinook - Straying

Juvenile fall chinook releases from the Umatilla River have caused concern because of returning adults straying to Columbia and Snake River facilities and spawning grounds located above McNary Dam. When comparing estimated adult recoveries from the Umatilla River with recoveries above McNary Dam, the data suggests that the releases of subyearling chinook have resulted in higher stray rates than the releases of yearling fish. The stray rates from releases of subyearling Bonneville stock have generally been higher than the stray rates from releases of subyearling Priest Rapids stock. The stray rate of Bonneville stock released near the mouth of the river in June of 1984, 1985 and 1986 has averaged 99.1% (preliminary data), while the stray rate of a group of Bonneville stock released from Bonifer in the fall of 1985 was 85.0% (Table 24). The stray rate (through age-5 fish, preliminary data) of Priest Rapids stock released near the mouth in May of 1987 (80.0%) is similar to the Bonneville stock stray rates. The stray rates (through age-4 and age-3 fish, respectively) from Priest Rapids stock released in May of 1988 and 1989 at RM 23 are greatly reduced (25.1 and 27.5% respectively). The average stray rate (preliminary data) of Priest Rapids stock released in the fall of 1988 and 1989 is even lower (14.7%). These releases however, were made higher in the river (RM 63) than the spring releases.

The stray rate of yearling releases (Bonneville stock) from 1983 through 1988 has averaged 27.5% (preliminary data) (Table 24). The stray rates from the earlier releases (1983 to 1985) varied from 97.8 to 100.0%, but the estimated total number of adults recovered was low. Two and five adults were recovered at Lyons Ferry Hatchery from 1983 and 1984 releases, respectively, and 90 adults were recovered from the 1985 release (two were recovered in the Umatilla River and 88 were recovered at Lyons Ferry and Priest Rapids Hatcheries. The stray rate from 1986 releases was 64.9% and the stray rates from releases made from 1987 through 1988 vary from 5.9 to 35.3% (preliminary data).

The strays from subyearling releases of Bonneville stock have been recovered most often on spawning ground surveys conducted at Ringold. Adult strays from releases of all other subyearling groups have been recovered most frequently at Lyons Ferry and Priest Rapids Hatcheries. An estimated 79.9% of all strays from yearling releases have also been recovered at Lyons Ferry and Priest Rapids Hatcheries, although slightly more than half (51.3%) of the strays from the 1986 release were recovered from spawning ground surveys conducted at Ringold.

The high stray rate is believed to be the result of low flows at the mouth of the Umatilla River during the adult return season and in the case of subyearling releases

Table 24. Liberation, survival, and straying information for fall chinook salmon released in the Umatilla River.

Brood Year	Number Released	Date of Release	Size at Release	Release Location	Umatilla River		Estimated Adult Survival				Wells Dam		Spawn Grounds /2		Fish Traps			
					No.	%	Washington /1	Lyons Ferry	Hatcher's Priest Rapids	No.	%	No.	%	No.	%	No.	%	
<u>Subyearling spring releases (Tule stock)</u>																		
61	978336	Apr 82	79.0	Umatilla R. /3	0	0.0	0	0.0										
81	<u>2828835</u> 3807171	Apr 82	92.0	Umatilla R. (RM 1.5)	0	<u>0.0</u> 0.0	111	<u>100.0</u> 100.0	83	<u>74.8</u> 74.8	28	<u>25.2</u> 25.2						
<u>Subyearling spring releases (Bonneville stock)</u>																		
83	667190	June 84	85.1	Uma. R. (RM 1.5) & Col. R.	0	0.0	1135	100.0	89	7.8	38	3.3		1005	88.5	3	0.3	
84	3223172	June 85	92.3	Umatilla R. (RM 1.5)	47	2.0	2260	98.0	125	5.5	62	2.7		2073	91.7			
85	<u>2029602</u> 5919964	June 86	86.0	Umatilla R. (RM 1.5)	<u>0</u> 47	<u>0.0</u> 0.9	<u>1869</u> 5084	<u>100.0</u> 99.1	<u>417</u> 631	<u>25.0</u> 12.5	<u>126</u> 226	<u>7.5</u> 4.5		<u>1126</u> 4204	<u>87.5</u> 83.0	<u>3</u>	<u>0.1</u>	
<u>Subyearling spring releases (Priest Rapids stock)</u>																		
86	1476830	May 87	80.4	Umatilla R. (RM 1.5)	244	20.0	976	80.0	598	61.3	304	31.1	12	1.2	61	5	6.3	
86	2000	July 87	20.0	Minthorn	0	0.0	1	100.0	1	100.0								
87	1886757	May 88	68.3	Umatilla R. (RM 23)	143	74.9	48	25.1	38	79.2	10	20.8						
88	<u>2393711</u> 5759298	May 89	66.6	Umatilla R. (RM 23)	<u>124</u> 511	<u>72.5</u> 32.3	<u>47</u> 1072	<u>27.5</u> 67.7	<u>31</u> 668	<u>66.0</u> 62.3	<u>314</u>	<u>29.3</u>	<u>12</u>	<u>1.1</u>	<u>61</u>	<u>5.7</u>	<u>16</u> <u>16</u>	<u>34.0</u> <u>1.5</u>
<u>Subyearling fall releases (Bonneville stock)</u>																		
84	51000	Oct 85	16.2	Bonifer	3	15.0	17	85.0	17	100.0								
<u>Subyearling fall releases (Priest Rapids stock)</u>																		
87	14408	Nov 88	9.8	Minthorn	3	75.0	1	25.0			1	100.0						
87	79681	Nov 88	8.6	Nr. Minthorn	44	83.0	9	17.0	1	11.1	4	44.4					3	33.3
88	78825	Oct 89	10.9	Minthorn	8	100.0	0	0.0										
88	<u>78132</u> 251046	Oct 89	11.1	Nr. Minthorn	<u>3</u> 58	<u>100.0</u> 85.3	<u>0</u> 10	<u>0.0</u> 14.7	<u>1</u>	<u>10.0</u>	<u>5</u>	<u>50.0</u>					<u>3</u>	<u>30.0</u>

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Table 24. (Cont.)

Brood Year	Number Released	Date of Release	Size at Release	Release Location	Estimated Adult Survival										Spawn		Fish Traps	
					Umatilla River		Washington /1		Lyons Ferry		Washington Hatcheries		Wells Dam		Grounds /2		No.	%
<u>Yearling spring releases (Bonneville stock)</u>																		
81	100564	April 83	5.9	Bonifer & Meacham Cr.	0	0.0	2	100.0	2	100.0								
82	175104	April 84	8.6	Bonifer & Meacham Cr.	0	0.0	5	100.0	5	100.0								
83	198162	Mar 85	7.8	Uma. R. (RM 87) & Bonifer	2	2.2	88	97.8	81	92.0	7	8.0						
84	91036	Mar 86	4.8	Bonifer & Minthorn	61	35.1	113	64.9	45	39.8	4	3.5		58	51.3	6	5.3	
85	109143	Mar 87	8.1	Minthorn	201	80.1	22	9.9	18	81.8	2	9.1		2	8	9.1		
85	102363	Mar 87	8.6	Bonifer	112	84.7	61	35.3	61	100.0								
86	100791	Mar 88	8.8	Minthorn	272	94.1	17	5.9	17	100.0								
86	99550	Apr 88	10.2	Bonifer	205	81.2	15	6.8	13	88.7	3	20.0						
	976713				853	72.5	323	27.5	242	74.9	16	5.0		60	18.8	6	1.9	

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/1 Estimated Washington recoveries above McNary Dam.  
 R Ringold unless otherwise noted.  
 /3 Approximately 48.7% of the fish were released at RM 1.5 and 51.3% at RM 51.5.  
 /4 Ten from Lyons Ferry.  
 /5 Twenty-four from the Tucannon River, 24 from the Yakima River, and 12 from Priest Rapids.  
 /6 From the Snake River.

particularly, lack of imprinting because all early releases of subyearlings (1982 through 1989) have been in the lower river and in the Columbia River itself (1984 releases). There is optimism that the stray rate will be reduced in future years. Beginning in 1990, all releases of fall chinook juveniles have been in the upper river (RM 56 to 89) and all future releases are proposed for the upper river. Proposed facilities would also be used to acclimate a portion of juvenile fall chinook as well as other species prior to release. The Umatilla Basin Project will help to provide better attraction and fish passage flows in the Umatilla River. Plans call for an exchange of Columbia River water for water which is currently being taken directly from the Umatilla River for irrigation. Columbia River water will be pumped into the irrigation delivery systems, leaving Umatilla River water in the river.

### Spring Chinook

The first coded-wire tagged releases of spring chinook in the Umatilla River were in 1988 from Carson stock (Table 25). Two groups (1986 brood) were released in April (one acclimated group from Bonifer and one group between Umatilla RM 23 and RM 2 of Meacham Creek), and two groups (1987 brood) were released in November (one group from Bonifer and one group into the upper Umatilla River at RM 89). The purpose for the releases was to evaluate acclimation, but several problems were encountered in both the spring and fall experiments (Lofy 1989). These problems essentially eliminate any possible comparison between acclimated and non-acclimated fish.

The estimated survival rates (through age-5 fish; preliminary data) for the spring release groups are 0.72 and 0.70%. Approximately 82.7% of the fish recovered have been from the Umatilla River and 17.3% have been recovered from the Columbia River. The preliminary recovery rate (through age-4 fish) of the acclimated group released in the fall is 0.50%, but less than 1,200 fish were released and recoveries have been minimal. Recoveries from the group of fish released at RM 89 have also been low (0.09%; preliminary data). All but one of the adult recoveries from the fall releases have been from the Umatilla River.

In the spring of 1989, a third acclimation experiment was conducted. One group of fish was acclimated at Bonifer, while a control group was released into Meacham Creek concurrent with the acclimated group. Both groups were released at 10.6/lb. Preliminary data (through age-4 fish) suggests that survival of the control group (0.30%) is higher than survival of the acclimated group (0.24%). Estimated Umatilla River recoveries from the non-acclimated release (0.28%) are also higher than recoveries from the acclimated group (0.23%). Evaluation of this experiment is complicated however, because of difficulties with releasing the acclimated group (Lofy and Rowan 1990). Table 25 shows the release date as March to May. The fish were transferred into Bonifer on March 7, but many fish escaped on March 10 because of plugged effluent screens which resulted in the pond overflowing. Observations during steelhead acclimation that followed, showed that several thousand spring chinook were still in the pond and were released with the steelhead on May 23. The date of release for this group was therefore recorded as March 10 to May 23, 1989.

Table 25. Liberation and survival information for spring chinook salmon released in the Umatilla River.

Brood	Number Released	Date of Release	Size at Number		CWT Code	Release Location	Estimated Adult Survival			
			Release	Tagged			%	Total	Columbia River	Umatilla River
86	35946	Mar-Apr 88	10.1	26640	074325	Bonifer	0.62	224	28 /1	196
86	35148	Mar-Apr 88	10.1	25863	074326	Bonifer	0.93	327	86	241
86	35137	Mar-Apr 88	10.1	25853	074327	Bonifer	0.60	210	41 /2	169
	-----			-----			-----	---	---	---
<b>Total</b>	<b>106231</b>			<b>78356</b>			<b>0.72</b>	<b>761</b>	<b>155</b>	<b>606</b>
86	34187	Apr 88	8.6	26319	074328	Uma.R. (RM 23-81)	0.51	175	23	152
86	33573	Apr 88	8.6	25722	074329	Uma.R. (RM 23-81)	0.74	247	37 /3	210
86	34118	Apr 88	8.6	26252	074330	Uma.R. (RM 23-81)	0.85	290	40	250
	-----			-----			-----	---	---	---
<b>Total</b>	<b>101878</b>			<b>78293</b>			<b>0.70</b>	<b>712</b>	<b>100</b>	<b>612</b>
87	416	Nov 88	21.4	410	074420	Bonifer	0.00	0	0	0
87	399	Nov 88	21.4	393	074423	Bonifer	0.75	3	0	3
87	381	Nov 88	21.4	376	074424	Bonifer	0.79	3	0	3
	-----			-----			-----	---	---	---
<b>Total</b>	<b>1196</b>			<b>1179</b>			<b>0.50</b>	<b>6</b>	<b>0</b>	<b>6</b>
87	26109	Nov 88	11.1	25987	074427	Corp. Cr.	0.08	21	0	21
87	24183	Nov 88	11.1	24070	074429	Corp. Cr.	0.08	19	1	18
87	25475	Nov 88	11.1	25356	074430	Corp. Cr.	0.10	25	0	25
	-----			-----			-----	---	---	---
<b>Total</b>	<b>75767</b>			<b>75413</b>			<b>0.09</b>	<b>65</b>	<b>1</b>	<b>64</b>
87	26135	Mar-May 89	10.6	25427	074433	Bonifer	0.27	71	4	67
87	27756	Mar-May 89	10.6	27004	074434	Bonifer	0.26	71	3	68
87	26093	Mar-May 89	10.6	25386	074436	Bonifer	0.20	51	5	46
	-----			-----			-----	---	---	---
<b>Total</b>	<b>79984</b>			<b>77817</b>			<b>0.24</b>	<b>193</b>	<b>12</b>	<b>181</b>
87	28153	Mar 89	10.6	27585	074439	Nr. Bonifer	0.27	75	6	69
87	28116	Mar 89	10.6	27550	074440	Nr. Bonifer	0.34	96	5	91
87	24663	Mar 89	10.6	24165	074443	Nr. Bonifer	0.28	68	7	61
	-----			-----			-----	---	---	---
<b>Total</b>	<b>80932</b>			<b>79300</b>			<b>0.30</b>	<b>239</b>	<b>18</b>	<b>221</b>
88	24968	Oct 89	12.0	24801	075063	Bonifer	0.01	2	1	1
88	28299	Oct 89	12.0	28109	075101	Bonifer	0.00	0	0	0
88	27483	Oct 89	12.0	27299	075102	Bonifer	0.01	2	0	2
	-----			-----			-----	---	---	---
<b>Total</b>	<b>80750</b>			<b>80209</b>			<b>0.00</b>	<b>4</b>	<b>1</b>	<b>3</b>

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Table 25. (cont.)

Brood	Number Released	Date of Release	Size at Number		CWT Code	Release Location	Estimated Adult Survival			
			Release	Tagged			%	Total	Columbia River	Umatilla River
88	27287	Oct 89	12.0	27137	075103	Nr. Bonifer	0.01	2	0	2
88	28718	Oct 89	12.0	28560	075104	Nr. Bonifer	0.01	4	0	4
88	27848	Oct 89	12.0	27695	075105	Nr. Bonifer	0.00	1	0	1
-----				-----			-----	---	---	---
<b>Total</b>	<b>83853</b>			<b>83392</b>			<b>0.01</b>	<b>7</b>	<b>0</b>	<b>7</b>
88	38224	March 90	9.0	26638	075106	Bonifer	0.00	0	0	0
88	37538	March 90	9.0	26160	075107	Bonifer	0.00	0	0	0
88	38583	March 90	9.0	26888	075108	Bonifer	0.00	0	0	0
-----				-----			-----	---	---	---
<b>Total</b>	<b>114345</b>			<b>79686</b>			<b>0.00</b>	<b>0</b>	<b>0</b>	<b>0</b>
88	39012	March 90	9.6	25611	075109	Nr. Bonifer	0.01	3	0	3
88	40072	March 90	9.6	26307	075110	Nr. Bonifer	0.02	8	0	8
88	38343	March 90	9.6	25172	075111	Nr. Bonifer	0.01	5	0	5
-----				-----			-----	---	---	---
<b>Total</b>	<b>117427</b>			<b>77090</b>			<b>0.01</b>	<b>16</b>	<b>0</b>	<b>16</b>

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File Name: C:\123R2\FILES\CHSSURV

- /1 Includes one observed fish captured at Cowlitz Hatchery in Washington.
- /2 Includes one observed fish captured at Tucannon Trout Hatchery in Washington.
- /3 Includes one observed fish captured at Hells Canyon trap.

Two other acclimation evaluation experiments have been performed at Bonifer. One experiment was conducted in the fall of 1989 and another experiment was conducted in the spring of 1990. Both releases were from 1988 brood and the only recoveries through 1991 have been age-3 fish.

### Coho

Coded-wire tagged yearling coho salmon have been released into the Umatilla River since 1987 (Table 26). These fish have been from Tanner Creek stock reared at Cascade Hatchery.

The first release was from Minthorn in April, 1987. The average survival rate was 1.67%. The highest percentage of the recoveries was in the ocean (55.5%), while recoveries

Table 26. Liberation and survival information for coho salmon released in the Umatilla River. /1

Brood	Number Released	Date of Release	Size at Release	Number Tagged	CWT Code	Release Location	Estimated Adult Survivals				
							%	Total	Ocean	Col.R.	Uma.R.
a5	37245	Apr a7	13.5	13440	073617	Minthorn	1.93	721	346	338	36
a5	53754	Apr a7	13.5	19879	073624	Minthorn	1.67	898	522	352	24
a5	70890	Apr 87	13.5	26740	073625	Minthorn	1.54	1090	636	427	27
	-----			-----			-----	-----	-----	-----	-----
Total	161889			60059			1.67	2708	1504	1117	a7
86	68208	Mar 88	16.8	20592	074356	Lower Umatilla R.	4.29	2925	1679	858	388
86	73650	Mar 88	17.3	1a963	074357	Lower Umatilla R.	4.07	2995	1724	746	524
86	61606	Mar 88	15.7	18513	074358	Lower Umatilla R.	4.09	2519	1521	562	436
	-----			-----			-----	-----	-----	-----	-----
Total	203464			58068			4.14	8438	4924	2166	1348
87	75970	Mar 89	17.2	27062	074609	Nr. Minthorn	0.55	415	255	121	39
a7	72627	Mar 89	17.3	26416	074610	Minthorn	1.01	731	533	118	80
a7	a4672	Mar 89	19.1	26739	074611	Minthorn	1.07	909	700	114	95
	-----			-----			-----	-----	-----	-----	-----
Total	157299			53155			1.04	1640	1233	232	175
88	67309	Mar 90	13.5	28033	074814	Minthorn	2.76	1858	651	1032	175
88	59682	Mar 90	13.3	26381	074813	Nr. Minthorn	2.81	1676	593	946	138
88	65095	Apr 90	11.2	27226	074815	Minthorn	3.61	2350	866	1284	201
a9	152974	Mar 91	15.4	24584	075535	Minthorn	0.01	19	0	0	19
a9	449678	Mar 91	16.5	25905	075534	Uma Rm 56-60	0.02	104	0	17	a7
a9	352977	Mar 91	16.8	24851	075533	Uma Rm 63-70	0.01	28	0	0	28

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/1 Survival data for the 1989 brood includes age-2 fish only (1991 returns).

in the Columbia River and Umatilla River were 41.2 and 3.2%, respectively. Exploitation of this release was 95.1%. Exploitation rates in the commercial ocean and Columbia River gillnet fisheries were 39.4 and 25.9%, respectively. The sport fishery accounted for 29.8% of the catch while no fish were captured in the treaty fishery.

The second release of coded-wire tagged coho was in the lower Umatilla River in March, 1988 (Table 26). These fish were smaller than the fish released in 1987, but overall survival was much higher (4.14%). The ocean recovery rate (58.4%) was similar to the recovery rate for the 1987 release (55.5%). The recovery rates in the Columbia and Umatilla rivers (25.7 and 16.0%, respectively) differed however. Exploitation of this release (83.2%) was lower than the exploitation rate for the 1987 releases (95.1%). Exploitation rates in the commercial ocean and Columbia River gillnet fisheries were 32.1 and 17.9%, respectively. The exploitation rates in the sport and treaty fisheries were 30.9 and 2.3%, respectively.

Two groups of coho were released in 1989 (Table 26). One group was acclimated at Minthorn and a control group was released into the Umatilla River at the same time as the acclimated release. Estimated survival of the acclimated group was nearly twice that of the control group (1.04 versus 0.55%, respectively). The percentages of the acclimated fish recovered in the ocean, Columbia River, and Umatilla River were 75.2, 14.1 and 10.7%, respectively. The percentages of the control fish recovered were 61.4, 29.2 and 9.4%, respectively. The estimated recovery rate of adults in the Umatilla River from the acclimated release (0.11%) was also twice that of the control group (0.05%). These recovery rates suggest that acclimation provided a benefit toward overall survival and survival back to the Umatilla River. The exploitation rates on the acclimated and non-acclimated groups were 57.8 and 85.5%, respectively.

Three groups of coho (1988 brood) were released in the spring of 1990 (Table 26). One group was acclimated at Minthorn for 21 days and released in March, while a non-acclimated group was released instream concurrent with the acclimated group. A third group was held at Minthorn and given the opportunity to voluntarily release (Rowan 1991). Very few fish voluntarily left the pond however, and they were crowded out of the pond in April after being held for 36 days. The size at release for this group of fish (11.2/lb.) was higher than the average size of the acclimated and control groups (13.5 and 13.3/lb.).

The estimated survival rates (preliminary data) of the acclimated group released in March and the non-acclimated control group are similar (2.76 and 2.81%, respectively). The estimated survival rates to the Umatilla River are also similar for the acclimated and control groups (0.26 and 0.23%, respectively). Unlike the experiment conducted in 1989, the data for the 1990 releases indicate no benefit of acclimation to overall survival and only a slight increase in survival back to the Umatilla River. The overall survival of the group held longer at Minthorn is much higher, however (3.61%). The return to the Umatilla River is also higher (0.31%). It is difficult to know whether the increase in survival is a result of increased

acclimation time or a larger mean weight at release. Both factors may be beneficial in increasing adult survival.

The distribution of the recoveries from all three releases is similar. Ocean recoveries range from 35.4 to 36.9%, Columbia River recoveries range from 54.6 to 56.4%, and Umatilla River recoveries range from 8.4 to 9.4%. The exploitation rates are also very similar for all three releases and range from 83.3 to 87.0%.

## **Project Difficulties**

### Operational problems at Bonifer

In previous years, problems at Bonifer with excessive aquatic vegetation, disease and low dissolved oxygen concentrations during fall acclimation of juvenile salmon have occurred (Rowan 1991). In 1989, 1990 and 1991, the fish were held for only a three-day post-transport recovery period to help alleviate these problems. This strategy appears to be partially successful in that disease has not been a problem since the 1988 fall release of spring chinook. Low dissolved oxygen concentrations continue to be experienced however. Oxygen concentrations have been adequate for short-term juvenile holding without feeding, but long term holding has been difficult and is not recommended without oxygen supplementation. The aquatic vegetation problem was partially solved in 1991. Prior to arrival of the fish in November, the pond was drained for approximately one week and allowed to dry as much as possible. Most of the vegetation appeared to have died and did not come back when the pond was refilled. This eliminated release problems but the decomposing plant material may have reduced oxygen concentrations.

### Operational problems at Minthorn

At Minthorn, insufficient flows, low oxygen concentrations and disease have been reoccurring problems in the fall (Rowan 1991). Raceway effluent water had to be recirculated back into the intake pond and liquid oxygen supplementation was required. As a result of these problems, an acclimation study was not conducted at Minthorn in the fall of 1991.

### Research problems

Definitive information on the outmigration of particular releases of juvenile salmon has been difficult to obtain. Multiple releases make it difficult to distinguish between acclimated and control groups and subspecies (fall and spring chinook of similar size). Unless fish are differentially marked or sacrificed for coded-wire tagged recovery, different groups can not be distinguished downstream in the Umatilla or Columbia River.

## Summary of Expenditures

Expenditures for activities associated with the operation, maintenance and evaluation of Bonifer and Minthorn Acclimation Facilities in 1991 totaled \$198,810.75. Most expenditures were for personnel and subcontract to coded-wire tag fish (Table 27).

Table 27. Expenditures for Bonifer and Minthorn Facilities operation, maintenance and evaluation in 1991.

Line Item	Expenditure
Personnel	80,804.14
Travel (all)	413.00
Fish Food	3,424.00
Property Lease	307.22
Facility Use Fees	1488.00
Electricity/Utilities (Minthorn)	1,793.68
Materials and Supplies	7,366.51
Communications (telephone/alarm)	2,643.98
Repairs and Maintenance (equipment servicing)	2,273.57
Printing/Duplication	870.31
Equipment Rental (GSA mileage, rental & service)	6,712.67
Equipment Rental (General)	400.82
Training	526.50
Office Supplies	14.77
	-----
SUBTOTAL:	109,039.17
Indirect	30,421.93
Capital Equipment *	1,725.00
Sub-contract	57,623.55
	-----
TOTAL:	198,810.15
* Capital Equipment	
Trailer	1,250.00
Chair	174.00
Attache Case	58.50
Air pump	243.00
	-----
Total:	1,725.50

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## **APPENDICES**

Appendix A. Umatilla River summer steelhead broodstock collection in 1990-91.

Date	Mark /2	Hatchery /1				Wild				Total			
		Hale	Female	Unknown	Total	Male	Female	Unknown	Total	Hale	Female	Unknown	Total
11-2	3 LOP	0	1	0	1	0	3	0	3	0	4	0	4
11-5	3 LOP	0	0	0	0	1	1	0	2	1	1	0	2
11-13	3 LOP	1	1	0	2	5	0	0	5	6	1	0	7
11-26	3 LOP	0	0	1	1	0	0	0	0	0	0	1	1
12-13	3 LOP	0	1	0	1	2	3	0	5	2	4	0	6
12-31	3 LOP	1	1	0	2	0	0	0	0	1	1	0	2
1-22	2 LOP	1	1	0	2	2	2	0	4	3	3	0	6
2-1	2 LOP	0	0	0	0	0	2	0	2	0	2	0	2
2-6	2 LOP	10	13	0	23	6	4	0	10	16	17	0	33
2-7	2 LOP	1	2	0	3	6	6	0	12	7	a	0	15
2-11	2 LOP	0	0	0	0	3	4	0	7	3	4	0	7
2-13	2 LOP	1	0	0	1	0	0	0	0	1	0	0	1
2-15	2 LOP	2	4	0	6	2	2	0	4	4	6	0	10
2-17	2 LOP	1	2	0	3	0	0	0	0	1	2	0	3
2-21	2 LOP	3	10	0	13	5	5	0	10	a	15	0	23
2-22	2 LOP	2	0	0	2	0	0	0	0	2	0	0	2
2-25	2 LOP	0	6	0	6	0	3	0	3	0	9	0	9
2-27	2 LOP	7	0	0	7	0	0	0	0	7	0	0	7
3-1	1 LOP	3 /3	6	0	9	2	0	0	2	5	6	0	11
3-4	1 LOP	5 /3	1	0	6	2	1	0	3	7	2	0	9
3-a	1 LOP	2	0	0	2	0	0	0	0	2	0	0	2
3-11	1 LOP	2 /3	4	0	6	1	1	0	2	3	5	0	a
3-15	1 LOP	2 /4	2	0	4	0	0	0	0	2	2	0	4
3-20	1 LOP	2 /3	1	0	3	0	0	0	0	2	1	0	3
3-29	1 LOP	0	0	0	0	2	4	0	6	2	4	0	6
4-3	1 LOP	0	0	0	0	2	4	0	6	2	4	0	6
4-11	1 LOP	0	0	0	0	4	4	0	a	4	4	0	a
4-22	1 LOP	0	0	0	0	1	4	0	5	1	4	0	5
		...	...	...	...	...	...	...	...	...	...	...	...
	Total	46	56	1	103	46	53	0	99	92	109	1	202

Revised: 1-25-92

File Name: C:\123R2\FILES\91BROOD

- /1 ADLV clipped unless otherwise noted.
- /2 3LOP = three left opercle hole punches.  
2LOP = two Left opercle hole punches.  
1LOP = one Left opercle hole punch.
- /3 Adipose clipped only.
- /4 One is Ad only clipped.

Appendix B. Steelhead broodstock spawning at Minthorn Acclimation Facility in 1991.

Date Spawmed	Fish No.	Sex	Family No.	Fork Length (mm)	Meps Length (mm)	Wt. (lbs.)	Fin Marks	Opercle Mark	Haul Date	Scale No.	Green Eggs	Eyed Eggs
4-1-91	1	F	A	630	535	3.81	AdRV	2LOP	Jan-Feb	S1-1		
	2	F	A	740	620	5.87	AdLV	2LOP	Jan-Feb	SI-2		
	3	F	A	760	645	6.5	AdLV	2LOP	Jan-Feb	SI-3		
Fertilized with three wild males (live spawned)												
4-1-91	4	F	B	695	580	4.87	AdLV	2LOP	Jan-Feb	SI-4		
	5	F	B	715	600	5.75	AdLV	2LOP	Jan-Feb	SI-5		
	6	F	B	730	615	5.75	AdLV	2LOP	Jan-Feb	SI-6		
Fertilized with three wild males (live spawned)												
4-1-91	7	F	C	685	585	4.81	AdLV	2LOP	Jan-Feb	S1-7		
	8	F	C	675	570	5.18	AdLV	1LOP	Mar-Apr	SI-8		
	9	F	C	675	570	4.43	AdLV	2LOP	Jan-Feb	SI-9		
Fertilized with three wild males (live spawned)												
4-1-91	10	F	D	---	575	4.56	None	3LOP	Nov-Dee	S1-10		
	11	F	D	710	610	5.18	None	3LOP	Nov-Dee	S1-11		
	12	F	D	---	565	4.37	None	2LOP	Jan-Feb	S1-12		
	13	M	D	720	575	7.25	AdLV	2LOP	Jan-Feb	S2-2		
	14	M	D	745	600	7.5	AdLV	2LOP	Jan-Feb	S2-3		
Fertilized with three hatchery males (one was live spawned)												
4-t-91	15	F	E	---	575	5	AdLV	2LOP?	Jan-Feb	SI-13		
	16	F	E	720	620	5.93	AdLV	1LOP	Mar-Apr	S1-14		
	17	F	E	725	625	5.43	AdLV	3LOP	Nov-Dee	S1-15		
Fertilized with three wild males (live spawned)												
4-1-91	18	F	F	680	580	5.31	AdLV	2LOP	Jan-Feb	SI-16		
	19	F	F	715	590	5.5	AdLV	2LOP	Jan-Feb	SI-17		
	20	F	F	745	635	6.81	AdLV	2LOP	Jan-Feb	SI-18		
Fertilized with three wild males (Live spawned)												
4-1-91	21	F	G	710	585	5.68	AdLV	1LOP	Mar-Apr	SI-19		
Fertilized with three wild males (live spawned)												

Revised: 1-25-92

File Name: C:\123R2\FILES\SPAWN91

Appendix B. (cont.)

Date Spawned	Fish No.	Sex	Family No.	Fork Length (mm)	Meps Length (mm)	Wt. (lbs.)	Fin Marks	Opercle Mark	Haul Date	Scale No.	Green Eggs	Eyed Eggs
4-1-91	22	F	G	730	620	6.18	None	2LOP	Jan-Feb	S1-20		
	23	F	G	580	490	3.18	None	2LOP	Jan-Feb	S2-1		
	24	M	G	800	655	9.37	AdLV	2LOP	Jan-Feb	S2-4		
	25	M	G	770	640	8.5	AdLV	2LOP	Jan-Feb	S2-5		
The eggs were combined with fish number 21 to form one family group											138,868	114,092
4-8-91	26	F	H	765	645	6.93	AdLV	2LOP	Jan-Feb	S3-1		
	27	F	H	695	590	6.06	AdLV	2LOP	Jan-Feb	S3-2		
	28	F	H	700	580	5.31	AdLV	2LOP	Jan-Feb	S3-3		
Fertilized with three wild males (live spawned; unused)												
4-8-91	29	F	I	715	610	5.31	AdLV	2LOP	Jan-Feb	S3-4		
	30	F	I	695	595	5.06	AdLV	2LOP	Jan-Feb	S3-5		
	31	F	I	695	595	5	AdLV	2LOP	Jan-Feb	S3-6		
Fertilized with three wild males (live spawned; two used; one unused)												
4-8-91	32	F	J	695	595	5.93	AdLV	2LOP	Jan-Feb	S3-7		
	33	F	J	700	600	5.18	AdLV	2LOP	Jan-Feb	S3-8		
	34	F	J	745	630	6.06	AdLV	2LOP	Jan-Feb	S3-9		
Fertilized with three wild males (live spawned; one used; two unused)												
4-8-91	35	F	K	705	595	5.5	AdLV	2LOP	Jan-Feb	S3-10		
	36	F	K	705	600	5.18	AdLV	2LOP	Jan-Feb	S3-11		
	37	F	K	755	640	6.68	AdLV	2LOP	Jan-Feb	S3-12		
Fertilized with three wild males (live spawned; unused)												
4-8-91	38	F	L	A 5	620	5.43	AdLV	3LOP	Nov-Dee	S3-13		
	39	F	L	710	605	5.93	AdLV	3LOP	Nov-Dee	S3-14		
	40	F	L	710	605	6.31	AdLV	1LOP	Mar-Apr	S3-15		
Fertilized with three wild males (live spawned; one used; two unused)												
4-8-91	41	F	M	765	640	6.81	None	3LOP	Nov-Dee	S3-16		
	42	F	M	540	450	2.25	None	1LOP	Mar-Apr	S3-17		
	43	F	M	710	590	5.56	None	1LOP	Mar-Apr	S3-18		
	44	M	M	710	590	6.12	AdLV	2LOP	Jan-Feb	S3-19		
	45	M	M	695	570	6.43	AdRV	1LOP	Mar-Apr	S3-20		
	46	M	M	785	645	9.12	AdLV	2LOP	Jan-Feb	S4-1		

Appendix B. (cont.)

Date Spawmed	Fish No.	Sex	Family No.	Fork Length (mm)	Meps Length (mm)	Wt. (lbs.)	Fin Marks	Opercle Mark	Haul Date	Scale No.	Green Eggs	Eyed Eggs
4-8-91	47	F	N	760	630	6.75	None	2ROP	Jan-Feb	S4-2		
	48	F	N	755	625	6.56	None	2LOP	Jan-Feb	S4-3		
	49	M	N	815	670	9.25	AdLV	2LOP	Jan-Feb	S4-4		
	50	M	N	740	605	7.93	AdLV	2LOP	Jan-Feb	S4-5		
											-----	
											142,292	115,658
4-a-91	51	F	---	665	560	6.8	AdLV	1LOP	Mar-Apr	MI-3	Green	
4-15-91	52	F	0	675	560	4.9	None	2LOP	Jan-Feb	S4-6		
	53	F	0	700	580	5.9	None	1LOP	Mar-Apr	S4-7		
	54	F	0	---	595	5.8	None	1LOP	Mar-Apr	S4-8		
Fertilized with three wild males (live spawned; unused)												
4-15-91	55	F	P	680	565	5.1	None	2LOP	Jan-Feb	S4-9		
Fertilized with the same three males used in family group 0											-----	-----
											24,052	21,261
4-23-91	56	F	Q	700	595	5.4	None	1LOP	Mar-Apr	S6-12		
	57	F	Q	665	580	4.2	None	3LOP	Nov-Dec	S6-13		
	58	F	Q	730	635	5.5	None	2LOP	Jan-Feb	S6-14		
Fertilized with three wild males (Live spawned; unused)												
4-23-91	59	F	R	595	520	2.6	None	1LOP	Mar-Apr	S6-15		
	60	F	R	770	660	6.7	None	2LOP	Jan-Feb	S6-16		
	61	F	R	720	625	5.4	None	1LOP	Mar-Apr	S6-17		
Fertilized with three wild males (Live spawned; unused)												
4-23-91	62	F	S	755	660	6.3	None	1LOP	Mar-Apr	S6-18		
	63	F	S	715	615	5.4	None	3LOP	Nov-Dec	S6-19		
	64	F	S	690	595	4.9	None	2ROP	Jan-Feb	S6-20		
Fertilized with three wild males (Live spawned; unused)											-----	-----
											55,896	50,796
4-29-91	65	F	T	---	595	5.6	None	2LOP	Jan-Feb	S7-1		
	66	F	T	695	575	5.3	None	2LOP	Jan-Feb	S7-2		
	67	F	T	660	555	4.4	None	1LOP	Mar-Apr	S7-3		
Fertilized with three wild males (Live spawned; unused)											-----	-----
											20,846	14,284

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File Name: C:\123R2\FILES\SPAWN91

Appendix B. (cont.)

Date Spawmed	Fish No.	Sex	Family No.	Fork Length (mm)	Meps Length (mm)	Wt. (/1 (lbs.))	Fin Marks	Opercle Mark	Haul Date	Scale No.	Green Eggs	Eyed Eggs
4-29-91	68	M	---	770	630	a.3	None	3LOP	Nov-Dee	S7-4	Not used	
	69	M	---	655	550	4.8	None	1LOP	Mar-Apr	S7-5	Not used	
	70	M	---	590	490	4.0	None	2LOP	Jan-Feb	S7-6	Not used	
	71	F	---	740	630	7.3	None	1LOP	Mar-Apr	S7-7	Green	
	72	F	---	670	560	6.1	None	2LOP	Jan-Feb	S7-8	Green	
	73	F	---	695	590	6.1	None	1LOP	Mar-Apr	S7-9	Green	
5-6-91	74	F	U	695	610	4.7	None	2LOP	Jan-Feb	S8-1		
	75	F	U	555	480	2.7	None	2LOP	Jan-Feb	sa-2		
	76	F	U	560	485	2.6	None	2LOP	Jan-Feb	sa-3		
	77	M	U	545	465	3.1	None	3LOP	Nov-Dee	sa-4		
	78	M	U	---	500	2.6	None	3LOP	Nov-Dee	sa-5		
	79	M	U	560	470	3.0	None	1LOP	Mar-Apr	sa-6		
5-6-91	80	F	V	565	455	2.3	None	1LOP	Mar-Apr	sa-7		
	81	F	V	575	485	2.9	None	2LOP	Jan-Feb	S8-8		
	a2	M	V	790	675	8.8	Ad only	1LOP	Mar-Apr	sa-9		
	a3	M	V	555	460	2.5	None	2LOP	Jan-Feb	S8-10		
5-6-91	a4	F	W	655	555	3.8	None	2LOP	Jan-Feb	S8-11		
	a5	F	U	---	515	3.3	None	2LOP	Jan-Feb	sa-12		
	86	M	U	595	500	3.4	None	3LOP	Nov-Dee	S8-13		
	a7	M	W	530	445	2.3	None	2LOP	Jan-Feb	sa-14		
											-----	-----
											28,402	26,987
											=====	=====
TOTAL											410,356	343,078
FECUNDITY											6,412	

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/1 Stripped weights.

Appendix C. Fall chinook salmon spawning at **Minthorn**  
 Acclimation Facility in 1991.

Date Spawned	Family No./1	Females	Males	Green Eggs	Eyed Eggs
11-6-91	1	4	4		
	2	4	4		
	3	4	4		
	4	4	4		
	5	4	4		
	6	4	4		
	7	4	4		
	8	3	3		
	---	1 Green	0		
		32	31	96,263	88,734
11-12-91	9	4	4		
	10	4	4		
	11	4	4		
	12	4	4		
	13	4	4		
	14	4	4		
	15	4	4		
	16	4	4		
	17	4	4		
	18	4	4		
	19	4	4		
	20	2	2		
	---	1 Green	1 Green		
		47	47	202,088	177,432
11-14-91	21	4	4		
	22	4	4		
	23	4	4		
	24	4	4		
	25	4	4		
	26	4	4		
	27	4	4		
	28	2	2		
		---	0	2 Green	
		30	32	126,033	110,270

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File Name: C:\123R2\FILES\CHFSPAWN

Appendix C. (cont.)

Date Spawned	Family No./1	Females	Males	Green Eggs	Eyed Eggs
11-18-91	29	4	4		
	30	4	4		
	31	4	4		
	32	4	4		
	33	4	4		
	34	4	4		
	35	4	4	Live spawned	
	36	1	1	Live spawned	
	---	1 Bloody	1	Green	
		---	---	-----	-----
		30	30	99,436	92,244
11-21-91	37	4	4	Live spawned	
	38	4	4	Live spawned	
	39	4	4		
	40	4	4		
	41	1	1		
	---	2 Green	0		
		1 Spent	0		
		---	---	-----	-----
		20	17	59,322	53,250
11-26-91	42	4	4		
	43	2	2		
		---	---	-----	-----
		6	6	21,406	20,250
		===	===	=====	=====
	TOTALS	165	163	601,548	542,180
	FECUNDITY			3,783	

Revised: 1-25-92 File Name: C:\123R2\FILES\CHFSPAWN

/1 A spawning matrix of 1:1 was utilized, but after fertilization, the eggs from four females were combined to form one family group.

Appendix D. Fish sampled at the Westland Canal fish trapping facility in 1991. /1

Salmonids															
Date	Total Fish Sampled	Hatchery			Natural Production			Non-game and Warm Water Species							
		Coho (Y)	Chinook (Y)	Chinook (SY)	STS (Y)	STS (Y)	Coho (Y)	Chinook (SY)	STS (Y)	Suckers	Dace	Chisel-mouths	Shiners	Squawfish	Other
6-17	535	1	0	501	3	6	1	2	0	6	3	8	1	2	1
6-19	321	0	0	295	1	4	4	1	0	6	0	4	0	6	0
6-21	154	0	0	123	0	3	0	1	0	18	0	5	1	1	2
6-24	361	0	0	333	2	2	0	5	0	5	0	9	0	5	0
6-26	339	0	0	320	2	3	0	6	0	0	0	4	2	2	0
6-28	413	0	0	385	0	0	0	71	0	8	0	6	0	2	1
7-1	511	0	0	481	0	2	0	5	0	11	0	9	0	3	0
7-3	314	3	0	267	0	0	0	37	0	2	0	3	1	1	0
7-8	239	0	0	98	0	0	0	720	1	6	0	0	3	2	9
7-11	155	0	0	28	0	0	0	51	0	41	0	7	15	8	5
7-15	155	0	0	29	0	0	3	84	1	6	0	10	0	13	9
7-18	65 /2	0	0	30	0	0	0	0	0	20	0	10	0	4	1
7-22	79	0	0	27	0	0	1	0	0	15	0	9	1	12	14
7-25	50 /3	0	0	45	0	0	0	5	0						
8-1	22 /4	0	0	21	0	0	0	1	0						
8-7	57 /4	0	0	49	0	0	0	8	0						
8-14	26 /4	0	0	23	0	0	1	2	0						
TOTAL	3796	4	0	3055	8	20	10	339	2	144	3	84	24	61	42

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File Name: C:\123R2\FILES\WLDSA912

/1 Y = yearling; SY = subyearling.

A high degree of variability in species and size made it difficult to obtain random samples.

/2 Estimated numbers. The fish were not sampled.

/3 Estimated numbers. The fish were not sampled and non-salmonid species were not hauled.

/4 Actual counts. Non-salmonid species were not sampled or hauled.

Appendix E. Summary of hourly temperature data at Minthorn  
Acclimation Facility in 1991.

DAY	JANUARY			FEBRUARY		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
1	5.6	7.3	6.4	7.2	8.1	7.6
2	5.3	6.7	5.8	7.8	8.6	8.2
3	5.3	5.9	5.6	7.8	9.1	8.5
4	5.3	5.7	5.5	8.5	8.9	8.6
5	4.9	5.5	5.1	8.4	9.9	8.9
6	4.6	5.2	4.8	6.6	8.7	7.8
7	4.3	5.7	4.9	6.5	8.7	7.6
8	5.3	7.1	6.1	6.6	8.5	7.5
9	5.3	6.1	5.5	7.3	8.1	7.7
10	5.6	6.7	6.1	7.3	7.8	7.5
11	6.5	7.1	6.8	7.3	7.7	7.4
12	7.3	9	8.2	7.1	8.1	7.6
13	7.8	9.1	8.4	7.8	9.3	8.6
14	8.1	9.2	8.6	8.7	9.8	9.3
15	6.1	9.1	7.5	8.7	9.2	9.0
16	6.7	8.7	7.6	8.0	9.4	8.7
17	8.6	9.9	9.1	7.4	8.7	8.0
18	8	8.8	8.4	7.0	8.6	7.9
19	7.6	8.5	8.1	8.1	9.3	8.7
20	6.6	7.9	7.2	8.5	9.6	9.0
21	6.2	7.7	6.9	8.4	10.4	9.2
22	6.3	7.8	7.1	7.6	10.0	8.6
23	6.2	7.5	6.9	6.7	9.6	8.1
24	6.5	7.8	7.1	6.5	9.7	8.0
25	5.8	7.1	6.5	6.5	9.8	8.0
26	6.1	7.3	6.6	6.4	9.6	7.9
27	5.3	7.4	6.3	6.4	9.8	8.0
28	5.9	6.9	6.5	6.4	9.4	7.9
29	4.6	6.4	5.6			
30	5.7	6.9	6.2			
31	6.2	7.8	7			
Total	4.3	9.9	6.7	6.4	10.4	8.2

Revised: 1-31-92

File Name: C:\123R2\FILES\91MNTEMP

Appendix E. (cont.)

DAY	MARCH			APRIL		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
1	6.8	8.4	7.5	8.7	12.1	10.4
2	6.4	7.9	7.1	8.9	10.8	9.7
3	7.1	10.1	8.5	7.4	9.5	8.6
4	7.6	9.2	8.6	8.7	10.6	9.5
5	6.5	8.7	7.4	8.5	9.6	9.1
6	6.6	9.0	7.6	7.7	11.9	9.6
7	6.7	8.2	7.4	7.8	10.5	9.1
8	6.4	10.3	8.2	7.0	11.1	9.2
9	7.0	8.9	8.0	8.3	11.1	9.4
10	7.1	9.3	8.1	6.9	9.5	8.1
11	6.5	9.4	7.9	7.5	12.3	9.7
12	7.3	8.5	7.8	7.2	12.6	9.8
13	6.4	10.2	8.1	7.6	12.6	10.1
14	6.6	8.8	7.6	8.5	11.0	9.6
15	6.5	9.9	8.0	7.7	9.3	8.4
16	6.0	10.3	8.1	8.3	11.4	9.6
17	6.4	10.4	8.2	8.0	11.6	9.8
18	6.4	9.3	7.9	7.6	13.4	10.3
19	7.4	8.2	7.9	8.1	12.8	10.4
20	6.9	11.1	8.8	8.1	12.9	10.5
21	6.6	11.0	8.9	8.8	13.9	11.1
22	7.8	9.8	8.6	8.7	14.1	11.2
23	7.4	9.5	8.4	8.6	12.6	10.7
24	7.7	9.7	8.4	9.2	11.5	10.1
25	6.7	8.4	7.5	8.0	11.6	9.6
26	6.2	10.1	8.0	7.8	11.1	9.4
27	6.4	10.8	8.4	8.2	9.9	9.0
28	7.3	8.9	8.1	7.5	11.7	9.5
29	7.0	10.8	8.8	8.0	12.6	10.0
30	7.3	11.8	9.5	8.1	13.9	10.9
31	8.4	12.3	10.4			
Total	6.0	12.3	8.2	6.9	14.1	9.7

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Appendix E. (cont.)

DAY	MAY			JUNE		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
1	8.5	13.3	10.8	9.2	15.4	12.2
2	8.3	13.5	10.8	9.7	15.7	12.5
3	8.2	13.9	11.0	9.6	14.7	11.9
4	9.2	14.5	11.8	8.6	13.1	11.0
5	10.0	12.2	11.1	9.8	12.6	11.1
6	9.3	11.8	10.4	9.4	12.6	10.9
7	9.2	11.3	10.3	9.4	13.6	11.5
8	9.4	12.4	10.5	10.2	14.5	12.3
9	8.1	10.9	9.7	-9.9	16.1	12.9
10	8.6	12.2	10.4	10.3	16.7	13.5
11	9.5	12.8	11.0	11.4	15.9	13.4
12	9.4	12.1	10.5	10.2	12.8	11.6
13	9.2	11.8	10.4	9.8	12.2	11.0
14	9.6	14.8	11.9	10.0	15.2	12.3
15	9.2	14.7	11.8	10.3	14.1	12.3
16	10.5	12.1	11.3	10.5	14.4	12.5
17	9.5	10.8	10.1	10.0	15.7	12.9
18	9.0	13.1	11.0	10.5	15.1	12.7
19	8.6	10.6	9.3	10.8	13.4	12.2
20	8.3	10.2	9.1	11.1	12.6	11.8
21	8.3	11.6	9.7	10.9	14.3	12.5
22	8.6	13.2	10.6	11.1	15.6	13.2
23	8.8	13.5	10.8	11.0	15.3	13.3
24	8.9	12.6	10.4	11.8	14.4	12.8
25	8.9	11.6	10.1	11.6	15.0	13.2
26	8.7	13.7	10.9	11.6	16.6	14.1
27	8.9	14.1	11.2	11.8	16.2	14.1
28	8.6	14.9	11.5	12.3	14.7	13.7
29	9.1	12.6	10.8	11.9	13.2	12.6
30	9.2	13.5	11.1	11.3	16.8	14.0
31	9.2	15.0	11.9			
Total	8.1	15.0	10.7	8.6	16.8	12.5

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Appendix E. (cont.)

DAY	JULY			AUGUST		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
1	12.3	17.6	14.9	15.8	18.7	17.2
2	12.6	18.2	15.4	15.0	18.6	16.8
3	13.0	18.5	15.8	15.3	18.9	17.1
4	13.4	18.3	15.8	15.8	18.6	17.2
5	12.9	18.0	15.4	16.2	18.4	17.2
6	12.5	17.4	15.0	16.2	19.3	17.6
7	12.3	17.4	14.9	16.2	18.7	17.4
8	12.7	17.7	15.2	15.8	19.3	17.5
9	13.2	16.9	15.1	16.2	19.1	17.6
10	12.6	17.5	15.1	15.6	18.4	16.9
11	12.8	17.7	15.3	14.6	18.0	16.4
12	13.6	18.3	16.0	14.7	18.2	16.5
13	14.7	18.6	16.6	15.0	18.4	16.7
14	14.0	17.9	16.0	15.3	18.7	17.0
15	13.6	16.2	15.1	15.6	19.0	17.3
16	13.7	15.0	14.4	15.9	19.1	17.5
17	13.6	16.1	14.6	16.2	19.3	17.7
18	12.9	17.6	15.3	16.5	19.5	18.0
19	13.7	17.9	15.8	17.4	20.0	18.6
20	13.9	18.0	15.9	16.8	19.5	18.1
21	14.2	18.3	16.3	16.2	19.1	17.6
22	14.7	18.5	16.6	16.2	19.1	17.7
23	14.9	18.8	16.9	16.3	18.8	17.5
24	15.5	18.3	16.9	15.4	17.4	16.5
25	15.4	18.1	16.6	15.4	17.8	16.5
26	14.5	18.0	16.3	14.6	17.6	16.2
27	14.7	18.5	16.6	15.0	16.7	16.0
28	15.3	18.6	17.0	15.4	16.8	16.2
29	15.3	18.7	17.0	15.3	18.3	16.9
30	15.4	19.0	17.1	15.9	18.6	17.3
31	15.4	18.6	17.1	16.1	18.4	17.3
Total	12.3	19.0	15.9	14.6	20.0	17.2

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Appendix E. (cont.)

DAY	SEPTEMBER			OCTOBER		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
1	16.2	18.0	17.0	13.9	15.4	14.8
2	14.7	17.4	16.1	13.9	15.3	14.6
3	14.6	17.4	16.1	12.8	14.4	13.7
4	14.9	17.6	16.3	11.9	13.7	12.9
5	15.0	17.7	16.4	11.6	13.4	12.7
6	15.1	17.7	16.5	11.8	13.6	12.9
7	15.9	17.2	16.6	12.4	14.1	13.3
8	14.7	16.9	15.9	12.3	13.8	13.1
9	13.9	16.3	15.3	12.0	13.7	13.0
10	14.4	16.8	15.6	12.1	13.7	13.1
11	14.4	17.0	15.8	12.2	13.8	13.1
12	14.6	17.1	15.9	12.5	14.1	13.3
13	15.0	16.4	15.7	12.2	13.5	12.9
14	13.9	16.2	15.1	11.8	13.7	12.8
15	13.4	16.0	14.9	11.8	13.7	12.9
16	13.8	16.2	15.1	12.8	13.6	13.2
17	14.2	16.4	15.4	11.8	13.1	12.4
18	14.3	16.3	15.4	10.8	12.6	11.8
19	14.0	16.2	15.3	11.2	13.0	12.0
20	14.4	16.0	15.2	11.1	13.2	12.3
21	13.9	15.6	14.7	12.2	13.6	12.9
22	12.6	14.8	13.8			
23	13.0	15.0	14.1	11.6	12.3	11.9
24	13.2	15.3	14.4	11.1	11.7	11.5
25	13.6	15.6	14.7	11.4	12.4	12.0
26	13.9	15.8	14.9	11.2	12.1	11.7
27	14.2	15.9	15.1	10.7	11.2	10.9
28	14.8	15.7	15.3	10.3	11.3	10.8
29	13.7	15.6	14.7	9.3	10.2	9.7
30	13.5	15.4	14.6	8.3	9.8	9.2
31				9.5	10.1	9.8
Total	12.6	18.0	15.4	8.3	15.4	12.4

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File Name: C:\123R2\FILES\91MNTMP

Appendix E. (cont.)

DAY	NOVEMBER			DECEMBER		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
1	9.6	10.3	10.0	8.8	10.3	9.7
2	9.5	10.3	10.0	9.8	10.4	10.1
3	9.1	10.0	9.5	9.9	11.0	10.3
4	9.8	11.1	10.3	9.7	10.8	10.2
5	11.1	12.2	11.7	9.6	10.6	10.1
6	11.1	11.9	11.4	8.3	10.8	10.5
7	10.8	11.3	11.1	6.5	7.8	7.1
8	10.8	11.5	11.2	7.8	9.9	9.0
9	11.0	11.8	11.4	8.8	10.4	9.6
10	10.6	11.6	11.2	8.6	9.8	9.2
11	10.8	11.6	11.2	8.6	10.2	9.5
12	11.5	11.9	11.7	8.5	10.0	9.7
13	10.5	11.6	11.1	8.1	9.5	8.7
14	9.7	10.5	10.3	7.8	8.8	8.3
15	8.9	10.0	9.5	7.1	8.5	7.8
16	8.7	9.5	9.1	8.0	8.4	8.2
17	9.2	10.1	9.7	7.9	8.1	8.0
18	9.1	10.2	9.7	7.8	8.4	8.1
19	9.1	9.7	9.4	8.0	9.1	8.5
20	9.6	10.7	10.2	7.1	8.5	7.8
21	9.7	10.4	10.0	7.3	8.7	8.0
22	8.7	9.8	9.3	8.1	8.7	8.4
23	8.6	9.7	9.2	8.1	8.7	8.4
24	9.5	9.8	9.6	8.1	8.6	8.3
25	9.8	10.8	10.3	8.0	8.5	8.2
26	8.5	10.4	9.3	7.8	8.1	8.0
27	7.5	9.9	8.1	7.8	8.2	8.0
28	8.0	10.0	9.1	7.6	8.0	7.8
29	8.8	10.0	9.5	7.4	7.9	7.7
30	8.1	9.8	9.0	7.6	8.5	7.9
31				7.8	8.1	7.9
Total	7.5	12.2	10.1	6.5	11.0	8.7

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Appendix F. Dissolved oxygen and temperature data for Minthorn Acclimation Facility in 1991. /1

Date	Pump Intake		Proposed Intake		Lower Raceway			Upper Raceway		Spring	
	D.O.	Temp.	D.O.	Temp.	Head	Outlet		Outlet		D.O.	Temp.
					D.O.	D.O.	Temp.	D.O.	Temp.	D.O.	Temp.
06-Mar F /2		7.0			10.5	8.5	7.0		7.0		7.0
07-Mar F	8.8	7.0			9.0	7.1		7.2		6.6	
08-Mar F	9.6	6.4			9.0	7.1	6.4	7.2	6.4	5.4	6.2
09-Mar F	10.4	7.1			9.0	7.6	7.1	7.1	7.1	6.6	7.1
10-Mar F	a.4	7.5			8.8	7.3	7.5	7.2	7.5	6.0	7.5
11-Mar F	9.8	7.0			10.2	8.6	7.0	8.4	7.0	6.8	7.0
12-Mar F	10.1	7.5			10.4	8.3	7.5	8.4	7.5	6.8	6.0
13-Mar F	11.3	6.5			11.7	9.5	6.3	9.3	6.3		6.0
14-Mar F	10.2	7.0			8.8	7.2	6.2	7.3	6.2		5.2
15-Mar F	10.6	6.1			9.6	7.0	6.9	6.8	7.0	6.8	6.4
16-Mar F	10.9	6.1			9.2	7.2	6.1	7.2	6.1	6.7	5.9
17-Mar F	10.3	6.9			10.7	8.4	6.9	8.5	6.9	6.4	6.5
18-Mar F	11.2	6.5			11.9	9.5	6.5	9.3	6.5	8.0	6.5
19-Mar F	10.6	7.5			11.1	8.4	7.5	8.0	7.5	8.0	7.5
20-Mar F	10.8	7.0			11.2	8.8	7.0	8.4	7.0	7.4	7.0
21-Mar F	9.9	7.0			9.0	7.6	7.0	7.3	7.0		6.9
22-Mar F	8.8	8.0			8.9	6.6	8.0	6.4	8.0	6.4	8.0
23-Mar F	8.5	7.6			8.8	7.2	7.4	7.1	7.4	6.6	7.5
24-Mar F	8.0	8.0			8.4	6.4	8.0	6.4	8.0	6.4	8.0
03-Apr F	10.8	7.9					7.9		7.9	7.6	8.0
04-Apr F	10.4	8.9			9.9	7.6	9.1	8.0	9.0	6.4	9.1
05-Apr F	10.4	9.0			9.1	7.8	9.2	8.2	9.0	6.6	9.2
06-Apr F	10.2	8.1			9.9	8.4	8.9	8.9	8.4	7.5	8.9
07-Apr F	12.1	8.5					8.5		8.5		8.5
09-Apr F	10.1	9.0			10.4	10.4	9.0	9.5	9.0	7.8	9.0
10-Apr F	10.0	7.0			11.2	10.4	7.0	9.3	7.0	8.4	7.0
11-Apr F	10.8	7.0			9.8		7.2	8.7	7.0	6.0	7.0
12-Apr F	12.6	7.2			10.2	8.2	8.0	8.6	7.9	7.1	7.9
13-Apr F	8.8	7.9			8.9	6.8	8.0	7.9	8.1	7.1	8.1
14-Apr F	12.4	9.5					9.5		9.5	8.4	9.5
16-Apr F	9.1	8.5	9.2	9.9	9.5	7.3	8.9	7.0	8.8	7.0	8.9
17-Apr F	10.6	8.4	10.1	10.2	10.2	9.2	8.9	9.1	8.9	7.0	8.9
18-Apr F	10.6	8.0	9.7	10.1	9.6		8.2	9.0	8.1	7.5	8.2
19-Apr F	9.8	8.5	9.4	10.9	9.5	8.4	8.9	8.5	8.9	6.9	9.0
20-Apr F	10.0	8.4	8.0	10.0	9.8	9.8	8.9	7.9	8.8	6.3	8.8
21-Apr F	10.7	9.0	10.4	10.0	11.3	10.8	9.0		9.0	7.6	9.0
22-Apr F	10.1	9.0	10.0	10.0	11.2	10.0	9.0	9.5	9.0	7.6	9.0
23-Apr F	10.3	9.0			10.6	7.8	9.2	8.9	9.2	6.6	9.4
24-Apr F	8.8	9.5	8.4	9.0	9.2	8.4	9.5	7.9	9.5	6.8	9.0
25-Apr F	8.9	7.8	9.6	9.1	9.5	8.6	7.0		8.1	6.9	8.4
26-Apr F	9.0	7.5	7.5		9.3	8.8	8.0	8.3	9.0	6.8	8.0

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Appendix F. (cont.)

Date	Pump Intake		Proposed Intake		Louer Raceway			Upper Raceway		Spring	
	D.O.	Temp.	D.O.	Temp.	Head	Out let		Out Let		D.O.	Temp.
					D.O.	D.O.	Temp.	D.O.	Temp.	D.O.	Temp.
27-Apr F	10.5	8.2	10.3	9.2	10.5	7.8	8.5	8.2	8.5	7.0	8.9
28-Apr F	11.2	8.0	8.4	9.0	12.0		8.0		8.0	8.0	8.0
30-Apr F	11.2	9.0	12.0	10.0	12.0	10.0	9.0	9.5	9.0	8.8	9.0
01-May F	10.1	9.1	11.2	10.2	9.7	7.8	9.1	8.2	9.2	6.6	9.9
02-May F		10.5	8.8	11.5	12.0	10.4	10.0		10.0	8.3	11.0
04-May F	8.5	9.5	7.7	10.1	8.8		9.9	8.4	10.0	6.0	10.0
05-May F	9.6	10.0	8.8	10.5	10.0	9.0	10.0	9.2	10.5	7.6	10.0
06-May F	11.1	10.0			11.6	8.8	10.0	9.2	10.0	7.6	10.0
07-May F	9.2	9.5	10.2	11.0	9.2	9.2	9.5	9.7	9.5	6.8	10.0
08-May F		11.0	12.4	12.0		10.4	11.0				11.0
09-May F	10.4	8.5	10.9	11.0	10.8	9.2	8.5	9.6	8.5	8.0	8.5
10-May F	8.9	8.8	9.5	9.3	8.9	7.7	8.8	9.5	8.2	7.0	8.0
13-May F		9.0	10.5	12.0			9.0			6.0	8.0
15-May	9.3	10.0		14.0	10.4	9.3	10.0	9.5	10.0	6.8	10.5
21-May	12.6	9.0	10.5	10.5							9.0
28-May	12.4		12.0	13.5							
04-Jun	10.1	9.5	11.1	9.5						8.0	10.0
13-Jun	11.3	11.5	12.0	11.5						8.4	12.0
03-Jul	10.5		7.2								
10-Jul	9.2	13.0	6.5	13.0							11.0
17-Jul		14.0	9.6	12.0						8.6	14.0
24-Jul	8.4	16.0	10.2	13.0						5.9	16.0
30-Jul	9.2	17.0	9.4	14.5						5.7	17.0
09-Aug	10.8	18.0	11.2	15.0						7.9	18.0
22-Aug	10.0	17.5	10.0	15.0						7.2	18.0
27-Aug	10.6	16.5	12.0	13.5						8.0	16.5
03-Sep	9.2	15.5	12.0	12.0						7.2	15.5
26-Sep		14.0	8.4	11.5						4.8	14.0
02-Oct	8.1	13.9	11.2	12.2							
07-Oct	7.2	12.0	8.6	10.2							
15-Oct	7.6	12.2	8.9	10.2							
30-Oct	7.7										
07-Nov	9.4	11.5	9.0	11.2							
14-Nov	10.4	9.0	8.1	10.0		7.3	9.0	7.0	9.0	6.2	9.0
20-Nov	7.6	10.5	7.0	10.5		6.5	10.1	6.2	10.1	5.9	10.3
09-Dec	9.8	9.0	8.9	11.0				7.7	8.9	7.8	9.0
16-Dec	9.5	8.1	8.1	10.1						6.8	8.0
26-Dec	9.9	8.0	8.4	9.9						6.6	8.0

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/1 D.O. is in mg/l and temperature is in degrees C.  
 /2 F indicates the presence of fish.

Appendix G. Summary of hourly temperature data at Bonifer  
Acclimation Facility in 1991.

DAY	JANUARY			FEBRUARY		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
1	5.2	6.8	5.9	5.8	8.5	7.1
2	4.9	5.7	5.3	7.1	8	7.6
3	3.7	5.5	5	6.6	8.8	7.8
4	4	5.5	4.7	7.4	8.5	8
5	2.9	5.3	4.1	7.4	9.7	8.3
6	3.4	4.9	4.3	5.6	9.2	7.4
7	3.7	5.9	4.7	6	10	7.9
8	5.5	7.8	6.3	6.1	9.5	7.5
9	4.1	6.7	5.1	6.7	9.2	7.6
10	5.3	6.3	5.7	6	8.2	7.1
11	6.3	8.4	7.2	6.3	7.4	6.9
12	6.1	8	7	7.9	6.1	7.2
13	6.1	8.5	7.2	8.5	6.9	7.7
14	6.6	9.1	7.7	10.3	7.4	8.4
15	7.8	9.1	8.6	8.5	7.1	7.7
16	7.9	9.5	8.6	8.5	6.7	7.6
17	8.1	9.7	8.8	7.5	6.4	6.9
18	7.4	9.5	8.1	7.9	6.1	7
19	6.8	8.5	7.5	8	6.8	7.4
20	6	8	6.7	8.4	7.1	7.6
21	5.2	7.5	6.3	10	7.2	8.4
22	5.6	7.4	6.4	8.5	6.9	7.5
23	5.7	7.8	6.6	8.7	5.8	7.1
24	5.5	7.7	6.6	8.5	5.5	6.9
25	4.2	6.4	5.6	8.2	5.6	6.8
26	3.7	6.7	5.4	8.1	5.6	7
27	3.8	6.5	5.2	7.8	5.8	6.9
28	3.9	6.2	5.6	8.5	6	7.3
29	3.6	6.1	4.7			
30	4.9	5.6	5.3			
31	4.9	7.1	6			
Total	2.9	9.7	6.2	5.6	10.0	7.5

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Appendix G. (cont.)

DAY	MARCH			APRIL		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
1	6.2	7.9	7	8.3	10.1	9.2
2	5.5	6.9	6.1	8.5	10.3	9.1
3	6	8.7	7.2	7.2	8.8	8.2
4	7.3	8.1	7.8	8	9.5	8.7
5	5.7	7.1	6.3	8.1	9	8.6
6	5	6.5	5.8	7.2	10.5	8.9
7	5.8	6.4	6.1	7.8	9.2	8.5
8	6	9.2	7.6	6.7	9.6	8.4
9	6.6	7.6	7.3	7.8	9.6	8.5
10	6.5	8.1	7.4	6.2	7.6	7
11	6.3	8	7.2	6.2	10	8.1
12	6.6	7.4	7	6.9	11.6	9.1
13	6	8.5	7.3	6.9	11.6	9.1
14	6.2	7.6	7	8	10.1	9
15	6.1	8.2	7.1	7.1	8.1	7.8
16	5.6	9	7.4	7.7	9.2	8.3
17	6.3	9.5	7.9	7.4	10	8.7
18	6.5	8.1	7.4	7.2	11.8	9.4
19	6.8	7.7	7.2	7.6	11.1	9.4
20	6.4	9.9	8.1	7.9	11.9	9.8
21	6.4	10.1	8.4	8.7	13.8	11
22	7.8	9.5	8.6	8.2	13.8	10.6
23	7.1	9.1	8.1	8.3	12.1	10
24	7.2	8.4	7.7	8.8	11	10
25	6.3	7.5	6.9	8.3	10.3	9.2
26	4.6	10	6.1	7.8	10.3	9.1
27	4.2	10.8	6.9	8.4	9.5	9
28	5.9	8.1	6.7	7.8	11	9.5
29	6	12.4	8.6	8.1	11	9.5
30	6.9	8.3	7.7	7.8	12.7	10.2
31	7.6	10	8.9			
Total	4.2	12.4	7.3	6.2	13.8	9.1

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Appendix G. (cont.)

DAY	MAY			JUNE		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
1	8.7	13.6	10.6	9.5	11.8	10.9
2	8.1	14.7	10.2	10	13.1	11.4
3	7.3	13.1	9.4	9.8	14.3	11.8
4	7.9	12.4	10.2	9.2	11.8	10.6
5	9	10.1	9.6	9.5	11.5	10.4
6	8.9	10.1	9.5	9.6	11.7	10.6
7	8.8	9.9	9.3	9.5	11.3	10.4
8	8.5	10.6	9.6	10	12.1	10.9
9	8.1	9.8	9	9.6	12.8	11.3
10	8.5	10.4	9.4	10.1	13.2	11.8
11	8.9	10.3	9.5	10.8	13.6	12.2
12	8.5	10	9.2	9.9	11.6	10.9
13	8.6	9.8	9.3	10.3	11	10.6
14	8.9	12.1	10.3	10	12.3	11.2
15	8.3	11.5	10	10.5	11.8	11.1
16	9.1	10.4	9.8	10.8	12.8	11.7
17	8.9	10	9.4	11.2	12.5	11.9
18	8.6	10.3	9.4	11.1	12.3	11.7
19	8.7	9.7	9.1	11.3	12.2	11.6
20	8.7	10	9.3	11.1	11.8	11.2
21	8.4	10.8	9.4	10.8	12.1	11.3
22	8.5	11.8	9.9	11.1	12.1	11.6
23	8.8	11.4	10	11.1	12.5	11.8
24	9	10.9	9.9	11.5	12.6	12
25	9.1	11.7	10.3	11.7	12.6	12.1
26	9.3	11.9	10.4	11.6	12.8	12.2
27	9	11.8	10.4	11.8	13	12.5
28	8.7	12.2	10.6	12.2	13	12.5
29	9.2	10.8	10.1	11.8	12.6	12
30	9.3	11.8	10.6	11.6	12.8	12.1
31	9.3	12	10.8			
Total	7.3	14.7	9.8	9.2	14.3	11.5

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Appendix G. (cont.)

DAY	JULY			AUGUST		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
1	11.8	13.1	12.5	14.7	17.4	16
2	12.1	13.4	12.8	15.3	16.8	16
3	12.5	15.2	13.8	15.4	16.8	16.1
4	11.9	15	13.6	15.7	16.9	16.3
5	12.1	14.7	13.6	15.7	16.8	16.2
6	12.1	14.4	13.5	15.6	17	16.3
7	12.1	14.4	13.4	15.9	16.8	16.4
8	12.4	14.5	13.6	15.7	17.1	16.4
9	12.8	14.5	13.7	16.1	17.4	16.7
10	12.8	14.5	13.7	15.3	17.4	16.3
11	13.1	14.7	14	14.6	16.4	15.5
12	13.7	15.4	14.6	14.6	16.4	15.4
13	14.5	16	15.3	14.7	16.5	15.7
14	14.7	16	15.4	15	16.4	15.7
15	14.5	15.6	14.9	15.2	16.6	15.9
16	13.7	14.7	14	15.3	16.6	16
17	12.8	13.9	13.5	15.6	16.8	16.2
18	12.6	14.9	13.8	15.8	16.9	16.4
19	13.7	15.8	14.8	16.2	17.5	16.8
20	13.8	15.8	14.9	16.2	17.5	16.9
21	14	16.3	15.2	16.1	17.2	16.7
22	14.4	16.9	15.6	16	17	16.6
23	14.6	17	15.8	15.3	16.8	16.1
24	14.8	17.4	15.9	14.9	15.9	15.4
25	14.3	17.4	15.1	14.4	15.8	15.1
26	13.4	16.6	15	13.9	15.3	14.7
27	14.4	16.4	15.3	14	14.8	14.3
28	15.1	16.8	15.9	13.4	14.2	13.8
29	15.5	17.1	16.3	13.9	15.4	14.6
30	15.8	17.8	16.6	14.7	16	15.4
31	14.7	16.9	15.8	15	16.2	15.7
Total	11.8	17.8	14.6	13.4	17.5	15.9

Revised: 1-31-92

File Name: C:\123R2\FILES\91BNTEMP

Appendix G. (cont.)

DAY	SEPTEMBER			OCTOBER		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
1	15	16.2	15.7	13.4	14	13.8
2	14.1	15.5	14.8	13.6	14	13.8
3	13.8	14.9	14.4	10.7	14.2	12.4
4	13.9	15.3	14.7			
5	14	15.4	14.7			
6	14.3	15.1	14.7			
7	14.4	14.9	14.6			
8	13.9	14.5	14.2			
9	13.5	14.3	13.8	9.7	15.3	11.7
10	13.3	14	13.7	10	15.1	11.8
11	13.4	14.1	13.9	10.1	15.3	12
12	13.6	14.3	14	10.3	15	11.9
13	13.9	14.2	14.1	9.8	14.7	11.5
14	13.4	14.1	13.8	9.8	14.7	11.6
15	13.1	13.9	13.5	10.1	15.3	11.9
16	13.3	13.9	13.6	10.5	13.1	11.4
17	13.6	14.3	13.9	9.6	13.7	11.3
18	13.8	14.4	14.1	9.1	13.5	10.7
19	13.7	14.3	14.1	9.8	14	11.2
20	14	14.6	14.2	9.8	14.4	11.4
21	13.7	14.6	14	10.6	12.6	11.4
22	12.9	13.9	13.2			
23	12.5	12.9	12.7	9.4	10.6	9.8
24	12.6	13	12.8	8.9	9.3	9.1
25	13	13.6	13.3	8.6	10.3	9.5
26	13.5	14.1	13.8	8.9	10.2	9.7
27	13.6	14.1	13.9			
28	14	14.4	14.2			
29	13.4	14.4	13.9			
30	13.2	14.1	13.7			
31						
Total	12.5	16.2	14.0	8.6	15.3	11.4

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File Name: C:\123R2\FILES\91BNTEMP

Appendix G. (cont.)

DAY	NOVEMBER			DECEMBER		
	MIN.	MAX.	AVE.	MIN.	MAX.	AVE.
1				6.9	8.9	7.8
2				7.7	8.9	8.1
3				8.2	10.3	9.0
4				8.6	10.0	9.1
5	7.5	9.6	8.6	8.6	9.8	9.3
6	9.1	10.3	9.7	8.6	10.0	9.2
7	9.2	10.0	9.6	8.5	9.6	8.8
8	8.6	10.8	9.5	8.3	9.5	8.9
9				8.3	9.2	8.8
10				8.0	8.6	8.4
11				7.5	9.2	8.3
12				7.9	9.2	8.7
13				7.0	8.1	7.3
14				6.7	7.1	6.9
15				5.6	6.7	5.9
16	6.4	8.4	7.7	5.5	6.5	6.0
17	7.8	8.2	8.0	5.6	6.1	5.8
18	7.5	8.0	7.8	5.4	6.7	6.1
19	7.8	8.8	8.4	5.9	6.8	6.4
20	8.2	9.7	8.8	5.9	7.1	6.4
21	8.6	9.6	8.9	5.2	7.1	6.1
22	8.5	9.2	8.7	6.2	7.6	6.7
23	7.1	8.5	7.8	7.1	7.3	7.1
24	7.5	8.8	8.2	6.3	7.1	6.7
25	8.5	9.7	9.0	6.3	7.1	6.8
26	9.1	10.5	9.3	5.7	7.1	6.5
27	7.4	10.0	8.7	6.3	7.8	7.0
28	7.8	10.3	8.9	6.4	7.4	6.8
29	7.1	9.2	7.9	6.0	7.0	6.5
30	6.1	8.0	7.0	6.1	6.7	6.5
31				6.7	7.3	6.9
Total	6.1	10.8	8.6	5.2	10.3	7.4

Revised: 1-31-92

File Name: C:\123R2\FILES\91BNTEMP

Appendix H. Dissolved oxygen and temperature data for gonifer Acclimation Facility in 1991.

Date	Dissolved Oxygen (mg/l)						Temperature (C)					
	Springs			Proposed Intake			Springs			Proposed Intake		
	Outlet #1	#2	#3	#1	#2	Outlet	#1	#2	#3	#1	#2	
06-Mar F	10.5	9.4	8.4	11.2	9.0	8.8	6.0	8.2	9.2			
07-Mar F	9.0	8.0	8.8	9.6	10.4	9.2	6.9	7.2	7.0	7.2	8.1	8.2
08-Mar F	8.2	7.6	8.7	9.8	9.5	9.8	7.2	7.2	7.0	7.2	8.2	8.2
09-Mar F	7.9	8.7	9.4	10.8	9.3	8.0	7.5		9.0	7.0	8.0	8.0
10-Mar F	9.2	9.9			11.6	8.8	6.5	7.0	6.0	7.0	7.0	7.0
11-Mar F	8.1	7.6	8.9	9.7	9.6	8.4	6.5	6.5	7.0	6.0	7.0	7.0
12-Mar F	7.9		8.9	11.2	10.4	8.8	6.0	6.0	6.0	7.0	6.0	7.0
13-Mar F	7.2	8.8	8.8	9.9	9.4	8.6						
14-Mar F	7.5	8.6	9.2	9.6	9.5	9.1	6.9	6.2	6.2	6.4	7.2	8.0
15-Mar F	9.3	9.3	8.4	11.0	10.6	9.5		5.9	6.9	6.2	6.9	8.0
16-Mar F	9.1	10.7	10.4	12.8	10.7	8.4	6.5	6.5	7.0	6.9	8.0	8.0
17-Mar F	8.4	9.2	9.7	10.7	10.3	8.8	6.5	6.9	6.5	6.5	7.0	8.0
18-Mar F	8.0	10.0	10.0	12.0		7.0						
19-Mar F	9.1	10.7	10.0	12.0	9.0	7.0	7.0	8.0	7.0	7.0	8.0	8.0
20-Mar F	9.2	9.6	8.6		9.3		7.0	6.5	7.0	7.7	8.0	8.0
21-Mar F	8.6	9.1	8.1	9.7	10.3	7.8	8.0	7.9	7.2	7.4	7.9	8.0
22-Mar F	9.5	8.6	8.7	10.8	10.4	9.0	8.0	8.0	7.2	7.2	8.0	8.0
23-Mar F	8.8	8.3		9.6		8.2	7.5	7.5	7.0	7.0	8.0	8.0
24-Mar F							6.5	6.0	6.5	6.0	6.5	6.5
25-Mar F							6.5	6.0	6.5	6.0	6.5	6.5
03-Apr F					10.8	9.2	7.5	10.0	7.5	7.5	8.0	8.0
04-Apr F						10.5	8.5	10.0	7.5	8.0	8.0	8.0
05-Apr F	9.4	9.3	8.6	11.5	8.6	9.2		9.9	7.0	7.9	7.9	8.8
06-Apr F			9.1		8.3	9.2	8.0	9.0	7.2	7.2	7.9	8.0
07-Apr F						10.4	8.0	10.0	8.0	8.0	8.0	8.0
08-Apr F							8.5	10.0	8.0	8.0	8.0	8.0
09-Apr F							8.5	10.0	8.0	8.0	8.0	8.0
10-Apr F	9.2	10.1	8.4	10.0	9.2	8.3	6.5		6.5	6.0	6.0	6.0
11-Apr F	9.8	10.8	9.9			10.9	7.2	10.6	8.0	8.2	8.0	8.0
12-Apr F	10.8	11.6	9.4	12.5	9.6	10.3	8.8	10.4	8.2	8.0	8.2	7.9
13-Apr F	10.8	11.1	10.6	12.4	9.6	11.9	8.4	10.9	8.9		9.4	
14-Apr F	11.2	10.2	10.0	12.8		10.4	9.0	8.5	9.0	8.5	8.5	8.5
15-Apr F	10.4	10.4	9.0	11.9	10.9	9.9	8.1	9.1	7.8	7.8	7.8	7.8
16-Apr F	10.5	10.4	9.5	11.5	11.7	9.2	9.0	10.0	7.9	7.8	8.1	8.0
17-Apr F		10.0	9.4	12.9		9.1	10.8	11.9	8.4	9.0	9.0	8.2
18-Apr F		11.2	8.4	12.2	10.2	8.7	10.0	10.8	8.1	8.0	8.3	8.0
19-Apr F		11.6	10.3		10.1	9.9	10.1	11.9	8.4	9.3	11.4	8.9
20-Apr F		11.2	10.4		12.7	10.3	11.0	13.0	10.0	9.0	10.0	8.0
21-Apr F						10.8	11.0	14.0	10.0	9.5	9.5	8.5
22-Apr F							11.0	14.0	10.0	9.5	9.5	8.5
23-Apr F	7.3	10.1			11.9	9.7	11.0	12.5	10.0	9.1	9.0	9.0
24-Apr F	8.5	9.1	8.0	9.3	9.9	8.0	9.5	8.5	7.5	7.0	7.0	7.0

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Appendix H. (cont.)

Date	Dissolved Oxygen (mg/l)						Temperature (C)					
	Springs			Proposed Intake			Springs			Proposed Intake		
	Outlet	#1	#2	#3	#1	#2	Outlet	#1	#2	#3	#1	#2
25-Apr F		10.4	8.7		11.6	9.2	9.2	10.9	8.0	9.0	8.9	8.2
27-Apr F	8.6	8.6					8.9	8.0	8.0	7.2	7.8	7.8
28-Apr F	10.0	11.2	9.6	12.2	12.4	9.6	8.0	8.5	8.0	8.0	8.0	8.0
30-Apr F					12.8		10.0		10.0	9.0	9.0	8.5
01-May F		11.0	8.8		13.0	9.6	11.0	13.0	9.2	9.9	9.8	9.2
02-May F	9.4	11.5	9.6	11.4	11.5	9.6	8.0	8.0	8.0	7.5	8.0	8.0
07-May	10.0	9.5	8.4		10.4		11.5	11.0	9.0	9.5	8.5	7.5
15-May			9.8		12.1				10.5	11.0	11.0	8.0
21-May	10.2	11.2		10.6	9.8	8.8	10.9	10.9	9.1	9.0	9.0	8.4
28-May		9.2			8.6		10.9	11.9	10.0	9.2	9.3	9.1
04-Jun						9.6		12.0	10.5	10.0	10.0	9.5
13-Jun		10.2	7.2		8.4	8.0	11.5	11.0	10.5	10.0	10.0	9.0
03-Jul		9.6	7.6		8.3	8.4			13.0			10.0
10-Jul	7.6	9.0	6.3	8.9	7.9	8.4	15.0	12.0	13.0	11.0	11.0	10.0
17-Jul	7.1		5.2	7.2		7.6	15.0	12.0	12.0	11.0	10.0	9.5
24-Jul	7.5	10.8	6.0	9.5	9.5	8.8		14.0	12.5	13.5	12.0	41.0
30-Jul	8.2	10.4	6.3	10.8	8.4	8.0		14.5	13.0	14.0	14.0	11.0
09-Aug	9.2	11.7	6.0	8.8	7.6	7.2		15.0	14.5	15.5	12.5	12.0
22-Aug	8.4		4.0	10.0	7.6	7.2		17.5	15.5	15.5	14.0	13.5
27-Aug	8.9	10.2	5.3	10.8	8.8	9.2	15.5	13.5	13.5	13.5	13.5	13.5
03-Sep		9.4	6.0	11.7			15.5	14.5	13.5	13.0	13.0	12.0
26-Sep	9.6	8.6	5.2		7.6	8.6	14.0	12.0	13.0	12.5	13.0	13.0
02-Oct	8.6	9.3	2.6	11.5	6.6	6.8	15.0	13.0	13.1	14.0	14.5	14.5
07-Oct	9.5	9.2	3.6	8.8	6.6		11.9	10.0	11.1	11.2	13.5	13.9
15-Oct		9.2	4.4	9.2	6.8		12.9	10.0	12.1	12.0	13.9	13.5
30-Oct	7.8	9.6	5.8	7.7	6.1	8.0					11.9	11.8
06-Nov F	6.0	9.3	5.9	8.6	6.5	7.2	11.4	9.9	11.2	10.9	12.3	12.4
07-Nov F	5.8	9.0	5.8	8.2	6.9	6.9	10.0	10.5	10.9	12.0	13.9	13.0
08-Nov F	5.9	8.2	5.6		6.6	6.5	10.9	10.8	11.0	11.0	13.9	13.5
15-Nov			5.7	7.4	7.3	6.8		8.5	9.5	11.0	13.0	13.5
20-Nov	6.7	9.2	5.7	7.9	7.3	6.6	8.2	9.0	10.9	12.0	13.2	13.2
09-Dec	7.8	9.5	6.6	7.2	7.0	5.9		7.1	8.9	10.2	11.5	12.5
16-Dec	9.0	9.4	6.6	8.7	7.2	5.9	7.0	7.1	8.0	9.1	11.0	11.9
26-Dec	10.6	9.4	7.6	10.2	8.4	9.8	8.2	8.8	9.0	9.9	11.5	11.9

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Appendix I. Liberation and survival information for summer steelhead released in the Umatilla River.

Brood	CUT Code	CUT Released	Total Released	Estimated Recoveries		Year Recovered	Age at Recovery	Oregon		Canada	
				Number	%			Col. R. Gillnet	Sport	Umatilla River	Net & Seine
87	073859	9029	10187	20	0.20	89	2	6		14	
				27	0.27	90	3	6	21		
				-----	-----						
			<b>Totals</b>	47	0.48						
87	073860	9721	10075	30	0.31	89	2	14		16	
				42	0.43	90	3	21	21		
				-----	-----						
			<b>Totals</b>	72	0.74						
87	073861	9925	10287	32	0.32	89	2	10		22	
				32	0.32	90	3	12	3 / 1	17	
				-----	-----						
			<b>Totals</b>	64	0.64						
87	073856	9689	10423	32	0.33	89	2		11 / 2	21	
				34	0.35	90	3	13		19	2
				-----	-----						
			<b>Totals</b>	66	0.68						
87	073857	9455	10171	27	0.29	89	2	7		20	
				11	0.12	90	3		11		
				-----	-----						
			<b>Totals</b>	38	0.40						
87	073858	9448	10163	7	0.07	89	2			7	
				19	0.20	90	3		3 / 1	16	
				-----	-----						
			<b>Totals</b>	26	0.28						
88	074720	8784	9949	0	0.00	90	2				
				2	0.02	91	3		1 / 1	1	
				-----	-----						
			<b>Totals</b>	2	0.02						
08	074723	8789	9954	0	0.00	90	2				
				0	0.00	91	3				
				-----	-----						
			<b>Totals</b>	0	0.00						

Revised: 3-2-92

File Name: C:\123R2\FILES\STSSURV2

Appendix I (cont.)

Brood	CUT Code	CUT Released	Total Released	Estimated Recoveries		Year % Recovered	Age at Recovery	Oregon		Canada Net & Seine			
				Number				Col. R. Gillnet	Sport				
88	074724	8784	9949	0	0.00	90	2						
				2	0.02						91	3	2
				Totals									
88	074715	8800	9873	3	0.03	90	2			3			
				2	0.02						91	3	2
				Totals									
88	074717	8791	9864	1	0.01	90	2			1			
				1	0.01						91	3	1
				Totals									
88	074718	8778	9849	0	0.00	90	2						
				1	0.01						91	3	1
				Totals									
89	075212	9331	10239	31	0.33	91	2	7	9	15			
89	075213	9133	10022	23	0.25	91	2	6	1 /1	16			
a9	075214	9080	9964	23	0.25	91	2	7	3 /1	13			
89	075215	9511	9830	22	0.23	91	2	8	2 /1	12			
89	075216	9525	9845	24	0.25	91	2	6	1 /1	17			
89	075217	9454	9771	38	0.40	91	2		24 /3	14			

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/1 Caught at mouth of Deschutes River.

/2 Three caught at mouth of Deschutes River. Eight caught in Columbia River.

/3 One caught at mouth of Deschutes River. Twenty-three caught in Columbia River.

Appendix J. Liberation and survival information for fall chinook salmon released in the Umatilla River. /1

8r. Yr.	CWT Code	CUT Rel.	Total Ret.	Estimated Recoveries		Year Rec. Age		Oregon									
				No.	%	Ocean Corn Trawl Spt	Freshwater Col. R. Test Net Gillnet Fishery Spt Hatch Trap	Treaty Spawn Subs Ground									
81	050851	46707	306279	12	0.03	83	2		2	10							
				178	0.38	84	3	10		69							2
				20	0.04	85	4			16							
				----	----												
			Totals	210	0.45												
81	051057	102331	672057	20	0.02	83	2			8							
				454	0.44	84	3	28	1	161							
				50	0.05	85	4			39							
				6	0.01	86	5			5							
				----	----												
			Totals	530	0.52												
81	072663	102386	2828835	19	0.02	83	2			2							
				356	0.35	84	3	15		120		3					7
				63	0.06	85	4		2	52			1				
				9	0.01	86	5										
				----	----												
			Totals	447	0.44												
81	072741	99570	100564	7	0.01	83	2			4			3				
				15	0.02	84	3		1	11							1
				102	0.10	85	4	2	2	27		1	1	1			
				40	0.04	86	5			27							1
				----	----												
			Totals	164	0.16												
82	072829	96448	175104	13	0.01	85	3	3									
				228412	0.06	86	4	3		15							
				5	0.01	87	5										
				4	0.00	88	6			4							
				----	----												
			Totals	76	0.08												
83	073124	210441	667190	2	0.00	84	1										2
				996250	0.04	85	2			16							
				491	0.23	86	3	15		203							
				862	0.41	87	4	2		418		1	3				1
				196	0.09	88	5			117			4				
				0	0.00	89	6										
				----	----												
			Totals	1630	0.77												

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Appendix J. (cont.)

CUT Code	Year Rec.	Uashington						Calif.	Canada			Alaska	FWS
		Ocean Net & Treaty			Freshwater Spawn			Ocean	Ocean Net &			Ocean	Freshwater
		Com.Spt.	Seine	Troll	Spt.	Hatch.	Trap	Ground	Com.Spt.	Corn.	Seine	Spt.	Com.Spt.
050851	83												
	84	6		4	3				77	3	4		
	85								4				
051057	83								6		6		
	84	24	18	2		12			192		3		1
	85		6						4				
	86												1
072663	83										10		
	84	14	11		5	6	2		1687				1
	85		2				2		4	4			
	86		6					3					
072741	83												
	84											2	
	85			20			2		31		3	12	
	86								11			1	
072829	85		8										
	86	4	2				1		19	2	4	6	
	87						2		3				
	88												
0731 '4	84												
	85				5	8	44			2		4	
	86	5	6			8	86		149	5	4	9	1
	87		2		2	18	1	187	133	6		88	
	88	2				6			28	2		36	1
	89												

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Appendix J. (cont.)

Br. Yr.	CWT Code	CUT Rel.	Total Rel.	Estimated Recoveries Year				Oregon		Freshwater			Treaty Spawn Subs	Ground
				No.	%	Rec. Age	Year	Corn Trawl Spt	Col. R. Gillnet	Test Net Fishery Spt	Hatch	Trap		
83	073127	88306	198162	28	0.03	85	2			13				
				112	0.13	86	3	4		27			1	
				495	0.56	87	4	47	6	185	6		1	
				81	0.09	88	5	4		31				
				0	0.00	89	6							
				.....	.....									
			Totals	716	0.81									
84	073326	206756	3223172	29	0.01	86	2			13			2	
				352	0.17	87	3	12		129				
				854	0.41	88	4	9		512	7			
				538	0.26	89	5	6		240	2		1	
				22	0.01	90	6			7				
				.....	.....									
			Totals	1795	0.87									
84	073162	30838	51000	18	0.06	87	3			4				
				84	0.27	88	4			39				
				98	0.32	89	5	8		56			2	
				7	0.02	90	6			7				
				-----	-----									
			Totals	207	0.67									
84	073327	88396	91036	123	0.14	86	2			29			70	
			206815	310	0.35	87	3	5	14	93	5			
				1570	1.78	88	4	38	4	478	1 20		41	
				705	0.80	89	5	2	4	339			12	5
				79	0.09	90	6			35			1	
				-----	-----									
			Totals	2787	3.15									
85	073833	20636	197432	2	0.01	87	2							
				50	0.24	88	3			17				
				59	0.29	89	4			34				
				20	0.10	90	5							
				0	0.00	91	6							
				-----	-----									
			Totals	131	0.63									
85	073834	21335	198153	15	0.07	88	3							
				44	0.21	89	4			20				
				16	0.07	90	5			8				
				0	0.00	91	6							
				-----	-----									
			Totals	75	0.35									

Appendix J. (cont.)

CWT Code	Year Rec.1	Washington					Calif. Ocean Com. Spt.	Canada			Alaska Ocean Com. Spt.	FWS		
		Ocean		Freshwater		Spawn Ground		Ocean	Net <sup>o</sup> Corn.	Seine Spt.		Ocean Com. Spt.	Freshwater	
		Net & Treaty Com. Spt.	Troll	Spt.	Hatch.								Trap	Hatch.
073127	85					15								
	86	5	4		8			37	20	4	2			
	87	6	23		2	8	17	182			12			
	88				6		7	22	2					
	89							9						
073326	86													
	87	3			22	2	21	5	14	3	4	26	1	
	88	2	1		2	7	5	43	124	5	5	79	2	
	89	7				9	5	69	157	5		125		1
	90								68	5				
									12			3		
073162	87								9	4			1	
	88					3			30		4	6		
	89					7			20	2		3		
	90													
073327	86					3	6		5	9		1		
	87		21	2	10	18	8		20	68	35	9	2	
	88	89	28	1	69	24	17	21	680	1	8	49	1	
	89	12	9			14	20	35	192	4	8	49		
	90								8		4	31		
073833	87												2	
	88					1		21	4					
	89					3			17	5		5		
	90					2			13			5		
	91													
073834	88					1					4			
	89								2:			2		
	90								6			2		
	91													

Appendix J. (cont.)

Br. Yr.	CWT Code	CWT Rel.	Total Rel.	Estimated Recoveries Year				Oregon								
				No.	%	Rec.	Age	Ocean			Freshwater					
								Corn	Trawl	Spt	Col. R. Gillnet	Test Net Fishery	Spt Hatch	Trap	Treaty Spawn Subs	Ground
85	073835	20690	197488	3	0.01	87	2			3						
				8	0.04	88	3	4								
				24	0.12	89	4					15				
				30	0.14	90	5					15				
				0	0.00	91	6									
				-----	-----											
			Totals	65	0.31											
85	073836	20170	196952	26	0.13	88	3	2				7				
				60	0.30	89	4					29				
				12	0.06	90	5					12				
				3	0.01	91	6					3				
				-----	-----											
			Totals	101	0.50											
85	073837	20982	197788	5	0.02	87	2									
				34	0.16	88	3					7				
				35	0.17	89	4					7				
				21	0.10	90	5					14				
				0	0.00	91	6									
				-----	-----											
			Totals	95	0.45											
85	073838	20815	208103	2	0.01	87	2									
				13	0.06	88	3					6				
				40	0.19	89	4					18				
				21	0.10	90	5					11				
				0	0.00	91	6									
				-----	-----											
			Totals	76	0.37											
85	073839	21659	208958	5	0.02	87	2					4				
				22	0.10	88	3	4				15				
				59	0.27	89	4					40				
				28	0.13	90	5					23				
				0	0.00	91	6									
				-----	-----											
			Totals	114	0.53											

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Appendix J. (cont.)

CWT Code	Year Rec.	Washington				Calif.	Canada	Alaska	FWS
		Ocean		Freshwater		Ocean	Ocean	Ocean	Freshwater
		Net 8 Treaty	Spawn	Spt.Hatch.Trap	Ground	Com.Spt.	Corn. Seine Spt.	Com.Spt.	Hatch.Trap
073835	87								
	88			4					
	89			3			4	2	
	90			2			3	10	
	91								
073836	88						12	2	
	89			4	17		3	2	5
	90								
	91								
073837	87							5	
	88			1	21		5		
	89			3	17		8		
	90			1					6
	91								
073838	87							2	
	88			5	2				
	89				3		4		5
	90				2		8		
	91								
073839	87				1				
	88						3		
	89			1	3		10		5
	90				1		4		
	91								

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Appendix J. (cont.)

Br. Yr.	CWT Code	CWT Rel.	Total Rel.	Estimated Recoveries Year			Oregon									
				No.	%	Rec. Age	Ocean Com Trawl Spt	Col. Gillnet	R. Test Net Fishery Spt	Freshwater Hatch Trap	Treaty Spawn Subs	Ground				
85	073840	20269	207550	5	0.02	87	2									
				15	0.07	88	3	1		4						
				68	0.34	89	4			25						
				28	0.14	90	5			16						
				0	0.00	91	6									
				-----												
			Totals	116	0.57											
85	073841	20895	208184	37	0.18	88	3			12						
				44	0.21	89	4			19						
				14	0.07	90	5			a						
				0	0.00	91	6									
				-----												
			Totals	95	0.45											
85	073842	21694	208994	18	0.08	88	3	4		14						
				45	0.21	89	4			31						
				37	0.17	90	5			20						
				0	0.00	91	6									
				-----												
			Totals	100	0.46											
85	073823	10103	22216	4	0.04	87	2			4						
				24	0.24	88	3		4			4				
				112	1.11	89	4	2		44		8			1	
				61	0.60	90	5			31		4			2	
				7	0.07	91	6			3		3			1	
				-----												
			Totals	208	2.06											
85	073824	10243	22523	4	0.04	87	2			3		1				
				27	0.26	88	3					4		4		
				121	1.18	89	4	5	2	55				3		1
				57	0.56	90	5			22		1	1		3	
				1	0.01	91	6						1			
				-----												
			Totals	210	2.05											

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Appendix J. (cont.)

CWT Code	Year Rec.	Washington				Calif.	Canada	Alaska	FWS
		Ocean		Freshwater		Ocean	Ocean	Ocean	Freshwater
		Net & Treaty		Spawn			Net &		
		Com.Spt.	Seine Troll	Spt.Hatch.Trap	Ground	Com.Spt.	Corn. Seine Spt.	Com.Spt.	Hatch-Trap
<b>073840</b>	<b>87</b>			1			4		
	88	I		2		8			
	89			5		36		2	
	90			2				10	
	91								
073841	8 8		1	2	21	1			
	89			3	17	3		2	
	90				1			I 5	
	91								
<b>073842</b>	<b>88</b>								
	89		1	5		7		1	
	90					9		8	
	91								
<b>073823</b>	<b>a7</b>								
	88		3		1		5 4	1 2	
	89	2		2 2	1	39	4	6 1	
	90			4		6	4	10	
	91								
<b>073824</b>	<b>87</b>								
	88			10		6	2	1	
	89	5 4		3 5	1	24		13	
	90				1	20		I 9	
	91								

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Appendix J. (cont.)

Br. Yr.	CWT Code	CWT Rel.	Total Rel.	Estimated Recoveries Year				Oregon		Freshwater				
				No.	%	Rec.	Age	Ocean Com Trawl Spt	Col. R. Gillnet	Test Net Fishery Spt	Hatch Trap	Treaty Spawn Subsis	Ground	
85	073825	9917	21807	5	0.05	87	2			3		1		
				24	0.24	88	3			7			9	
				98	0.99	a9	4	8		30			7	2
				78	0.79	90	5			42			4	2
					0.00	91	6							
			Totals	205	2.07									
85	073826	9496	20881	4	0.04	87	2			3		1		
				27	0.28	88	3			9			6	
				92	0.97	89	4	1		32	3		6	
				55	0.58	90	5			33			2	
				6	0.06	91	6			6				
			Totals	184	1.94									
85	073827	9876	21716	8	0.08	87	2			8				
				12	0.12	88	3		2					
				105	1.06	89	4		1	36				
				37	0.37	90	5	3		10				
				4	0.04	91	6			4				
			Totals	166	1.68									
85	073828	10253	20786	15	0.15	88	3			4			1	
				712	1.09	89	4	12	1	35	3		2	
				100	0.98	90	5			49	15		2	2
				0	0.00	91	6							
			Totals	227	2.21									
85	073829	9970	20212	27	0.27	88	3			7	4		1	
				116	1.16	89	4	6		28	10		1	
				78	0.78	90	5			39			2	3
				a	0.08	91	6			8				
			Totals	229	2.30									

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Appendix J. (cont.)

CWT Code	Year Rec.1	Washington				Spawn Ground	Calif. Ocean Com.Spt.	Canada			Alaska Ocean Com.Spt.	FWS Freshwater Hatch.Trap
		Ocean Net & Treaty Com.Spt.	Seine Troll	Freshwater Spt.Hatch.Trap	Freshwater Spt.Hatch.Trap			Ocean Corn.	Ocean Seine	Ocean Spt.		
073825	a7										1	
	88			2								
	89	2	8	1	1			31	2	4	7	
	90				1			9			10	
	91											
073826	87											
	88		2		5						2	
	89	5			5	1		31	3	4	1	
	90							10			10	
	91											
073827	87											
	88								2	I		I
	89	2	6	7	5	1		30			10	
	90				1	1		12	2	I	5	
	91											
073828	88		3					2	4			1
	89	2		1	9			39	5		2	1
	90	4						18	3		7	
	91											
073829	88		2							9		
	89	7			4			46			12	
	90			1	2			9			18	1
	91											

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Appendix J. (cont.)

Br. Yr.	CWT Code	CWT Rel.	Total Rel.	Estimated Recoveries Year				Oregon		Freshwater				
				No.	%	Rec.	Age	Ocean Tom Trawl Spt	Col. Gillnet	R. Test Net Fishery Spt	Hatch Trap	Treaty Spawn Subs	Ground	
a5	073830	10135	20546	10	0.10	87	2							
				27	0.27	88	3		4				3	
				130	1.28	a9	4		62		1		3	
				99	0.98	90	5		31	18			3	1
				10	0.10	91	6		10					
				-----	-----									
			Totals	276	2.72									
85	073831	10053	20381	27	0.27	88	3		7				7	
				108	1.07	a9	4	2	33				7	1
				70	0.70	90	5		34				1	2
				4	0.04	91	6		4					
				-----	-----									
			Totals	209	2.08									
85	073832	10081	20438	4	0.04	a7	2		4					
				16	0.16	88	3				3		1	
				110	1.09	89	4	3	56				6	1
				86	0.85	90	5		34					2
				15	0.15	91	6		12		1	2		
				-----	-----									
			Totals	231	2.29									
86	073912	40793	497572	10	0.02	88	2		3				3	
				88	0.22	89	3		40					1
				166	0.41	90	4	7	74	2				
				12	0.03	91	5		12					
				-----	-----									
			Totals	276	0.68									
86	073913	41096	501266	17	0.04	88	2		4					
				106	0.26	89	3		42	2	1		1	
				169	0.41	90	4		85				3	
				7	0.02	91	5		5					
				-----	-----									
			Totals	299	0.73									
86	073914	39187	477992	16	0.04	88	2		4				7	
				96	0.24	89	3	5	24	2	6		3	
				178	0.45	90	4		65					
				9	0.02	91	5		9					
				-----	-----									
			Totals	299	0.76									

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Appendix J. (cont.)

CUT Code	Year Rec.1	Washington				Spawn Ground	Calif.	Canada			Alaska	FWS
		Ocean		Freshwater			Ocean	Ocean	Net 8		Ocean	Freshwater
		Com.Spt.	Seine Troll	Spt.Hatch	Trap		Com.Spt.	Corn.	Seine	Spt.	Com.Spt.	Hatch.Trap
073830	87				3				7			
	88							6	6	4	4	
	89	5	2		15	4		28		4	6	
	90					4		15			27	
	91											
073831	88				5				8			
	89	7	5		1	5		30		8	8	
	90					7		16			10	
	91											
073832	87											
	88		5		7							
	89				4	1		9	2	12	6	
	90					2		18	6		24	
	91											
073912	88					1						
	89		2		1	17	1	24	3		2	
	90		5			a	1	36			33	
	91											
073913	88					2			3	4	4	
	89		1		1	6	9	28	6		8	
	90		2			10	2	43				
	91	2							2		22	
073914	88					2			3			
	89				5	13		5	32			
	90				3	13	1	49	2		4	4
	91											

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Appendix J. (cont.)

Br. Yr.	CWT Code	CWT Rel.	Total Rel.	Estimated Recoveries Year			Ocean		Oregon					
				No.	%	Rec. Age	Com	Trawl Spt	Col. Gillnet	R. Fishery	Test Net Spt	Freshwater Hatch Trap	Treaty Spawn Subsis Ground	
86	073915	643	670	0	0.00	90	4							
				0	0.00	91	5							
				-----	-----									
				Totals	0	0.00								
86	073916	645	672	0	0.00	90	4							
				0	0.00	91	5							
				-----	-----									
				Totals	0	0.00								
86	074035	632	658	5	0.79	a9	3			4				
				0	0.00	90	4							
				0	0.00	91	5							
				-----	-----									
Totals	5	0.79												
86	074038	42068	52317	261	0.62	88	21			3	16	242		
				150	0.36	89	3	5	4	40		37		
				755	1.79	90	4	25	6	237	8	43	5	
				88	0.21	91	5	1		47	9	29	1	
				-----	-----									
Totals	1254	2.98												
86	074039	38978	48474	223	0.57	88	2				2	219		
				112	0.29	a9	3			7		52		
				686	1.76	90	4	26	5	228	3	32	4	
				74	0.19	91	5			45	8	1	14	2
				-----	-----									
Totals	1095	2.81												
86	074036	39509	50480	165	0.42	88	2					164		
				150	0.38	89	3		7	29		44		
				481	1.22	90	4	13	2	131	21	20	3	
				63	0.16	91	5		2	49		12		
				-----	-----									
Totals	859	2.17												
86	074037	38405	49070	158	0.41	88	2			3		155		
				110	0.29	89	3		12	26		34		
				491	1.28	90	4	27	5	146		28	3	
				129	0.34	91	5			88	17	17		
				-----	-----									
Totals	888	2.31												

Appendix J. (cont.)

CWT Code	Year Rec.	Washington				Calif.	Canada	Alaska	FWS				
		Ocean		Freshwater		Ocean	Ocean	Ocean	Freshwater				
		Net	8 Treaty	Spt.Hatch	Trap	Spawn	Corn.	Seine	Spt.	Hatch-Trap			
		Com.Spt.	Seine	Troll	Spt.Hatch	Trap	Ground	Com.Spt.	Corn.	Seine	Spt.	Com.Spt.	Hatch-Trap
073915	90												
	91												
073916	90												
	91												
074035	a9												
	90												
	91												
074038	88												
	89		5	6	9	6		3					
	90	28	20		31		6	278	28	8	61	1	
	91	1											
074039	88												
	89		2	2	11		1	6	26		5		
	90	15	22		49	8	5	197	10		82		
	91	2	2										
074036	88												
	89		23		6	5			22	11	2	1	
	90	14	13		10	4	4	4	196	2	44		
	91												
074037	88												
	89		4		1	12	1		4	15		1	
	90	6	10		11		6	4	190	3		52	
	91	2	5										

Appendix J. (cont.)

Br. Yr.	CWT Code	CWT Rel.	Total Rel.	Estimated Recoveries		Year Rec. Age		Oregon		Freshwater			Treaty Spawn	
				No.	%	Com	Trawl Spt	Col. Gillnet	R. Fishery	Test Net Spt	Hatch	Trap	Subsis	Ground
87	075007	198285	1886757	20	0.01	a9	2							10
				41	0.02	90	3			12				1
				27	0.01	91	4			23				4
				-----	-----									
			<b>Totals</b>	<b>88</b>	<b>0.04</b>									
87	074539	4438	4823	1	0.02	90	3							
				5	0.11	91	4			4				1
				-----	-----									
				<b>Totals</b>	<b>6</b>	<b>0.14</b>								
a7	074540	4289	4660	1	0.02	90	3							1
				5	0.12	91	4			4				1
				-----	-----									
				<b>Totals</b>	<b>6</b>	<b>0.14</b>								
87	074541	4533	4925	10	0.22	90	3			3				
				0	0.00	91	4							
				-----	-----									
				<b>Totals</b>	<b>10</b>	<b>0.22</b>								
87	074536	24656	26858	2	0.01	89	2							2
				17	0.07	90	3			6				4
				32	0.13	91	4			24		1		5
				-----	-----									
			<b>Totals</b>	<b>51</b>	<b>0.21</b>									
87	074537	23403	25493	3	0.01	a9	2							1
				33	0.14	90	3			5				8
				41	0.18	91	4	3		30				5
				-----	-----									
			<b>Totals</b>	<b>77</b>	<b>0.33</b>									
87	074538	25089	27330	2	0.01	89	2							2
				30	0.12	90	3	14		2				4
				43	0.17	91	4		1	19	1	2		10
				-----	-----									
			<b>Totals</b>	<b>75</b>	<b>0.30</b>									
88	074758	26790	27071	0	0.00	90	2							
				1	0.00	91	3							
				-----	-----									
				<b>Totals</b>	<b>1</b>	<b>0.00</b>								

Appendix J. (cont.)

CWT Code	Year Rec.1	Washington					Calif.	Canada	Alaska	FWS				
		Ocean		Freshwater		Spawn	Ocean	Ocean	Ocean	Freshwater				
		Net	Treaty	Spt.	Hatch.	Trap	Ground	Com.Spt.	Corn.	Seine	Spt.	Com.Spt.	Hatch.	Trap
075007	89					4								
	90	2				1			14	8		8		
	91													
074539	90									1				
	91													
074540	90													
	91													
074541	90					1			6					
	91													
074536	89													
	90					3	2					1	1	
	91				2									
074537	89													
	90	9					1	1	4	2				
	91		3											
074538	a9													
	90	5			3		2							
	91				3	7								
074758	90													
	91													

Appendix J. (cont.)

Br. Yr.	CWT Code	CWT Rel.	Total Rel.	Estimated Recoveries Year				Ocean		Oregon			Treaty Spawn Subsis Ground	
				No.	%	Rec.	Age	Com	Trawl	Spt	Col. Gillnet	R. Fishery		Test Net Spt Hatch Trap
88	074760	24285	25428	0	0.00	90	2							
				0	0.00	91	3							
				-----	-----									
			Totals	0	0.00									
88	074763	25350	25633	0	0.00	90	2							
				2	0.01	91	3						2	
				-----	-----									
			Totals	2	0.01									
88	074753	26358	26770	2	0.01	90	2							
				7	0.03	91	3		3		3		1	
				-----	-----									
			Totals	9	0.03									
88	074754	25028	26617	3	0.01	90	2						3	
				5	0.02	91	3				4		1	
				-----	-----									
			Totals	8	0.03									
88	074757	25438	25438	1	0.00	90	2						1	
				4	0.02	91	3				2		2	
				-----	-----									
			Totals	5	0.02									
88	074646	52228	797904	3	0.01	90	2							
				10	0.02	91	3				6			
				-----	-----									
			Totals	13	0.02									
88	074647	49771	797903	6	0.01	90	2						1	
				2	0.00	91	3				4		2	
				-----	-----									
			Totals	8	0.02									
88	074648	52244	797903	4	0.01	90	2							
				9	0.02	91	3				9			
				-----	-----									
			Totals	13	0.02									
a9	075403	52965	808560	8	0.02	91	2					3		5

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Appendix J. (cont.)

CWT Code	Year Rec.1	Washington				Calif.	Canada	Alaska	FWS
		Ocean Net & Treaty		Freshwater Spawn		Ocean	Ocean Net &	Ocean	Freshwater
		Com.Spt.	Seine Troll	Spt.Hatch.Trap	Ground	Com.Spt.	Corn. Seine Spt.	Com.Spt.	Hatch.Trap
074760	90 91								
074763	90 91								
074753	90 91						2		
074754	90 91								
074757	90 91								
074646	90 91			1			1		
074647	90 91						1		
074648	90 91			1	1		2		
075403	91								

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Appendix J. (cont.)

Br. Yr.	CWT Code	CWT Rel.	Total Rel.	Estimated Recoveries				Oregon			Freshwater			Treaty Spawn
				No.	%	Year Rec.	Age	Ocean Com	Trawl Spt	Gillnet	R. Test Net	Fishery Spt	Hatch Trap	
89	075404	52965	808560	9	0.02	91	2				6			3
89	075405	52965	808561	7	0.01	91	2							7
89	075325	23396	25311	0	0.00	91	2							
89	075326	21929	23724	0	0.00	91	2							
89	075327	21101	22828	1	0.00	91	2							1
89	075322	23413	25472	0	0.00	91	2							
89	075323	23617	25694	0	0.00	91	2							
89	075324	23420	25840	0	0.00	91	2							

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/1 The adult returns from the 1985-89 brood are incomplete.

Appendix J. (cont.)

CWT Code	Year Rec.1	Washington				Calif.	Canada	Alaska	FWS
		Ocean		Freshwater		Ocean	Ocean	Ocean	Freshwater
		Net & Treaty		Spawn			Net &		
		Com.Spt.	Seine Troll	Spt.Hatch.Trap	Ground	Com.Spt.	Corn. Seine Spt.	Com.Spt.	Hatch.Trap
075404	91								
075405	91								
075325	91								
075326	91								
075327	91								
075322	91								
075323	91								
075324	91								

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Appendix K. Liberation and survival information for spring chinook salmon released in the Umatilla River.

Brood	CUT Code	CUT Released	Total Released	Estimated Recoveries		Year Recovered	Age at Recovery	Hatch.	Oregon			
				Number	%				Col. R. Sport	Col. R. Gillnet		
86	074325	26640	35946	3	0.011	88	2	2				
				4	0.015	89	3					
				137	0.514	90	4				1	2
				22	0.083	91	5					2
				..	-----							
				Totals	166	0.623						
86	074326	25863	35148	0	0.000	88	2					
				2	0.008	89	3					
				182	0.704	90	4				26	3
				56	0.217	91	5				12	6
				--	-----							
				Totals	240	0.928						
86	074327	25853	35137	0	0.000	88	2					
				2	0.008	89	3					
				113	0.437	90	4				7	
				39	0.151	91	5				1	
				--	-----							
				Totals	154	0.596						
86	074328	26319	34187	1	0.004	88	2	1				
				3	0.011	89	3					
				91	0.346	90	4				2	
				40	0.152	91	5					
				--	-----							
				Totals	135	0.513						
86	074329	25722	33573	2	0.008	88	2	2				
				2	0.008	89	3					
				146	0.568	90	4				1	
				39	0.152	91	5				1	4
				..	-----							
				Totals	189	0.735						
86	074330	26252	34118	0	0.000	88	2					
				0	0.000	89	3					
				160	0.609	90	4				1	
				63	0.240	91	5				12	
				--	-----							
				Totals	223	0.849						

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Appendix K (cont.)

CWT Code	Year Recovered	Test Net Fishery /1	Indian Ceremonial /1	Oregon		Wash. Hatch.
				Umatilla R. Fish Trap	Umatilla R. Spawn Surveys	
074325	88					1
	89			4		
	90		11	108	15	
	91		2	5	13	
074326	88					
	89			2		
	90		12	132	9	
	91	1	3	27	7	
074327	88					
	89			2		
	90	1	17	74	12	
	91		2	22	14	
074328	88					
	89			3		
	90	1	11	66	11	
	91	1	2	32	5	
074329	88					
	89			2		
	90		15	125	5	
	91	1	3	27	3	
074330	88					
	89					
	90	2	11	132	14	
	91	1	4	38	8	

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Appendix K (cont.)

Brood	CUT Code	CWT Released	Total Released	Estimated Recoveries		Year Recovered	Age at Recovery	Oregon	
				Number	%			Hatch.	Col. R. Sport
87	074420	416	410	0	0.000	89	2		
				0	0.000	90	3		
				0	0.000	91	4		
				..	-----				
			<b>Totals</b>	0	0.000				
87	074423	399	393	0	0.000	89	2		
				0	0.000	90	3		
				3	0.752	91	4		
				--	-----				
			<b>Totals</b>	3	0.752				
87	074424	381	376	0	0.000	a9	2		
				0	0.000	90	3		
				3	0.787	91	4		
				--	-----				
			<b>Totals</b>	3	0.787				
a7	074427	26109	25987	0	0.000	89	2		
				0	0.000	90	3		
				21	0.080	91	4		
				..	-----				
			<b>Totals</b>	21	0.080				
a7	074429	24183	24070	0	0.000	89	2		
				2	0.008	90	3		
				17	0.070	91	4		
				--	-----				
			<b>Totals</b>	19	0.079				
87	074430	25475	25356	0	0.000	89	2		
				0	0.000	90	3		
				25	0.098	91	4		
				..	-----				
			<b>Totals</b>	25	0.098				
87	074433	25427	26135	0	0.000	89	2		
				4	0.016	90	3		
				65	0.256	91	4		
				..	-----				
			<b>Totals</b>	69	0.271				

Appendix K (cont.)

CUT Code	Year Recovered	Oregon			Umatilla R. Spawn Surveys	Wash. Hatch.
		Test Net Fishery /1	Indian Ceremonial /1	Umatilla R. Fish Trap		
074420	89					
	90					
	91					
074423	89					
	90					
	91					
074424	89					
	90					
	91					
074427	89					
	90					
	91			19	2	
074429	89					
	90			2		
	91		1	13	3	
074430	89					
	90					
	91			22	3	
074433	89					
	90			4		
	91		4	48	13	

Appendix K (cont.)

Brood	CUT Code	CUT Released	Total Released	Estimated Recoveries		Year Recovered	Age at Recovery	Hatch.	Oregon	
				Number	%				Col. R. Sport	Col. R. Gillnet
87	074434	27004	27756	0	0.000	89	2			
				2	0.007	90	3			
				67	0.248	91	4			
				--	.....					
				Totals	69	0.256				
87	074436	25386	26093	0	0.000	89	2			
				3	0.012	90	3			
				47	0.185	91	4			
				--	.....					
				Totals	50	0.197				
87	074439	27585	28153	1	0.004	89	2	1		
				0	0.000	90	3			
				73	0.265	91	4			
				--	.....					
				Totals	74	0.268				
87	074440	27550	28116	0	0.000	89	2			
				3	0.011	90	3			
				91	0.330	91	4			
				--	.....					
				Totals	94	0.341				
87	074443	24165	24663	1	0.004	89	2	1		
				2	0.008	90	3			
				64	0.265	91	4			
				--	.....					
				Totals	67	0.277				
88	075063	24801	24968	2	0.008	91	3	1		
88	075101	28109	28299	0	0.000	91	3			
88	075102	27299	27483	2	0.007	91	3			
88	075103	27137	27287	2	0.007	91	3			
88	075104	28560	28718	4	0.014	91	3			
88	075105	27695	27848	1	0.004	91	3			

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Appendix K (cont.)

CUT Code	Year Recovered	Test Net Fishery /1	Oregon			Wash. Hatch.
			Indian Ceremonial /1	Umatilla R. Fish Trap	Umatilla R. Spawn Surveys	
074434	89					
	90			2		
	91		3	58	6	
074436	89					
	90			3		
	91	1	4	35	7	
074439	89					
	90					
	91	1		58	10	
074440	89					
	90			2	1	
	91	1		76	10	
074443	89					
	90			2		
	91	2		48	10	
075063	91			1		
075101	91					
075102	91			2		
075103	91'			2		
075104	91			4		
075105	91			1		

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Appendix K (cont.)

Brood	CWT Code	CWT Released	Total Released	Estimated Recoveries		Year Recovered	Age at Recovery	Oregon		
				Number	%			Hatch.	Cot. R. Sport	Col. R. Gillnet
88	075106	26638	38224	0	0.000	91	3			
88	075107	26160	37538	0	0.000	91	3			
88	075108	26888	38583	0	0.000	91	3			
88	075109	25611	39012	2	0.008	91	3			
88	075110	26307	40072	5	0.019	91	3			
88	075111	25172	38343	3	0.012	91	3			

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/1 Columbia River.

Appendix K (cont.)

CUT Code	Year Recovered	Test Net Fishery /1	Oregon			Wash. Hatch.
			Indian Ceremonial /1	Umatilla R. Fish Trap	Umatilla R. Spawn Surveys	
075106	91					
075107	91					
075108	91					
075109	91			2		
075110	91			5		
075111	91			3		

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Appendix L. Liberation and survival information for coho salmon released in the Umatilla River. /1

Brood Code	CWT	CUT	Total Released	Estimated Recoveries		Year Recov.	Age	Oregon							
				No.	%			Ocean		Freshwater					
								Comm. Sport	Gillnet	Col. R. Fishery	Test Net	Sport Hatch.	Uma.R.		
85 073617		13440	37245	1	0.01	87	2						1		
				259	1.93	88	3	83	20	77	1	14	2	13	
				---	----										
				<b>Total</b>	<b>260</b>	<b>1.93</b>									
85 073624		19879	53754	0	0.00	87	2								
				332	1.67	88	3	96	52	83		26	6	9	
				---	----										
				<b>Total</b>	<b>332</b>	<b>1.67</b>									
85 073625		26740	70890	0	0.00	87	2								
				411	1.54	88	3	158	49	100		17	5	10	
				---	----										
				<b>Total</b>	<b>411</b>	<b>1.54</b>									
86 074356		20592	68208	38	0.18	88	2				16			22	
				845	4.10	89	3	202	126	171			8	95	
				---	----										
				<b>Total</b>	<b>883</b>	<b>4.29</b>									
86 074357		18963	73651	25	0.13	88	2							25	
				746	3.93	89	3	207	116	128		3	4	/2 110	
				---	----										
				<b>Total</b>	<b>771</b>	<b>4.07</b>									
86 074358		18513	61606	22	0.12	88	2							22	
				735	3.97	89	3	189	129	117	1	6	8	109	
				---	----										
				<b>Total</b>	<b>757</b>	<b>4.09</b>									
87 074609		27062	75970	7	0.03	89	2							7	
				141	0.52	90	3	32	24	2		32	4	7	
				---	----										
				<b>Total</b>	<b>148</b>	<b>0.55</b>									
87 074610		26416	72627	13	0.05	89	2							13	
				253	0.96	90	3	23	68	24	1		8	16	
				---	----										
				<b>Total</b>	<b>266</b>	<b>1.01</b>									
87 074611		26739	84672	17	0.06	89	2		2					15	
				270	1.01	90	3	56	35	16			12	15	
				---	----										
				<b>Total</b>	<b>287</b>	<b>1.07</b>									

Appendix L. (cont.)

CWT Code	Year Recov.	Washington					California			Canada		FWS Hatch.	
		Comm. Spt.	Ocean Seine	Treaty Troll	Buoy 10	FW Hatch. Spt.	comll. Spt.	Ocean Spt.	Comm. Spt.	Ocean Net & Seine			
073617	87 88		6			27			4	7	5		
073624	87 88		5			15			13	97	10		
073625	87 88					27	1	10	10	7	16	1	
074356	88 89	11	45	4	18	56	1 / 3	7	20	30	37	4	10
074357	88 89	6	44		16	57			8	12	31	4	
074358	88 89	19	52		22	36		1	11	17	11		7
074609	89 90		4			5			19	12			
074610	89 90	4	32		3	10			35	21	8		
074611	89 90	44	27		4	8			28	18	7		

Appendix L. (cont.)

CWT Brood Code	CUT Released	Total Released	Estimated Recoveries		Year Recov.	Age	Oregon		Freshwater					
			No.	%			Ocean Comm. Sport	Col. Gillnet	R. Test	Net Fishery	Sport Hatch.	Uma.R.		
88 074814	28033	67309	34	0.12	90	2		3	4			6	15	
			740	2.64	91	3	127	85	243	2	28	41	58	
			---	----										
		<b>Total</b>	<b>774</b>	<b>2.76</b>										
88 074813	26881	59682	50	0.19	90	2			16			6	5	22
			705	2.62	91	3	104	130	203		48	31	40	
			---	----										
		<b>Total</b>	<b>755</b>	<b>2.81</b>										
88 074815	27226	65095	37	0.14	90	2			2				8	25
			946	3.47	91	3	162	146	228	3	99	69	59	
			---	----										
		<b>Total</b>	<b>983</b>	<b>3.61</b>										
89 075535	24584	152974	3	0.01	91	2								3
89 075534	25905	449678	6	0.02	91	2						1		5
89 075533	24851	352977	2	0.01	91	2								2

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/1 Survival data for the 1989 brood includes age-2 fish only (1991 returns).

/2 Includes one fish recovered on spawn ground survey in Salmon River.

/3 Includes one fish recovered on spawn ground survey in Big White Salmon River.

Appendix L. (cont.)

CWT Code	Year Recov.1	Washington						California		Canada			FWS	
		Comm.	Spt.	Ocean Net & Seine	Treaty Troll	Buoy 10	FW Hatch.	Spt.	Ocean Comm.	Spt.	Ocean Comm.	Spt.	Net & Seine	Hatch.
074814	90					3							3	
	91	26	27			103								
074813	90					1								
	91	10	23			116								
074815	90			2										
	91	18	34			128								
075535	91													
075534	91													
075533	91													

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