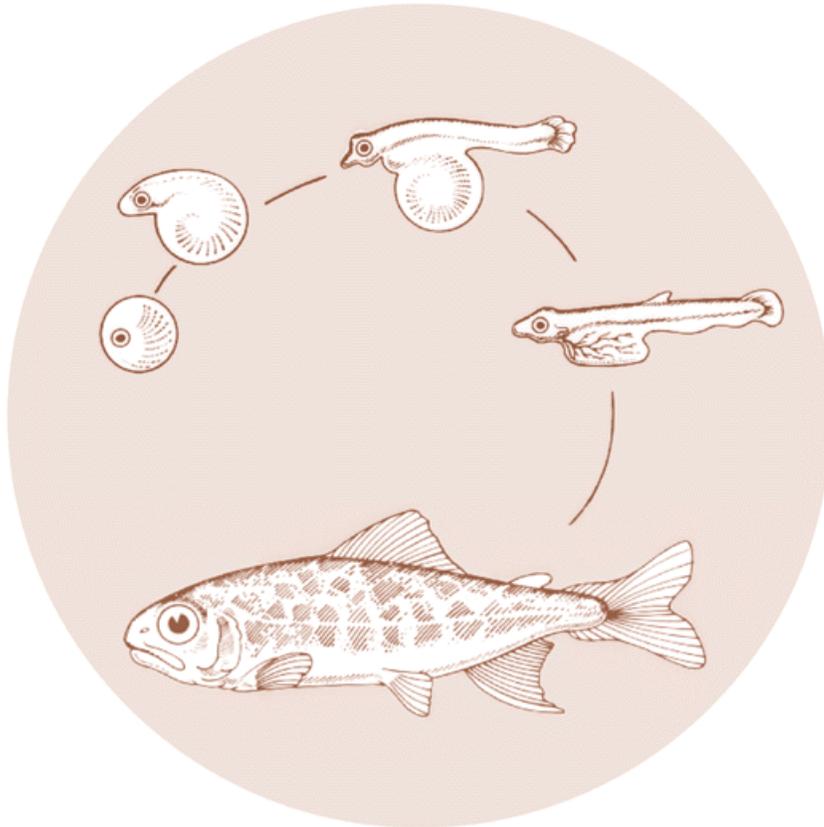


July 1991

# 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 1990



DOE/BP-17622-5



This report was funded by the Bonneville Power Administration (BPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views of this report are the author's and do not necessarily represent the views of BPA.

This document should be cited as follows:

*Rowan, Gerald D., Confederated Tribes of the Umatilla Indian Reservation, 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 1990 to Bonneville Power Administration, Portland, OR, Contract 84-AI-17622, Project 83-435, 124 electronic pages (BPA Report DOE/BP-17622-5)*

This report and other BPA Fish and Wildlife Publications are available on the Internet at:

**<http://www.efw.bpa.gov/cgi-bin/efw/FW/publications.cgi>**

For other information on electronic documents or other printed media, contact or write to:

Bonneville Power Administration  
Environment, Fish and Wildlife Division  
P.O. Box 3621  
905 N.E. 11th Avenue  
Portland, OR 97208-3621

Please include title, author, and DOE/BP number in the request.

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 1990

Prepared by:

Gerald D. Rowan

Confederated Tribes of the Umatilla Indian Reservation

Prepared for:

U.S. Department of Energy  
Bonneville Power Administration  
Environment, Fish and Wildlife  
PO Box 3621  
Portland, Oregon 97208

Project No. 83-435-00  
Contract No. DE-BI79-84BP17622

July 1991

## 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 increase 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 acclimation and release of juvenile salmon and steelhead.

Regularly-scheduled maintenance was completed in 1990. Equipment and pumps received maintenance and repair. Two of the Minthorn and all of the Bonifer pond outlet screens were replaced with vertical bars to alleviate clogging problems. A horizontal bar screen was installed in the water control structure at the largest spring at Bonifer to prevent fish from migrating upstream during acclimation. A pipe was installed under the railroad tracks at Bonifer to make unloading of fish from transport trucks easier and safer. The Minthorn access road was repaired to provide better access for delivery of fish to the facility and for general operations and maintenance.

A total of 92 adult steelhead were collected for broodstock at Threemile Dam from November, 1989 through April, 1990 and held at Minthorn. Twenty-one pairs were spawned. An additional four pairs were spawned at Threemile Dam. A total of 146,740 eggs were taken and transferred to Irrigon Hatchery for incubation. The eggs taken at Minthorn (124,740) were certified pathogen free and the eyed eggs were transferred to Oak Springs Hatchery for hatching and rearing. The 21,955 eggs taken at Threemile Dam however, tested positive for infectious hematopoietic necrosis (IHN). The ODFW kept these eggs at Irrigon Hatchery and reared the fish to 117.0/lb. before transferring them to Oak Springs Hatchery for further rearing.

An estimated 256 adult hatchery steelhead returned to the Umatilla River in 1989-90 (based on Threemile Dam trap counts and harvest estimates below Threemile Dam) and 104 were released upriver. Of these, one returned to Minthorn where the smolts were initially released.

In 1990, 2,190 spring chinook salmon returned to the Umatilla River (based on Threemile Dam trap counts: none were harvested below Threemile Dam) and 1,964 were released upriver. Of these, five were captured at Bonifer before the trap was pulled on June 18.

Acclimation of 114,345 spring chinook salmon and 59,747 steelhead was completed at Bonifer in the spring of 1990. At Minthorn, 132,404 coho salmon were acclimated and released. Acclimation of 71,864 fall chinook salmon at Minthorn and 80,438 spring chinook salmon at Bonifer was successfully completed in the fall.

Control groups 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 1990 and 1991. Each group received three separate coded-wire tag codes. One experiment for fall chinook salmon, two experiments for spring chinook salmon (spring and fall releases) and one experiment for summer steelhead were tagged.

The progress of outmigration for acclimated releases was monitored at the Westland Canal and Threemile Dam juvenile salmonid traps by CTUIR and ODFW personnel. Because the fish in each release were not uniquely identified, species, marks and lengths were used to discern general trends. The data suggests that salmonids released in the spring migrate downstream quite rapidly. The fish released from Minthorn and Bonifer were captured at Threemile Dam (60 and 78 rivermiles downstream, respectively) as early as two to four days after release.

Personnel from the ODFW Eastern Oregon Fish Pathology Laboratory in La Grande took samples of tissues and reproductive fluids from Umatilla River summer steelhead broodstock for monitoring purposes and to certify eggs as pathogen-free.

## 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 the Stanfield-Westland Irrigation District and to Ray Hill, Warren Groberg, Sam Onjukka and other Oregon Department of Fish and Wildlife (ODFW) personnel for providing assistance in the spawning of summer steelhead and for monitoring the fish for the presence of fish pathogens. Jim Phelps, Bill Duke and other ODFW staff assisted in the collection of data at Threemile Dam and Westland Canal. Dennis Isaac 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. Special thanks go to Suzanne Knapp (ODFW) for sharing her data on outmigrating juveniles captured at Threemile Dam. 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 CTUIR staff, whose cooperation and contributions are evident in this report. Doug Olson and Larry Cowapoo collected much of the data from adults returning to Threemile Dam and migration data for juvenile salmonids at Westland juvenile salmonid trap. Numerous biologists and technicians assisted in field sampling. Joe Richards provided the administration of the agreement. 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 Carl Sampson, Mike McCloud, Dave McKay and Gene Shippentower for the long hours and weekends spent running the facilities and for collecting much of the data.

## TABLE OF CONTENTS

ABSTRACT .....	ii
ACKNOWLEDGEMENTS .....	iv
TABLE OF CONTENTS .....	v
LIST OF TABLES .....	vii
LIST OF FIGURES .....	ix
 INTRODUCTION	
Background .....	1
Facility Description & Operations .....	1
Project Objectives .....	7
 MATERIALS AND METHODS	
Collection and Spawning of Summer Steelhead .....	9
Disease Sampling of Summer Steelhead Broodstock .....	9
Adult Returns to Bonifer .....	10
Adult Returns to Minthorn .....	10
Acclimation and Release of Juvenile Salmonids .....	10
Outmigration Monitoring .....	11
Assessment of Acclimation Facilities .....	11
Acclimation Research .....	12
Adult Survival and Umatilla River Returns .....	12
 RESULTS AND DISCUSSION	
Facility Maintenance .....	13
Collection and Spawning of Summer Steelhead .....	13
Disease Sampling of Summer Steelhead Broodstock .....	15
Adult Returns to Bonifer .....	15
Adult Returns to Minthorn .....	17
Acclimation and Release of Juvenile Salmonids .....	17
Acclimation at Minthorn	
Coho Salmon - 3/7 to 3/28 .....	17
Coho Salmon - 3/7 to 4/12 .....	24
Fall Chinook Salmon - 10/3 to 10/16 .....	24
Acclimation at Bonifer	
Spring Chinook Salmon - 3/8 to 3/22 .....	30
Summer Steelhead - 4/10 to 5/7 .....	30
Summer Steelhead - 4/10 to 5/7 .....	37
Spring Chinook Salmon - 10/23 to 10/26 .....	37
Outmigration Monitoring .....	39
Assessment of Acclimation Facilities .....	45
Acclimation Research .....	48
Adult Survival and Umatilla River Returns .....	50
Project Difficulties	
Operational Problems at Bonifer .....	64
Operational Problems at Minthorn .....	65
Research Problems .....	65

TABLE OF CONTENTS (cont.)

SUMMARY OF EXPENDITURES .....	66
LITERATURE CITED .....	67
APPENDICES .....	68

LIST OF TABLES

Number		Page
1.	Hatchery Releases of summer steelhead in the Umatilla River . . . . .*	2
2.	Hatchery Releases of fall chinook in the Umatilla River . . . . .	3
3.	Hatchery releases of spring chinook in the Umatilla River . . . . .	4
4.	Hatchery releases of coho salmon in the Umatilla River . . . . .	4
5.	Summer steelhead broodstock collection, spawning, and mortality in 1989-90 . . . . .	14
6.	Results of disease sampling of Umatilla River summer steelhead broodstock in 1990 . . . . .	16
7.	Juvenile salmon and steelhead released in the Umatilla River Basin in 1990 . . . . .	18
8.	Juvenile fall and spring chinook salmon releases in the Umatilla River Basin - 1982-1990 . . . . .	19
9.	Juvenile steelhead and coho salmon releases in the Umatilla River Basin - 1981-1990 . . . . .	20
10.	Liberation information for coho salmon coded-wire tagged and released in the Umatilla River Basin . . . . .	21
11.	Food rations, mortalities, temperatures, and D.O. concentrations during acclimation of juvenile salmonids in 1990 . . . . .	22
12.	Size and descaling data for juvenile salmonids released in the Umatilla River Basin in 1990 . . . . .	26
13.	Liberation information for fall chinook salmon coded-wire tagged and released in the Umatilla River Basin . . . . .	28
14.	Liberation information for spring chinook salmon coded-wire tagged and released in the Umatilla River Basin . . . . .	32
15.	Liberation information for summer steelhead coded-wire tagged and released in the Umatilla River Basin . . . . .	36

LIST OF TABLES (cont.)

Number	Page
16. Estimated number of juvenile salmonids captured at Threemile Dam juvenile salmonid trap (left bank) in 1990 .....	41
17. Estimated number of juvenile salmonids captured at Westland juvenile salmonid trap in 1990 .....	43
18. Summary of descaling data for juvenile salmonids captured at Threemile Dam and Westland Canal juvenile salmonid traps in 1990 .....	44
19. Coded-wire tagging of juvenile salmonids in 1990 for release in the Umatilla River .....	49
20. Liberation and survival information for summer steelhead released in the Umatilla River .....	52
21. Liberation and survival information for fall chinook salmon released in the Umatilla River .....	53
22. Liberation and survival information for Bonneville stock yearling fall chinook salmon released in the Umatilla River .....	57
23. Liberation and survival information for Bonneville stock subyearling fall chinook salmon released in the Umatilla River .....	58
24. Liberation and survival information for Priest Rapids stock fall chinook salmon released in the Umatilla River .....	60
25. Liberation and survival information for spring chinook salmon released in the Umatilla River .....	62
26. Liberation and survival information for coho salmon released in the Umatilla River .....	63
27. Expenditures for Bonifer and Minthorn Facilities operation, maintenance and evaluation in 1990 .....	66

LIST OF FIGURES

Number	Page
1. Umatilla River Basin and Confederated Tribes of the Umatilla Indian Reservation .....	5
2. Bonifer and Minthorn Acclimation Facilities and vicinity .....	6
3. Historical and 1989-90 runs of summer steelhead in the Umatilla River versus 1989-90 broodstock collection .....	14
4. Length frequencies of experimental groups of coho salmon released at Minthorn Acclimation Facility on 3/28/90 (acclimated versus control group - all fish) .	23
5. Length frequencies of experimental groups of coho salmon released at Minthorn Acclimation Facility on 3/28/90 (acclimated versus control group - coded-wire tagged fish) .....	23
6. Length frequencies of experimental group of coho salmon released at Minthorn Acclimation Facility on 3/28/90 (acclimated group - coded-wire tagged versus non-tagged fish) .....	25
7. Length frequencies of experimental group of coho salmon released at Minthorn Acclimation Facility on 3/28/90 (control group - coded-wire tagged versus non-tagged fish) .....	25
8. Length frequency of experimental group of coho salmon released at Minthorn Acclimation Facility between 3/9 and 4/12/90 (volitional release - all fish) . . . . .	27
9. Length frequencies of experimental group of coho salmon released at Minthorn Acclimation Facility between 3/9 and 4/12/90 (volitional release - coded-wire tagged versus non-tagged fish) .....	27
10. Length frequencies of experimental groups of fall chinook salmon released at Minthorn Acclimation Facility on 10/16/90 (acclimated versus control group - all fish) .....	31
11. Length frequencies of experimental groups of spring chinook salmon released at Bonifer Acclimation Facility on 3/22/90 (acclimated versus control group - all fish) .....	34

LIST OF FIGURES (cont.)

Number	Page
12. Length frequencies of experimental groups of spring chinook salmon released at Bonifer Acclimation Facility on 3/22/90 (acclimated versus control group - coded-wire tagged fish) .....	34
13. Length frequencies of experimental group of spring chinook salmon released at Bonifer Acclimation Facility on 3/22/90 (acclimated group - coded-wire tagged versus non-tagged fish) .....	35
14. Length frequencies of experimental group of spring chinook salmon released at Bonifer Acclimation Facility on 3/22/90 (control group - coded-wire tagged versus non-tagged fish) .....	35
15. Length frequencies of experimental groups of summer steelhead released at Bonifer Acclimation Facility on 5/7/90 (acclimated versus control group - all fish) . .	38
16. Length frequencies of experimental groups of summer steelhead released at Bonifer Acclimation Facility on 5/7/90 (coded-wire tagged versus Ad only) .....	38
17. Length frequencies of experimental groups of spring chinook salmon released at Bonifer Acclimation Facility on 10/26/90 (acclimated versus control group - all fish) .....	40
18. Length frequency distribution of juvenile chinook salmon captured at Threemile Dam in 1990 .....	46
19. Length frequencies of summer steelhead captured at Threemile Dam in 1990 (marked versus unmarked) .....	47

APPENDICES

Number	Page
A. Steelhead broodstock spawning and prespawn mortality at Minthorn Acclimation Facility and Threemile Dam in 1990 . . . . .	A-1
B. Summary of hourly temperature data at Minthorn Acclimation Facility in 1990 . . . . .	B-1
C. Dissolved oxygen and temperature data for Minthorn Acclimation Facility in 1990 . . . . .	C-1
D. Summary of hourly temperature data at Bonifer Acclimation Facility in 1990 . . . . .	D-1
E. Dissolved oxygen and temperature data for Bonifer Acclimation Facility in 1990 . . . . .**.....	E-1
F. Liberation and survival information for summer steelhead released in the Umatilla River . . . . .	F-1
G. Liberation and survival information for fall chinook salmon released in the Umatilla River . . . . .	G-1
H. Liberation and survival information for spring chinook salmon released in the Umatilla River . . . . .	H-1
I. Liberation and survival information for coho salmon released in the Umatilla River . . . . .	I-1

## 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. The single native anadromous stock left in the basin is a run of approximately 2,000 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 was 6.7% hatchery (adipose fin-clipped) fish in 1987-88 (the first season that fin-clipped fish were differentiated), 14.3% in 1988-89 and 14.7% in the 1989-90 season. Runs of salmon species have been rebuilt from stocks of various sources (Tables 2, 3 & 4). Forestry, agriculture, irrigation and hydropower are among the developments that have impacted all stocks in the Umatilla River Basin.

A comprehensive plan developed by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the 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 on the upper Umatilla River at rivermile (RM) 2.0 of Meacham Creek. The pond spills into Boston Canyon Creek which flows about 50 yards before entering Meacham Creek. Meacham Creek flows into the Umatilla River at RM 79 (Figures 1 & 2). 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. The largest spring parallels the railroad in a series of long pools before emptying into Bonifer. 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 (Figures 1 & 2). Minthorn Springs Creek is formed from the inflow of several springheads located immediately south of the Umatilla River and east of the facility.

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

Revised: 1-22-91

File Name: D:\123R2\DATA\HISTSSTR

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

Revised: 1-23-91

File Name: D:\123R2\DATA\HISTCHFR

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

Revised: 1-22-91

File Name: D:\123R2\DATA\HISTCHSC

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

Revised: 1-22-91

File Name: D:\123R2\DATA\HISTCHSC



Figure 1. Umatilla River Basin and Confederated Tribes of the Umatilla Indian Reservation.

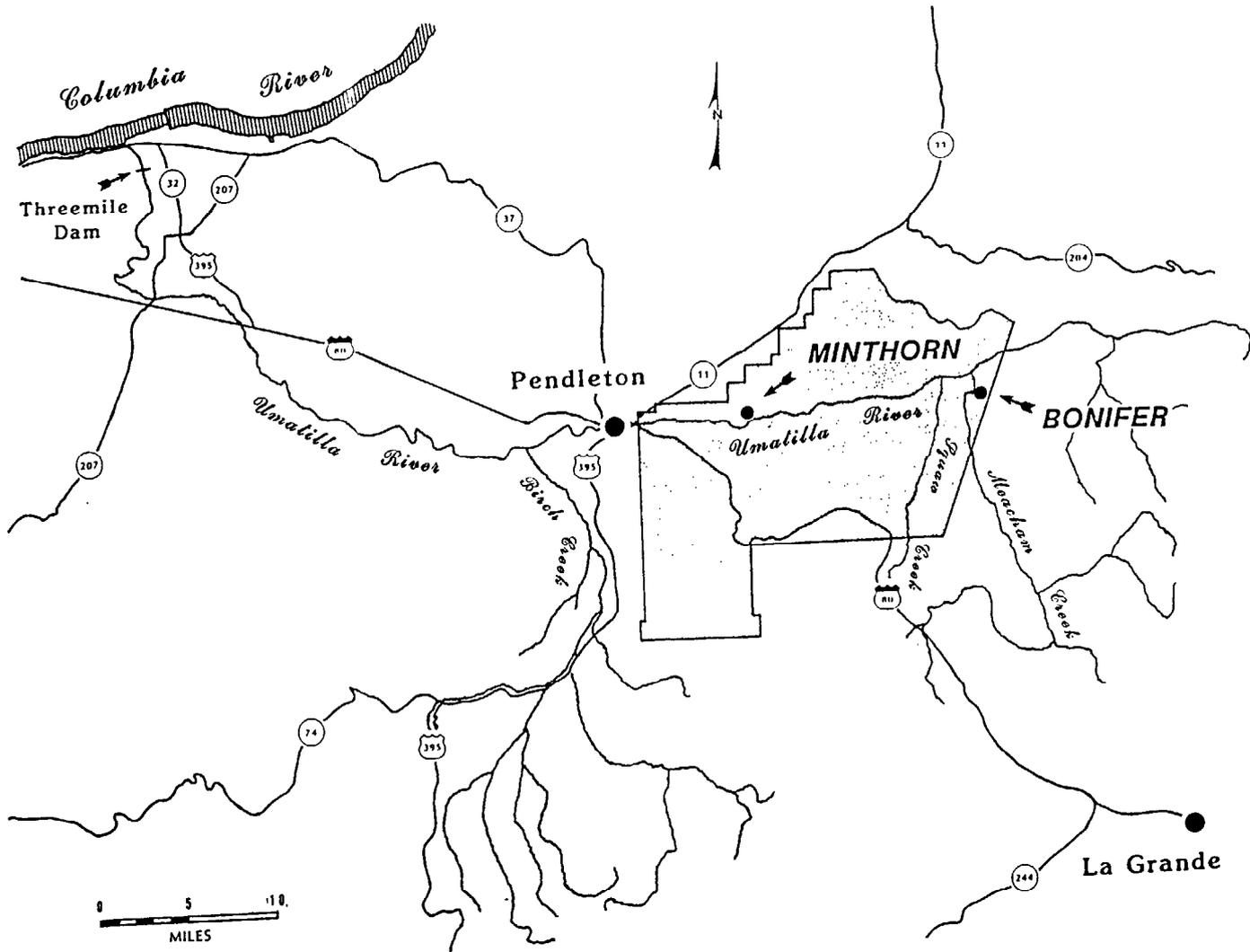


Figure 2. Bonifer and Minthorn Acclimation Facilities and vicinity.

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 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 with cooperation from ODFW. The facilities have been used for holding and spawning of adult summer steelhead and for acclimation and release of juvenile fall and spring chinook and coho salmon and summer steelhead. The main goals of acclimation are to reduce stress from trucking prior to release and improve imprinting of juvenile salmonids on water from Umatilla River sources to increase returns to the Umatilla River. In addition, an acclimation environment that is conducive to smoltification is desirable. The new Umatilla Hatchery will eventually be the source hatchery for Bonifer and Minthorn, and possibly 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 1990.

### Project Objectives

The following specific project objectives for 1990 are part of overall objectives to operate, maintain and evaluate Bonifer and Minthorn Acclimation Facilities:

1. Tag groups of juvenile salmon and steelhead for acclimation studies (sub-contract).
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 and health 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 non-clipped adult summer steelhead returning to the trap at Threemile Dam and transport them to holding facilities.

8. Spawn adult summer steelhead and provide eggs to ODFW for rearing and later release in the Umatilla River.
9. Monitor adult mortality and fish spawned for physical data and disease analysis.
10. Collect snouts and data from coded-wire tagged fish at Threemile Dam.
11. Access coded-wire tag recovery information from the Pacific 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 22, 1989 through May 17, 1990.

Adult steelhead were differentially marked during each time period in which they were collected. Fish were transported to Minthorn using a trailer with a 370-gallon, aerated tank. Beginning in late March, the fish were sorted weekly for maturation except an attempt was made to sort the "green" fish less frequently to avoid unnecessary handling. The ripe fish were spawned by Irrigon Hatchery and CTUIR personnel using standard hatchery practices. Every attempt was made to pair one female with one male. The eggs from each pair (family group) were water hardened in iodophor and transferred to Irrigon Hatchery to be incubated separately. The last two egg takes were from fish that were collected and spawned at Threemile Dam. Eggs from family groups which were certified free from replicating viruses were combined and transferred to Oak Springs Hatchery. Eggs testing positive for viruses remained at Irrigon Hatchery for hatching and initial rearing. The fry were then transported to Oak Springs Hatchery for further rearing. Incubation and rearing of steelhead eggs from adults spawned at satellite facilities will eventually occur at the new Umatilla Hatchery.

### 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 to certify eggs for transfer from Irrigon Hatchery to Oak Springs for hatching and rearing. Additional sampling as part of the Fish Health Monitoring Program for BPA was also performed on spawned fish and prespawn mortalities.

All 53 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 25 spawned fish were sampled for bacterial kidney disease (BKD) and 53 blood samples were taken to examine for erythrocytic inclusion body syndrome (EIBS).

Twenty-three steelhead that died during holding were individually sampled. 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.

#### Adult returns to Bonifer

Five adult spring chinook were captured at Bonifer while the trap was in operation from February 28 to June 18. They were released back into Meacham Creek.

#### Adult returns to Minthorn

One summer steelhead was captured at Minthorn while the trap was in operation from February to May. It was sacrificed for coded-wire tag recovery.

#### Acclimation and Release of Juvenile Salmonids

Juvenile salmonids were transported by ODFW from hatcheries using 2,000 and 5,000 gallon tankers. Transfers were completed in one to two days. Juveniles were fed 3mm Biomoist Feed (Bio-Products Inc., Warrenton, Oregon) twice each day.

Mortalities were removed daily at both facilities. ODFW pathology personnel were available for specific disease problems should they become apparent in mortalities or live fish.

Transfer mortality (immediate and delayed mortality) was defined as all fish that die within five days of the last transfer date. Total number of fish at release is estimated using ODFW transfer reports, acclimation mortality records and ODFW tagging records. Number of fish reported as tagged at release is estimated using tag retention sampling just prior to release and information on the total number of fish. Clipped fish are those with an adipose fin clip for salmon and a left ventral fin clip plus an adipose fin clip for steelhead. Fish reported as tagged have the correct fin clips for the species and a coded-wire tag.

Samples for length frequency data 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 fed was determined using Bioproducts Inc. feed charts.

#### Outmigration Monitoring

Juvenile salmonids were collected in the new trapping facility at Westland Canal (RM 27), about 36 and 54 river-miles downstream from Minthorn and Bonifer, respectively. The trap was first set on April 18 and operated until September 16. Twice during this period however (May 1 to 14 and May 29 to June 15), the trap was closed to allow the juveniles to migrate downstream during high water.

Species, marks and descaling indices were recorded on an enumerated subsample of fish. The fish were loaded into a fish transport truck by dip net or fish pump. Water displacement was used to determine the total pounds of fish loaded. 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.

Outmigrating juveniles were monitored at the Threemile Dam juvenile salmonid trap (left bank) from March 22 to June 14. The trap was initially set to capture approximately 5.0% of the fish, but this varied depending upon the total number of fish being bypassed. Species, marks, lengths and descaling indices were recorded.

#### Assessment of Acclimation Facilities

Automatic temperature recorders (Ryan Tempmentors<sup>a</sup>) recorded hourly temperatures at both facilities in 1990. 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 1990, juvenile salmonids were tagged and marked by ODFW under subcontract for both 1990 and 1991 releases. Tagging data included in this report were compiled from ODFW Coded Wire Tagging Operation Summaries. Three replicate tag codes were used for each test (acclimated) and control (non-

acclimated) group. Chinook and coho salmon were coded-wire tagged and adipose fin clipped. Summer steelhead were coded-wire tagged and adipose and left ventral fin clipped.

#### Adult Survival

Adult salmonids marked to indicate the presence of coded-wire tags were collected at the trap at Threemile Falls Dam and from Umatilla River spawning ground surveys. The snouts were removed and associated biological data were recorded. The snouts and data were sent to ODFW for tag removal and decoding.

Data available from the Pacific 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 completed at Minthorn in 1990. All electrical and pumping equipment were checked and serviced as necessary. Grates and screens at the pump intake and the head and outlet of the raceways were cleaned daily while fish were acclimated. One outlet screen on each pond was replaced with vertical bars to alleviate clogging problems. Weed abatement constituted much of the normally-scheduled maintenance. The Minthorn access road was repaired to provide better access for delivery of fish to the facility and for general operations and maintenance.

Routine maintenance work at Bonifer consisted mostly of weed abatement in the work area around the outlet, aquatic weed removal, and maintenance of the electric fence. The outlet screens were replaced with vertical bars to alleviate clogging problems. Horizontal bars were installed in the water control structure in the largest spring to prevent upstream migration of smolts during periods of acclimation. A pipe was installed under the railroad tracks to make unloading of fish from transport trucks easier and safer.

### Collection and Spawning of Adult Summer Steelhead

A total of 92 adult steelhead were captured at Threemile Dam between November 22, 1989 and April 18, 1990 and transported to Minthorn (Table 5). Fish collected in late April and May were not transported, but were spawned at Threemile Falls Dam.

Prespawn mortality of transported fish during the adult holding period was 39.0% (Table 5). This is the same as it was in 1988 but higher than it was in 1989 (20.0%). A total of 36 adults (25 females and 11 males) died prior to completion of spawning in 1990. Prespawn mortality was higher in females (50.0%) than it was in males (26.0%). As in previous years, mortality was low (2.0% in 1990) until after the first spawning when mortality increased (Appendix A). A larger percentage of the females collected in November and December (80.0%) were spawned than those collected during the periods January through February and March through April (53.0 and 19.0%, respectively, Table 5). Toward the end of the spawn season, nine females (eight of which were collected from January through April) were left in the holding pond. Every attempt was made to collect mature males at Threemile Dam, but before any could be collected, eight of the females died. Several of these females could have been spawned if mature males had been available.

Broodstock were selected throughout the entire run to provide a representative cross-section of the population (Figure 3). However, because the fish collected in November and December

Table 5. Summer steelhead broodstock collection, spawning, and mortality in 1989-90. 1/

No. Collected Date	No. Spawed			Mortality			Mortality			Mortality					
	Males	Females	Total	Males	% Females	% Total	% Males	% Females	% Total	% Males	% Females	% Total			
11-22/12-1	4	8	12	4	100	2/ 6	0	4	33	0	0	2	25	2	17
12-8	2	2	4	1	50	2	100	3	75	1	50	0	0	1	2 5
1-17	8	12	20	6	75	6	50	12	60	1	13	5	42	6	30
2-23	2	7	9	2	100	4	57	6	67	0	0	3	43	3	33
3-16/21	14	13	27	3/ 8	0	1	8	1	4	4	29	12	92	16	59
4-4/6	10	5	15	2/ 6	0	2	40	2	13	4	40	2	40	6	40
4-13/18	2	3	5	1	50	1	33	2	40	1	50	1	33	2	40
TOTALS	42	50	92	28	67	22	44	50	54	11	26	25	50	36	39

Revised: 1-23-91

File Name: D:\123R2\DATA\SSTBRTRA

1/ All broodstock were collected at Threemile Dam and transported to Mnthorn Acclimation Facility.

No clipped fish were collected for brood.

One female collected on 4-18 was returned to Threemile Dam for spawning.

One female collected on 1-17 and one collected on 4-6 escaped from the holding pond.

One male collected on 1-17 and two collected on 3-21 escaped from the holding pond.

2/ One was green.

3/ Two were green and one was not used.

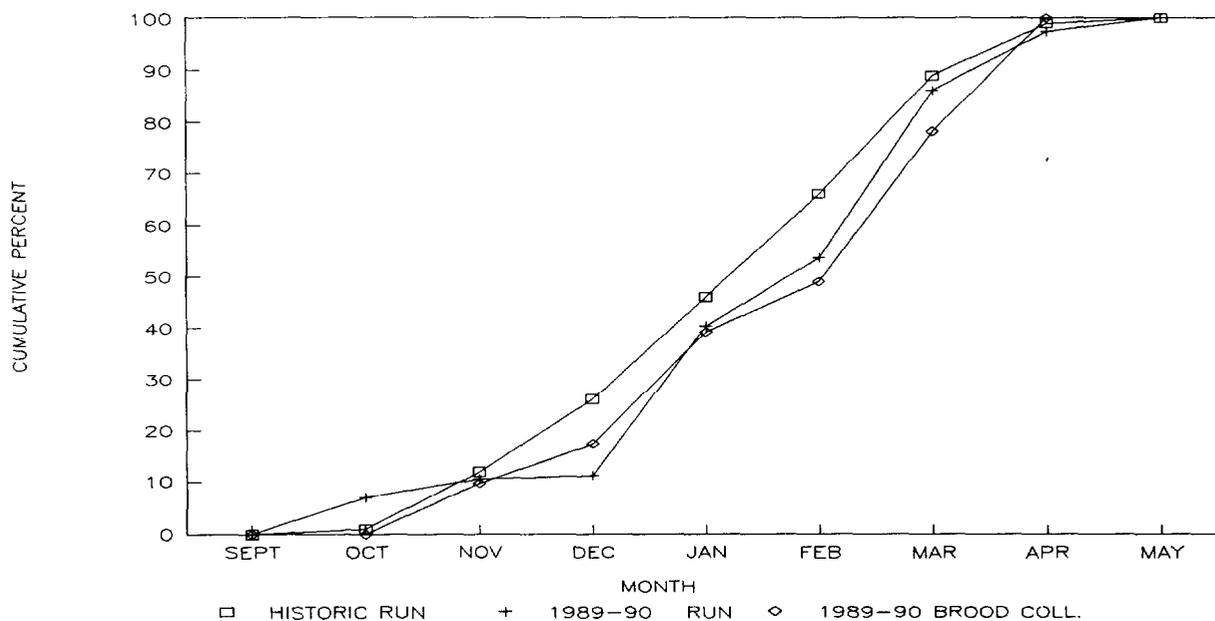


Figure 3. Historical and 1989-90 runs of summer steelhead in the Umatilla River versus 1989-90 broodstock collection.

matured first, and the later returning fish had a higher mortality rate (20.0% of the females collected in Nov. and Dec. died, 42.0% from Jan. and Feb., and 71.0% from March and April), a higher proportion of the early fish were spawned (Table 5). To insure that a representative spectrum of the population is spawned, a larger number of fish may need to be collected from the latter part of the run.

The adult holding facility also needs to be improved to reduce mortality. Potential improvements include enlargement of the holding pond and improvement of the screen system which is abrasive to the fish. Modifying the water inlet structure to provide a uniform flow distribution would also allow for treating the fish with formalin to control fungus.

Twenty-one females from Minthorn were spawned along with four females collected and spawned at Threemile Falls Dam. A total of 146,740 eggs were taken with a mean fecundity of 5,870 (Appendix A). The eggs taken at Minthorn (124,740) were certified free from replicating viruses and were shipped to Oak Springs Hatchery as eyed eggs. The 21,955 eggs taken at Threemile Dam however, tested positive for IHN and were kept at Irrigon Hatchery for hatching and initial rearing. In August, they were transferred at 117.0/lb. to Oak Springs Hatchery for further rearing.

#### Disease Sampling of Summer Steelhead Broodstock

The only pathogen detected in the fish spawned at Minthorn was BKD and only two of 25 fish sampled tested positive. Tests for IHN, IPNV and EIBS were negative (Table 6). All four females spawned at Threemile Dam however, tested positive for IHN (Table 6).

The only two pathogens detected in mortalities were spores of *C. Shasta* in eight of 23 fish and aeromonad/pseudomonad bacteria in 10 of the same 23 fish. Bacterial kidney disease was not detected in the mortalities.

#### Adult returns to Bonifer

In 1990, 2,190 spring chinook returned to the Umatilla River (based on Threemile Dam trap counts; none were harvested below Threemile Dam) and 1,964 were released upstream. Before the trap was pulled on June 18, five were captured at Bonifer and released back into Meacham Creek. Several adults were observed in Meacham Creek prior to spawning but only two were observed during spawning ground surveys. Most of the fish appeared to have dropped back into the Umatilla River to spawn due to low flows and high water temperatures in Meacham Creek during the spawning season. Several adult mortalities were recovered below the mouth of Meacham Creek before and during spawning season.

Table 6. Results of disease sampling of Umatilla River summer steelhead broodstock in 1990. /1

Group	Test	Incidence ---mm---	Comments
Spawned	IHNV	0/45	Spawned at Minthorn
		4/8	Spawned at Threemile Dam
	IPNV	0/45	Spawned at Minthorn
		0/8	Spawned at Threemile Dam
EIBS	0/50	Spawned at Minthorn	
	0/3	Spawned at Threemile Dam	
	BKD	2/25	Spawned at Minthorn
Morts/2	Ceratomyxa shasta	8/23	
	Aeromonas/ Pseudomonas	10/23	
	BKD	0/23	

Revised: 1-2-91

File Name: D:\123R2\DATA\DISSAMP

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

/2 All mortality from Minthorn Acclimation Facility.

## Adult returns to Minthorn

An estimated 256 adult hatchery steelhead returned to the Umatilla River in 1989-90 (based on Threemile Dam trap counts and estimated harvest below Threemile Dam) and 104 were released upriver. Of these, one returned to Minthorn (where the smolts were released) while the trap was in operation from February to May.

## Acclimation and Release of Juvenile Salmonids

Seven groups of acclimated juvenile salmonids (458,798 fish) were among the 5,027,709 salmon and steelhead released into the Umatilla River in 1990 (Table 7). Included in these were two coho groups and one group of untagged summer steelhead. The other four groups were tagged with funding from BPA and are part of the formal facility evaluations. Three tag codes for each test (acclimated) and control group (unacclimated) were tagged.

Fall chinook salmon have been released in the Umatilla River every year since 1982 and from acclimation facilities since 1983 (Table 8). In 1982, this release was of tule stock. Since then all releases have been of upriver bright stock (Table 2). This is the fifth year that spring chinook salmon of Carson-via-Lookingglass stock have been acclimated and released (Table 3 & 8). 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 9). Coho salmon have been released since 1987, and a portion have been acclimated when the facilities and the fish were available (Table 4 & 9).

## Acclimation at Minthorn

### Coho salmon - 3/7 to 3/28

A group of 67,309 coho salmon was acclimated at Minthorn for 21 days and released on March 28 at 13.5/lb. (Table 7). Included were 28,033 coded-wire tagged fish (Table 10). The fish were fed 1.0% body weight per day (BWD) during acclimation and mortality was less than 0.1% (Table 11). The mean temperature and D.O. during acclimation was 8.8 degrees C and 8.4 mg/l, respectively (Table 11).

On March 29, a control group of 59,682 coho salmon at 13.3/lb. was unloaded into the upper Minthorn pond and crowded out within half an hour (Table 7). Included were 26,881 coded-wire tagged fish (Table 10).

The length frequency distributions of both groups (all fish) were similar (Figure 4). The length frequency distributions of the coded-wire tagged fish however, were dissimilar (Figure 5). The

Table 7. Juvenile salmon and steelhead released in the Umatilla River Basin in 1990.

Species	Brood stock	Hatchery	Number	#/lb.	Location	In Facility	In River	Fish Mark	I /1	Marked
Fall Chin.	88	Bonneville	BOMeVille	255614	8.2	Uma. RM 70	-----	Mar 19-26	None	0
Fall Chin.	89	Bonneville	Irrigon	2425681	87.5	Uma.RM 70-79	-----	May 11-June 1	CWT	158895
Fall Chin.	89	Pr. Rapids	Irrigon	629800	82.4	Uma.RM 70-79	-----	May 22-23	None	0
Fall Chin. /2	89	Bonneville	Irrigon	71864	9.2	Minthorn	Oct 3	Oct 16	CUT	66427
Fall Chin. /2	89	Bonneville	Irrigon	76646	8.8	Nr. Minthorn	-----	Oct 16	CUT	70450
Subtotal			3459605							
Spring Chin.	88	Carson	Carson	99775	18.6	Uma. RM 23	-----	Apr 18	None	0
Spring Chin. /2	88	Crson/Lglass	Bonneville	114345	9.0	Bonifer	Mar 8	Mar 2 2	CWT	79686
Spring Chin. /2	88	Crson/Lglass	Bonneville	117427	9.6	Nr. Bonifer	-----	Mar 22-23	CUT	77090
Spring Chin. /3	89	Crson/Lglass	Bonneville	80438	11.5	Bonifer	Oct 23	Oct 26	CUT	80176
Spring Chin. /3	89	Crson/Lglass	Bonneville	77998	13.4	Nr. Bonifer	-----	Oct 26	CUT	77478
Subtotal			489983							
Early Coho /2	88	Tanner Cr.	Cascade	67309	13.5	Min. Up. Ru.	Mar 7	Mar 28	CUT	28033
Early Coho /4	88	Tanner Cr.	Cascade	65095	11.2	Min. Lo. Rw.	Mar 7	Mar 9-Apr 12	CWT	27226
Early Coho /2	88	Tanner Cr.	Cascade	59682	13.3	Nr. Ninthorn	-----	Mar 29	CUT	26881
Early Coho	88	Tanner Cr.	Cascade	594527	14.8	Uma. RM 70	-----	Mar 26-Apr 2	None	0
Early Coho	88	Tanner Cr.	Cascade	202315	14.5	Uma. RM 23	-----	Mar 26-28	None	0
Subtotal			988928							
Sun. Sthd.	89	Umat lla	Oak Springs	29522	7.7	Bonifer	Apr 10	May 7	Ad only	29522
Sun. Sthd. /2	89	Umat lla	Oak Springs	30225	5.9	Bonifer	Apr 10-11	May 7	CWT+LV	27544
Sum Sthd. /2	89	Umat lla	Oak Springs	29446	5.5	Nr. Bonifer	-----	May 8-9,11	CWT+LV	28490
Subtotal			89193							
TOTAL			5283323							

Revised: 10-29-90

File Name: D:\123R2\DATA\1990REL

- /1 lagged fish are given an adipose fin clip unless additional clips are indicated
- /2 Acclimation evaluation - (unacclimated control release occurred instream near facilities at time of acclimated release).
- /3 Fish were held at Bonifer for a 3-day post transport recovery period, then released at the same time as the instream control release.
- /4 Volitional release.

**Table 8. Juvenile fall and spring chinook salmon releases in the Umatilla River Basin (1982-1990). [1]**

Species	Fall Chinook			Spring Chinook			
	Lower Umatilla	Upper Umatilla	Bonifer	Minthorn	Lower Umatilla	Upper Umatilla	Bonifer
<b>Year</b>							
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 (sy)[3]	60,507 (y)	137,655 (y)	0	0	0	0
1986	2,029,602 (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)151	0	102,363 (y)	111,143 (y)	0	169,100 (sy)	99,897 (y)
1988	3,316,007 (sy)[5&7]	79,681 (sy)[8]	99,550 (y)	115,199 (y)	156,312 (y)[7]	210,496 (y)	107,427 (y)
1989	3,052,015 (sy)	295,575 (y)	0	78,825 (sy)[8]	0	164,786 (y)	160,734 (y)
1990	0	255,614 (y)	0	71,864 (sy)[8]	99,775 (y)	195,425 (y)	194,783 (y)
		3,132,127 (sy)[10]				191	[9]

Revised: 1-22-91

File Name: D:\123R2\DATA\REL81902

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

[2] Releases in 1982 were Tule stock; all others have been upriver brights.

[3] Subyearlings released below Threenile 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.

Table 9. Juvenile steelhead and coho salmon releases in the Umatilla River Basin (1981-1990) 111.

Species	Summer Steelhead				Coho		
	Lower Umatilla	Upper Umatilla	Minthorn	Bonifer	Lower Umatilla	Upper Umatilla	Minthorn
Year							
1981	0	17,558 (y)	0	0	0	0	0
		9,400 (sy)					
1982	0	59,494 (y)	0	0	0	0	0
		67,940 (sy)					
1983	0	60,500 (y)	0	0	0	0	0
		52,700 (sy)					
1984	0	0	0	57,939 (y)	0	0	0
				22,000 (sy)			
1985	0	0	0	53,850 (y)	0	0	0
				39,134 (sy)			
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)
IWO	0	29,446 (y)	0	59,747 (y)	202,315 (y)	654,209 (y)	132,404 (y)

Revised: 1-22-91

File Name: D:\123R2\DATA\REL81903

[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 10. 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		

Revised: 1-23-91

File Name: D:\123R2\DATA\90COHREL

Table 11. Food rations, mortalities, temperatures, and D.O. concentrations during acclimation of juvenile salmonids in 1990.

Species	Test	Release Location	Release Date	Food Fed (%/day)	Mortality		Temperature (C)			Dissolved Oxygen (mg/l)		
					5 Day	Total	Min.	Max.	Ave.	Min.	Max.	Ave.
Fall Chinook	Acct.	Minthorn	Oct 16	0.98	1435	1486	9.0	14.7	11.9	5.2	7.8	6.5
Spring Chinook	Acct.	gonifer	Mar 22	0.49	47	85	5.3	11.8	8.0	4.4	9.2	7.2
Spring Chinook	Accl.	Bonifer	Oct 26	0.0	32	32	9.6	13.4	11.6	5.5	6.0	5.8
Coho	Acct.	Minthorn	Mar 28	1.00	33	51	6.2	12.2	8.8	5.0	8.4	7.3
Coho /1	Vol. Rel.	Minthorn	Mar 9-Apr 12	1.16	34	35	6.2	13.3	9.4	5.8	9.4	7.5
Summer Steelhead	Acct.	Bonifer	May 7	0.82	5	233	7.0	15.6	10.9	8.0	10.4	8.9
Summer Steelhead	Ad Only	gonifer	May 7	0.82	5	228	7.0	15.6	10.9	8.0	10.4	8.9

Revised: 1-23-91

File Name: D:\123R2\DATA\PRSAMSU2

/1 These fish were allowed to voluntarily release from March 9 to April 12 when they were forced out of the pond.

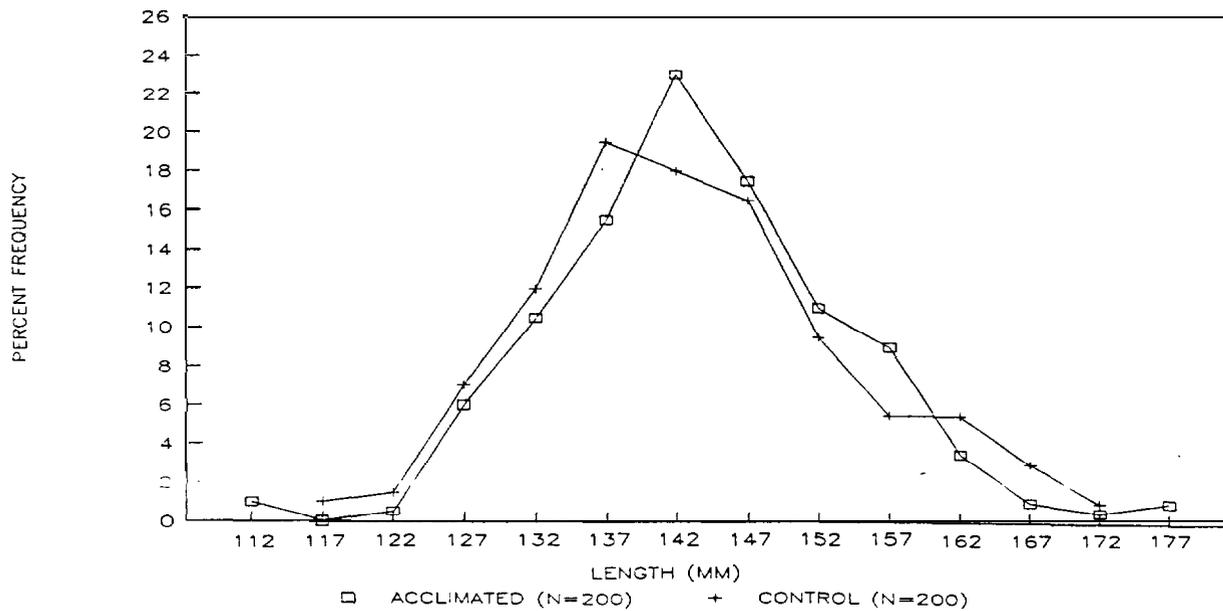


Figure 4. Length frequencies of experimental groups of coho salmon released at Minthorn Acclimation Facility on 3-28-90 (acclimated versus control group - all fish).

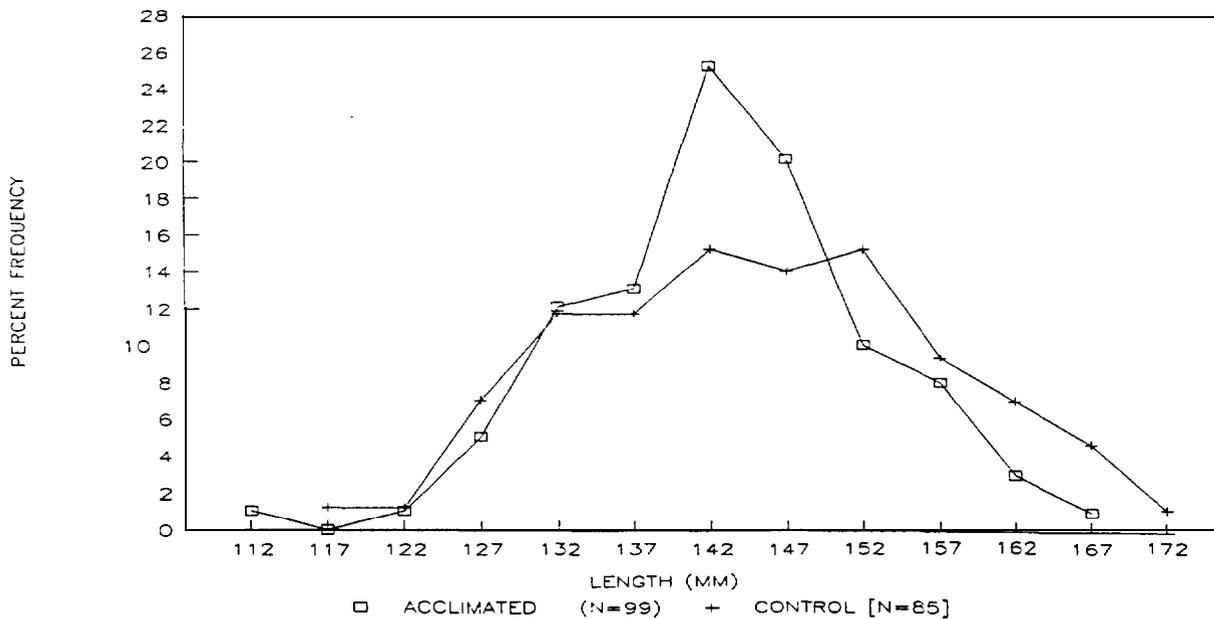


Figure 5. Length frequencies of experimental groups of coho salmon released at Minthorn Acclimation Facility on 3-28-90 (acclimated versus control group - coded-wire tagged fish).

coded-wire tagged control fish were slightly larger than the coded-wire tagged acclimated fish.

The length frequency distribution of the coded-wire tagged acclimated fish was similar to that of the non-tagged acclimated fish (Figure 6). The coded-wire tagged fish in the control group however, were larger than the non-tagged fish (Figure 7).

Descaling indices for both acclimated and control groups is given in Table 12. The percentage of acclimated fish with no descaling was 80.0% while that of control fish was 59.5%. The percentage of the control fish with partial descaling was twice that of the acclimated fish (40.0 versus 20.0%, respectively).

#### Coho salmon - 3/7 to 4/12

A second group of coho salmon was received at Minthorn on March 27 to evaluate volitional release. The tail screens were pulled on March 9 to allow the fish to leave the pond by swimming over the outlet damboards. Toward the end of March, it appeared that few if any of the fish had left the pond and a decision was made to continue holding the fish with the tail screens out. It was hoped that eventually the fish would show signs of smolting and voluntarily exit the pond.

On April 12, the fish (65,095 at 11.2/lb) were crowded out of the pond (Table 7). Included were 27,226 coded-wire tagged fish (Table 10). During the 36 days of acclimation, it appeared that very few if any fish left voluntarily. It is not known whether this was due to an inadequate release system or because the fish were not smolted and ready to leave. During acclimation, the fish did not congregate near the outlet damboards. An increase in water velocity over the damboards however, may have repelled the fish. A different release system with reduced velocities may prove to be more effective for a volitional release.

The fish were fed 1.16% BWD during acclimation and the mortality was less than 0.1% (Table 11). The mean temperature and D.O. was 9.4 degrees C and 9.4 mg/l, respectively (Table 11). The percentage of fish with partial descaling was 49.5% (Table 12). The length frequency distribution for all fish is shown in Figure 8. The length frequency distributions of coded-wire tagged versus non-tagged fish suggests that the smaller fish in the group were represented by coded-wire tagged fish (Figure 9).

#### Fall chinook salmon - 10/3 to 10/16

On October 16, a group of 71,864 fall chinook salmon at 9.2/lb. was released from Minthorn after being acclimated for 13 days (Table 7). Included were 66,427 coded-wire tagged fish (Table 13). The fish were fed 0.98% BWD and total mortality was 1,486 or 2.03% (Table 11). Most of the mortality (1,374) was a result of

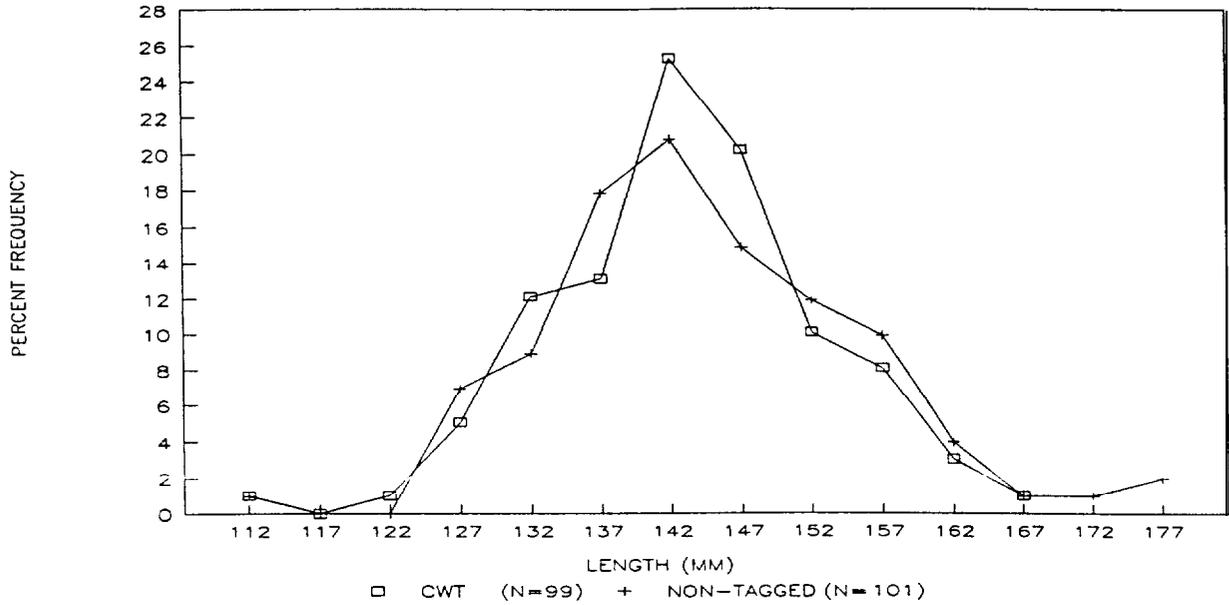


Figure 6. Length frequencies of experimental group of coho salmon released at Minthorn Acclimation Facility on 3-28-90 (acclimated group - coded-wire tagged versus non-tagged).

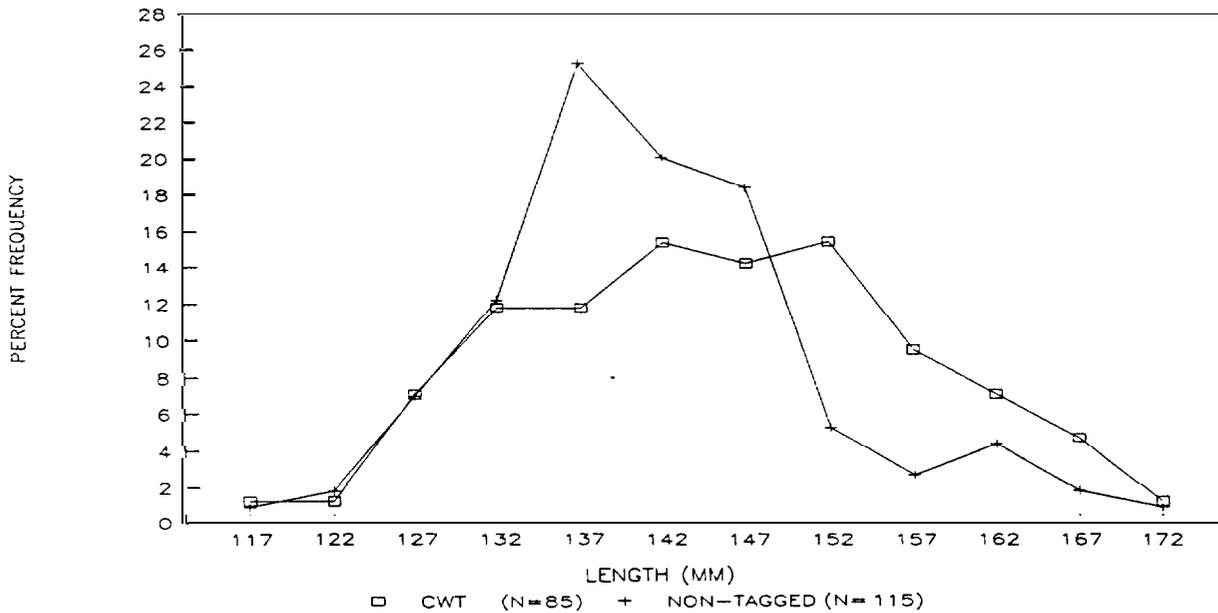


Figure 7. Length frequencies of experimental group of coho salmon released at Minthorn Acclimation Facility on 3-28-90 (control group - coded-wire tagged versus non-tagged).

Table 12. Size and descaling data for juvenile salmonids released in the Umatilla River Basin in 1990.

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	Oct 16	25.5	6.3	9.2	120	185	162	0.0	45.7	54.3	304
	Control	Nr. Minthorn	Oct 16	19.0	5.0	8.8	133	190	163	2.1	50.6	47.3	334
Spring Chinook	Test	Bonifer	Mar 22	29.7	2.4	9.0	118	247	161	1.5	34.0	64.5	200
	Control	Nr. Bonifer	Mar 22-23	25.6	2.7	9.6	116	241	157	2.8	34.0	63.2	400
Spring Chinook	Test	Bonifer	Oct 26	43.7	4.0	11.5	100	205	143	0.0	7.5	92.5	307
	Control	Nr. Bonifer	Oct 26	46.3	4.5	13.4	95	198	137	0.0	10.3	89.7	300
Coho	Test	Minthorn	Mar 28	30.3	7.2	13.5	111	177	144	0.0	20.0	80.0	200
	Control	Nr. Minthorn	Mar 29	25.5	7.9	13.3	118	171	143	0.5	40.0	59.5	200
Coho /1	Vol. Rel.	Minthorn	Mar 9-Apr 12	49.3	6.6	11.2	95	182	155	0.0	49.5	50.5	200
Summer Steelhead	Test	Bonifer	May 7	28.0	2.3	5.9	95	258	194	2.9	61.5	35.6	239
	Control	Nr. Bonifer	May 8-11	27.3	2.2	5.5	90	258	191	0.0	66.5	33.5	200
Summer Steelhead	Ad Only	Bonifer	May 7	30.5	2.7	7.7	93	253	176	5.0	69.8	25.2	202

Revised: 1-23-91

File Name: D:\123R2\DATA\PRSAMPSU

/1 These fish were allowed to voluntarily release from March 9 to April 12 when they were forced out of the pond. Since it appeared that few if any of the fish left the pond on their own, the data reported in the table was taken on April 12. On March 9, the fish averaged 15.9/lb. and 138 mm.

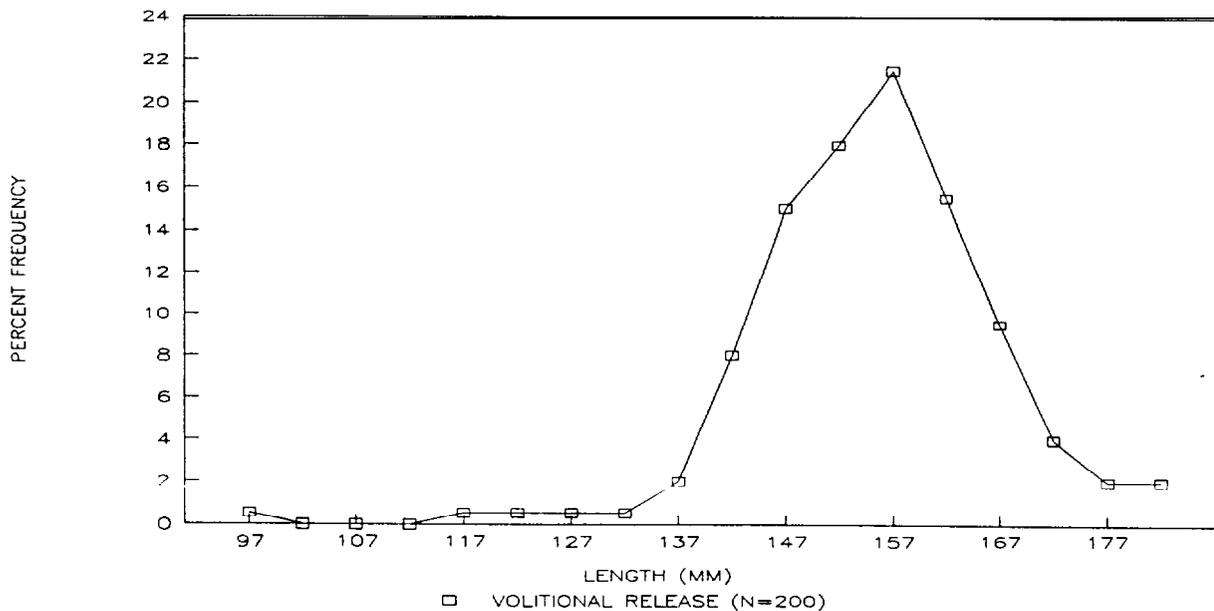


Figure 8. Length frequency of experimental group of coho salmon released at Minthorn Acclimation Facility between 3-9 and 4-12-90 (volitional release - all fish).

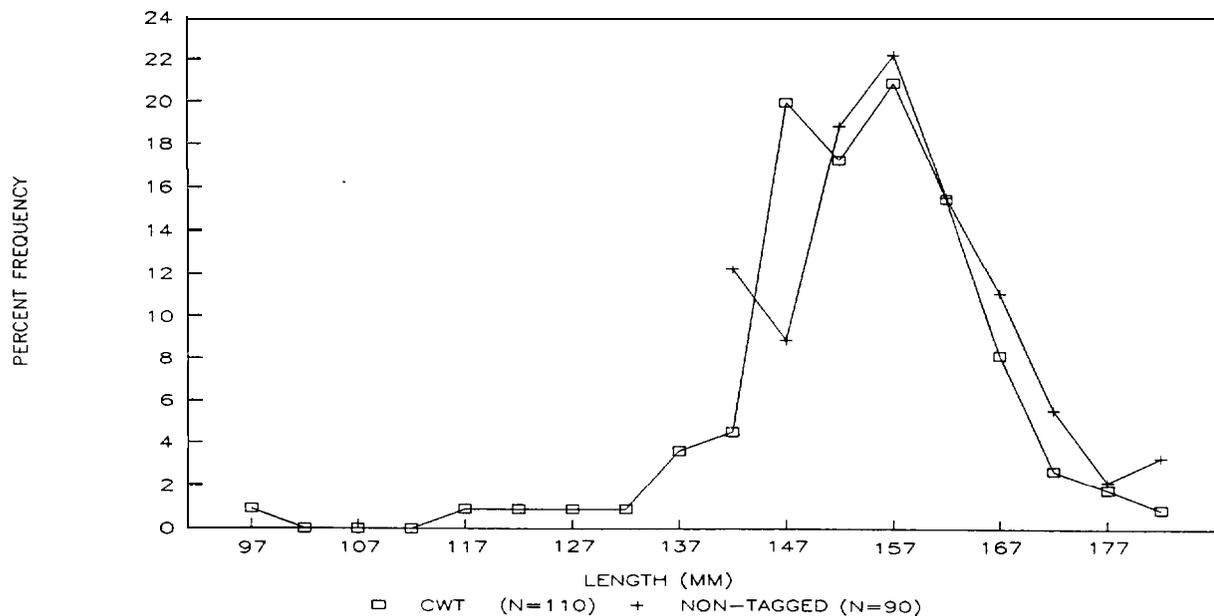


Figure 9. Length frequencies of experimental group of coho salmon released at Minthorn Acclimation Facility between 3-9 and 4-12-90 (volitional release - coded-wire tagged versus non-tagged).

Table 13. 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		

Revise: 1-22-91

File Name: D:\123R2\DATA\CHFCWTRE

Table 13. (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		

Revise: 1-22-91

File Name: D:\123R2\DATA\CHFCWTRE

problems with two compartments on the 5,000 gallon 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 11.9 degrees C and 6.5 mg/l, respectively (Table 11).

A control group of 76,646 fish at 8.8/lb. was also released on October 16 (Table 7). They were unloaded into the lower Minthorn pond and crowded out immediately. Included were 70,450 coded-wire tagged fish (Table 13).

The length frequency distributions of both groups were similar (Figure 10). Length frequencies for marked and unmarked fish were not differentiated because all fish were supposed to be marked.

The percentages of acclimated and control fish with partial descaling were similar (45.7 and 50.6%, respectively, Table 12). None of the acclimated fish and 2.1% of the control fish were totally descaled.

#### Acclimation at Bonifer

##### Spring chinook salmon - 3/8 to 3/22

On March 22, a group of 114,345 spring chinook at 9.0/lb. was released from Bonifer after a 14-day acclimation period (Table 7). Of these, 79,686 were coded-wire tagged (Table 14). The fish were fed 0.49% BWD and total mortality was less than 0.1% (Table 11). The mean temperature and D.O. during acclimation was 8.0 degrees C and 9.2 mg/l, respectively (Table 11).

A control group of 117,427 fish at 9.6/lb. was released into Meacham Creek on March 22 and 23 (Table 7). Included were 77,090 coded-wire tagged fish (Table 14).

The length frequency distributions of both groups (all fish and coded-wire tagged fish only) were similar (Figures 11 & 12, respectively). Figures 13 and 14 indicate that the length frequency distributions of the coded-wire tagged fish were similar to the non-tagged fish for both the acclimated and control groups.

The descaling indices were also similar for both groups (Table 12). Both the acclimated and control groups had 34.0% partial descaling, while 64.5 and 63.2% of the acclimated and control groups respectively, had no scale loss.

##### Summer Steelhead - 4/10 to 5/7

A group of 30,225 summer steelhead was acclimated at Bonifer for 27 days and released on May 7 at 5.9/lb. (Table 7). Included were 27,544 coded-wire tagged fish (Table 15). They were fed 0.82% BWD and total mortality was less than 0.1% (Table 11). The mean

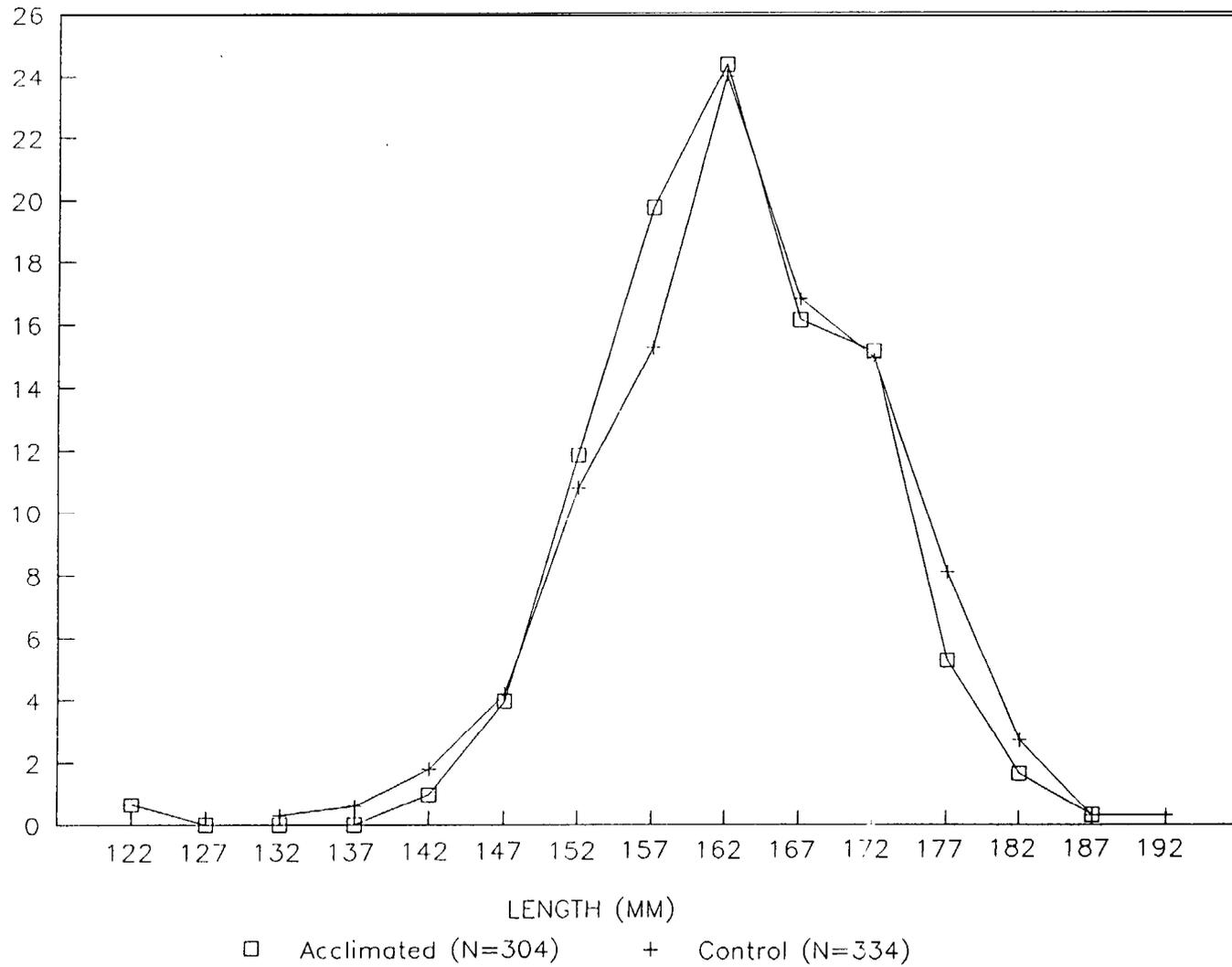


Figure 10. Length frequencies of experimental groups of fall chinook salmon released at Minthorn Acclimation Facility on 10-16-90 (acclimated versus control group - all fish).

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

Brood	Total number	Release time	Size (#/lb.)	Number	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		
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
	=====			=====		
	75,767			75,413		
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
	=====			=====		
	79,984			77,817		
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
	=====			=====		
	80,932			79,300		

Revised: 1-22-91

File Name: D:\123R2\DATA\90CHSR2

Table 14. (cont.).

Brood	Total number	Release time	Size (#/lb.)	Number tagged	CWT code	Release location
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>		
89	26757	Oct 90	11.5	26670	074505	Bonifer
89	26805	Oct 90	11.5	26717	074506	Bonifer
89	26876	Oct 90	11.5	26788	074507	Bonifer
	<u>80,438</u>			<u>80,175</u>		
89	26050	Oct 90	13.4	25876	074508	Nr. Bonifer
89	26279	Oct 90	13.4	26104	074509	Nr. Bonifer
89	25669	Oct 90	13.4	25497	074510	Nr. Bonifer
	<u>77,998</u>			<u>77,477</u>		

Revised: 1-22-91

File Name: D:\123R2\DATA\90CHSR2

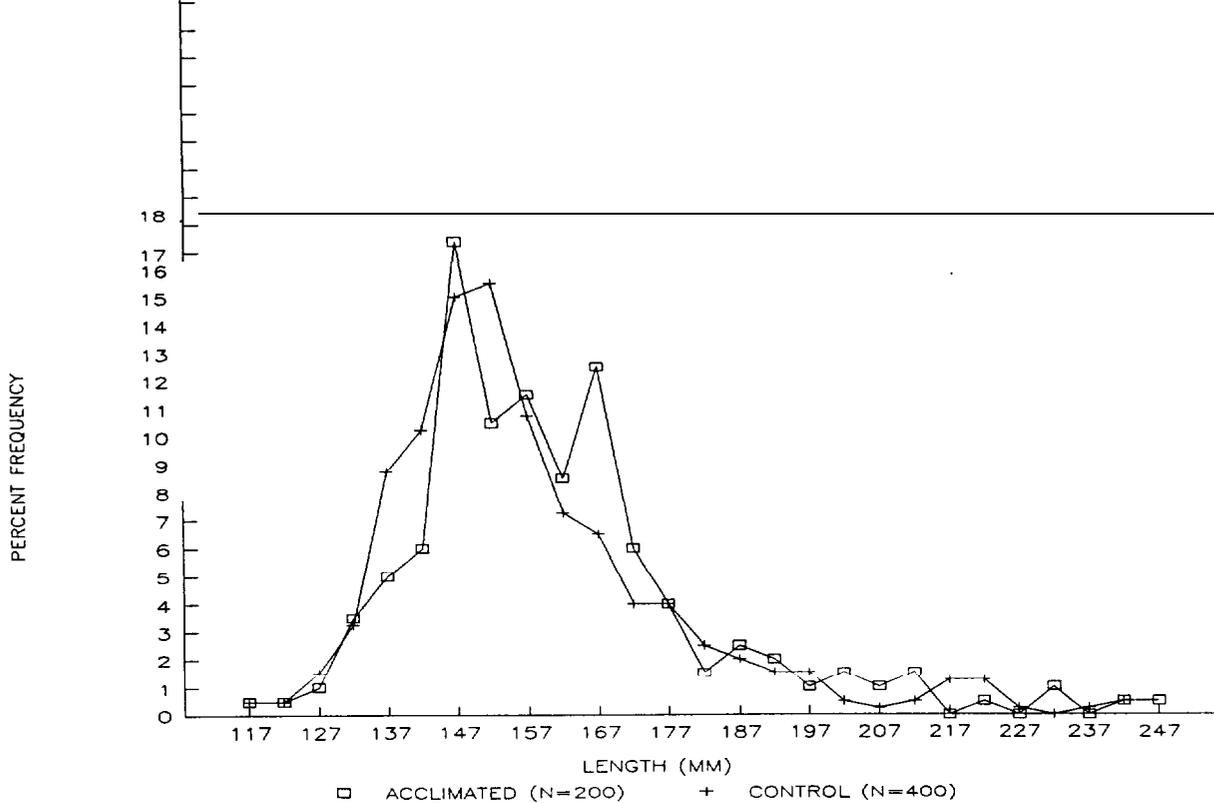


Figure 11. Length frequencies of experimental groups of spring chinook salmon released at Bonifer Acclimation Facility on 3-22-90 (acclimated versus control group - all fish).

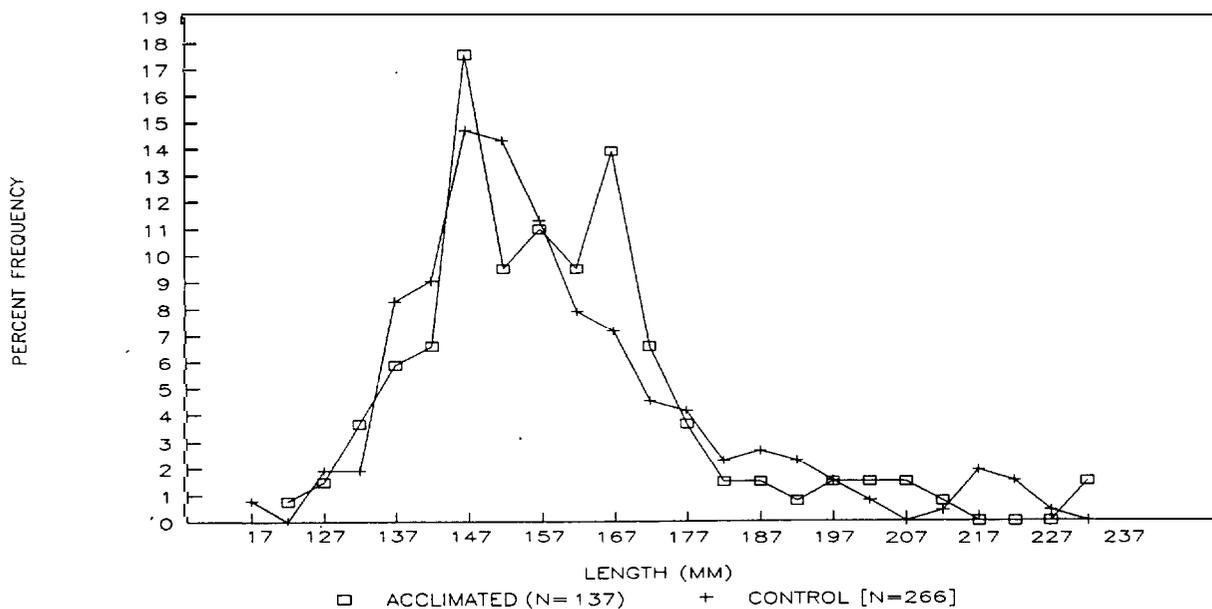


Figure 12. Length frequencies of experimental groups of spring chinook salmon released at Bonifer Acclimation Facility on 3-22-90 (acclimated versus control group - coded-wire tagged fish).

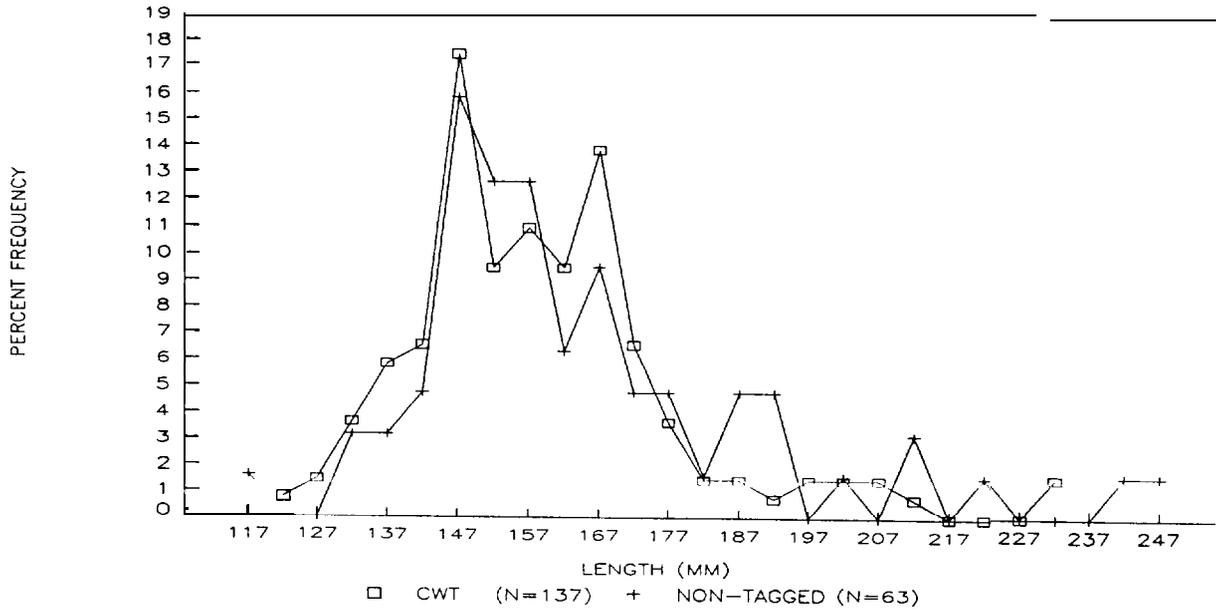


Figure 13. Length frequencies of experimental group of spring chinook salmon released at Bonifer Acclimation Facility on 3-22-90 (acclimated group - coded-wire tagged versus non-tagged).

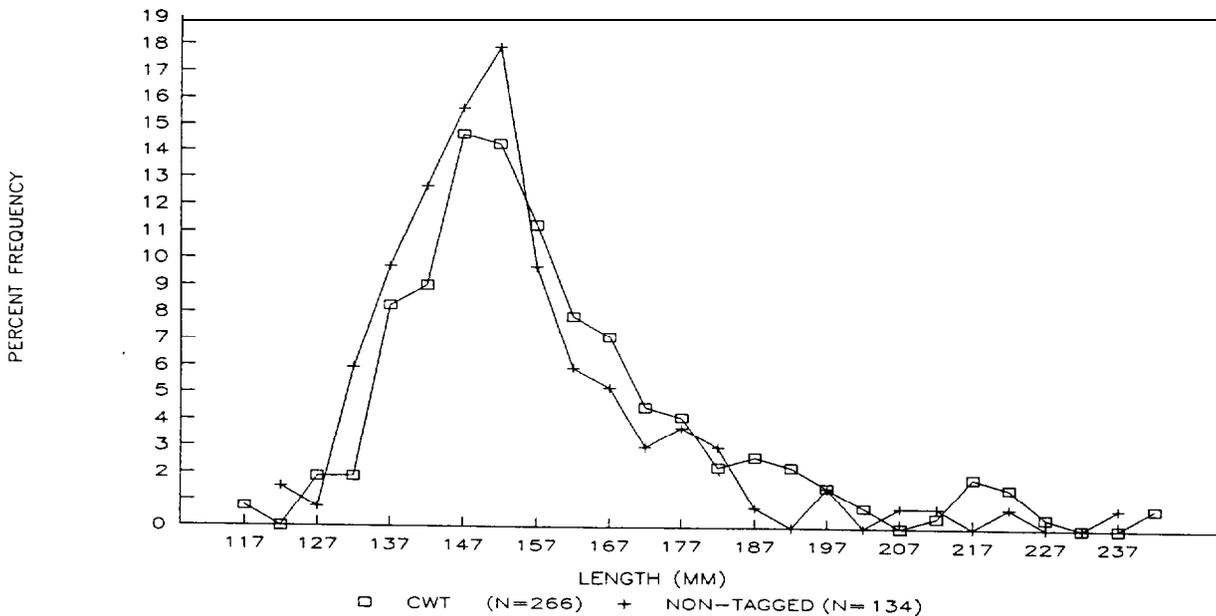


Figure 14. Length frequencies of experimental group of spring chinook salmon released at Bonifer Acclimation Facility on 3-22-90 (control group - coded-wire tagged versus non-tagged).

Table 15. 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
87	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
87	10,171	Apr 88	6.5	9,455	073857	Nr. Minthorn
87	10,163	Apr 88	6.5	9,448	073858	Nr. Minthorn
	=====			=====		
	30,757			28,592		
88	9,949	May 89	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		
89	10,239	May 90	5.9	9,331	075212	Bonifer
89	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
89	9,771	May 90	5.5	9,454	075217	Nr. Bonifer
	=====			=====		
	29,446			28,490		

=====

Revised: 1-22-91 File Name: D:\123R2\DATA\90STSREL

temperature and D.O. was 10.9 degrees C and 10.4 mg/l, respectively (Table 11).

Between May 8 and 11, a control group of 29,446 fish at 5.5/lb. was released into Meacham Creek (Table 7). Of these, 28,490 were coded-wire tagged (Table 15).

The length frequency distributions of both groups were similar (Figure 15). The descaling indices for both groups were also similar, although 2.9% of the acclimated fish were totally descaled compared to none of the control fish (Table 12).

#### Summer Steelhead - 4/10 to 5/7

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 7 but at 7.7/lb (Table 7). These fish were gradeouts from yearling fish used in the summer steelhead acclimation evaluation experiment. The ration fed, and mean temperature and D.O. during acclimation was the same as for the coded-wire tagged group (Table 11). Total mortality was also less than 0.1% (Table 11).

The length frequency distribution of this group, when compared to the coded-wire tagged group, was shifted to the left as would be expected due to their smaller size at release (Figure 16). The amount of descaling in the adipose only group was greater than it was in the coded-wire tagged group (Table 12). The adipose only fish were 5.0% totally descaled as compared to 2.9% of the coded-wire tagged fish. The amount of partial descaling was 69.8% in the adipose only group compared to 61.5% in the coded-wire tagged group.

#### Spring chinook salmon - 10/23 to 10/26

On October 26, 80,438 spring chinook at 11.5/lb. were released from Bonifer after a three-day post-transport recovery period (Table 7). Included were 80,176 coded-wire tagged fish (Table 14). The fish were not fed and the mortality was less than 0.1%. The mean temperature and D.O. during acclimation was 11.6 degrees C and 5.8 mg/l, respectively (Table 11).

The fish were held for a short period of time because of low flows and oxygen levels in the Bonifer pond at this time of year. Extended holding would necessitate feeding the fish which would further reduce the oxygen levels and put undue stress on the fish.

A control group 77,998 fish at 13.4/lb. was also released on October 26 (Table 7). They were unloaded into Bonifer pond because of low water in Meacham Creek and then were crowded out immediately along with the acclimated group. Included were 77,478 coded-wire tagged fish (Table 14).

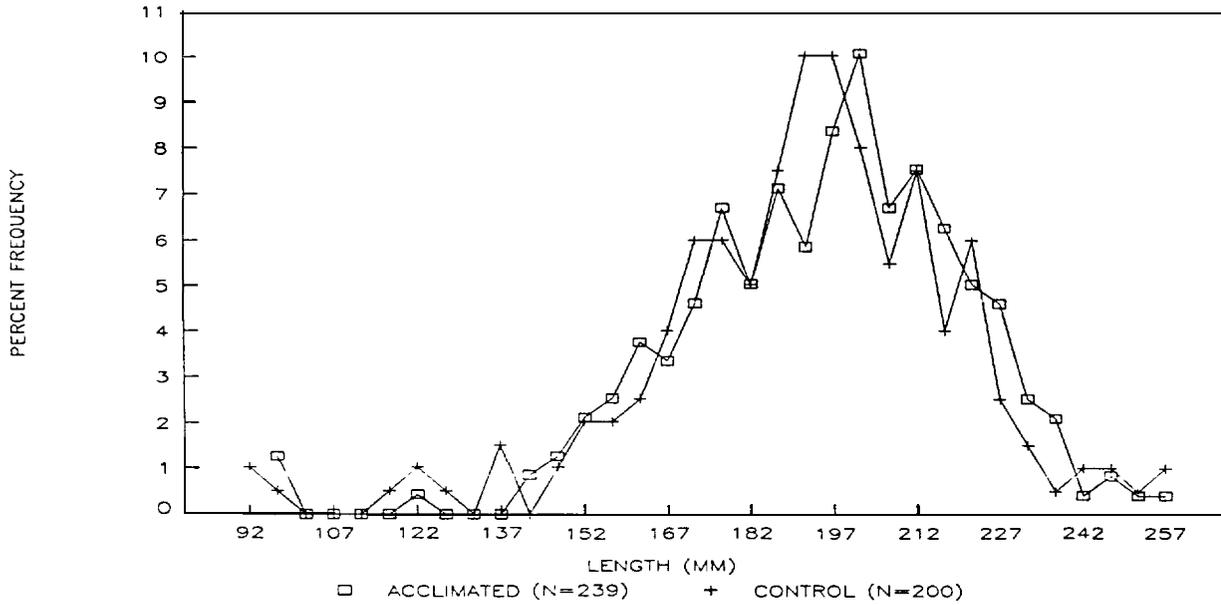


Figure 15. Length frequencies of experimental groups of summer steelhead released at Bonifer Acclimation Facility on 5-7-90 (acclimated versus control group - all fish).

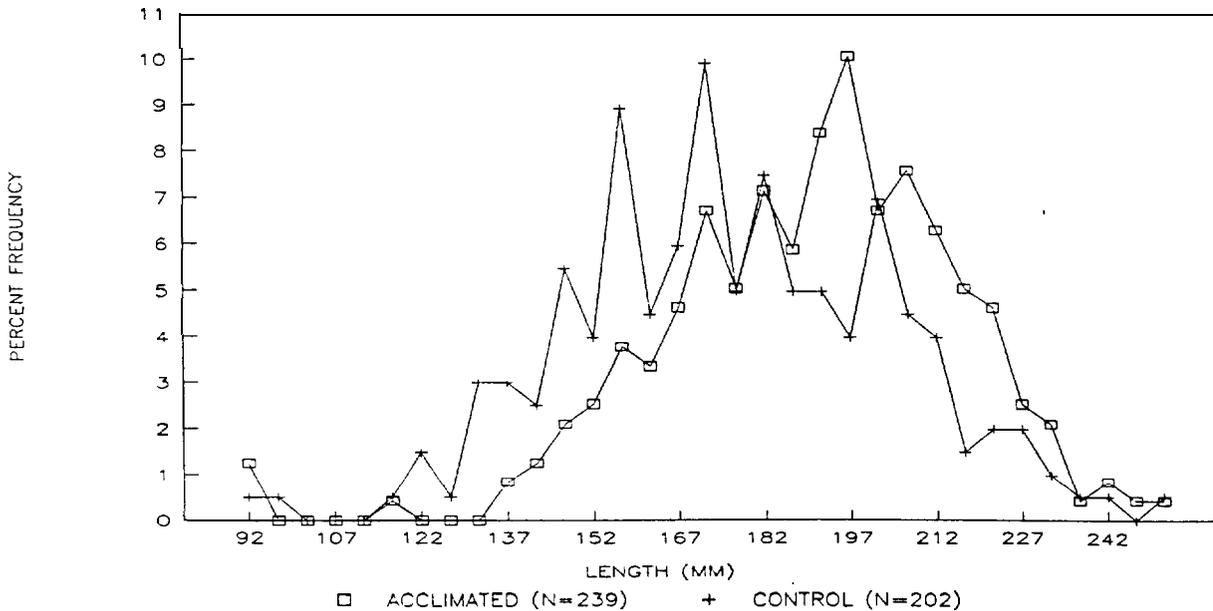


Figure 16. Length frequencies of experimental groups of summer steelhead released at Bonifer Acclimation Facility on 5-7-90 (coded-wire tagged versus Ad only).

The length frequency distributions of both groups (all fish) are shown in Figure 17. The length frequency of the acclimated fish is shifted slightly to the right as would be expected due to their larger size at release. Length frequencies of marked and unmarked fish were not differentiated because all fish were supposed to be tagged.

Descaling indices were similar for both groups (Table 12). The percentages of acclimated and control fish with partial descaling were 92.5 and 89.7%, respectively.

#### Outmigration Monitoring

Juvenile salmonids were sampled at the Westland Canal and Threemile Dam juvenile traps and data were recorded for comparison with release data to give an indication of outmigration timing and size.

Marked coho salmon released from Minthorn (RM 63) on March 28, were observed at Threemile Dam on April 3 (Table 16). Unmarked production coho released at Umatilla RM 70 on March 26 began arriving at Threemile Dam on March 28. The peak migration period was mid-April but fish were observed through May 31, with one fish being captured as late as June 13 (Tables 16 & 17).

The severity of descaling varied between Westland Canal and Threemile Dam. The descaling indices are very subjective however, and different individuals were recording data at each facility. This may contribute to some of the differences but general trends are probably still valid.

Coho yearlings were 75.2 and 46.2% partially descaled at Westland and Threemile Dam, respectively (Table 18). The percentage of fish that were totally descaled at Threemile Dam (6.1%) was nearly twice that observed at Westland (3.3%). The percentage of acclimated fish at release with partial descaling varied between 20.0 to 49.5% and the percentage of totally descaled fish was small (Table 12).

Marked spring chinook yearlings were released from Bonifer (RM 81) on March 22, and one was captured at Threemile Dam on the same day (Table 16). This was the first day that juveniles were sampled at Threemile Dam. Significant numbers of marked fish did not begin showing up until March 26. Unmarked chinook yearlings were released at RM 70 on March 19 and began showing up at Threemile on March 22. The marked fish captured on March 22 might have escaped from Bonifer or it may have been a 1989 fall release.

The peak migration period for chinook yearlings was early to mid-April (Tables 16 & 17). The last fish was observed at Threemile Dam on May 31.

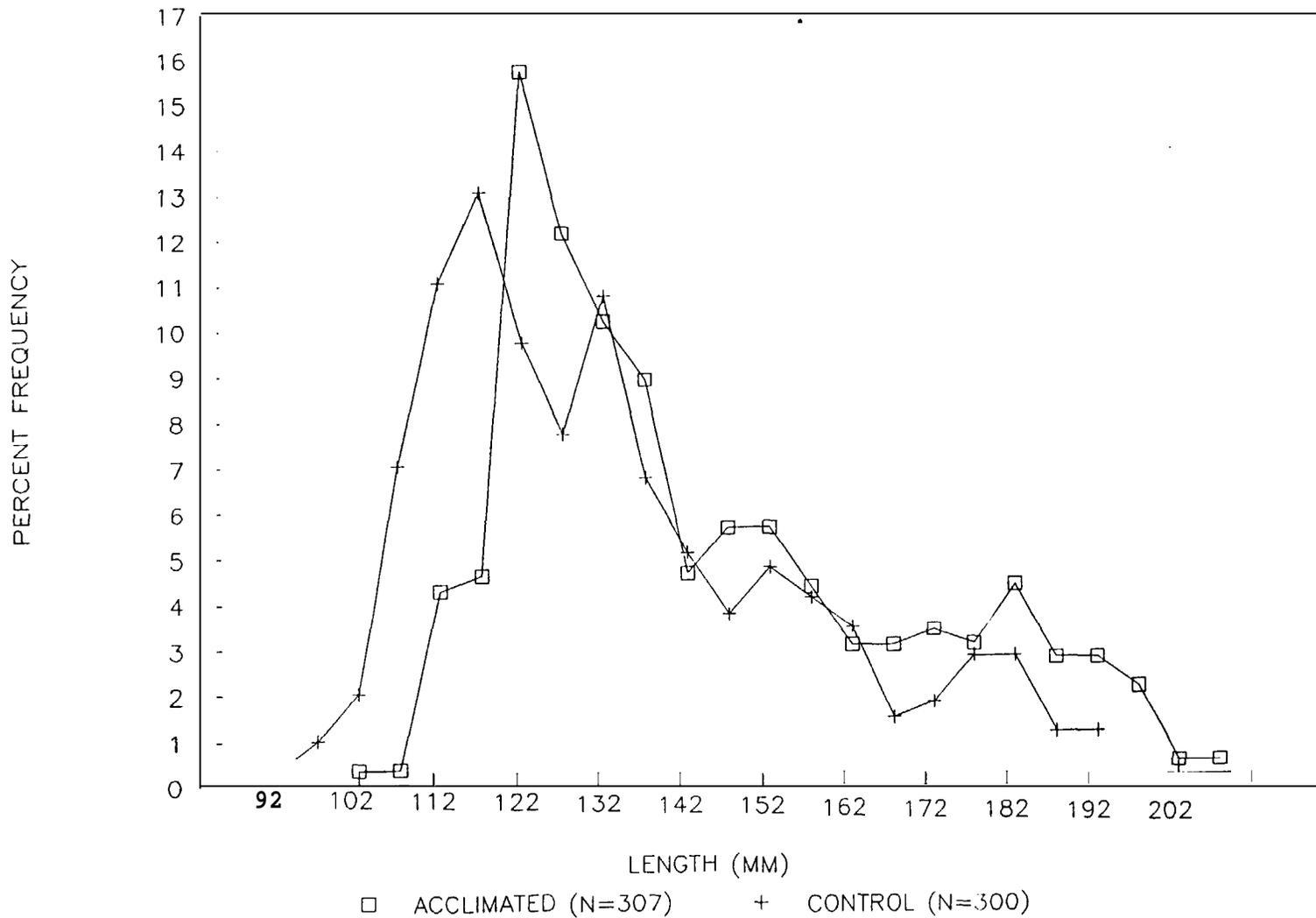


Figure 17. Length frequencies of experimental groups of spring chinook salmon released at Bonifer Acclimation Facility on 10-26-90 (acclimated versus control group - all fish).

Table 16. Estimated number of juvenile salmonids captured at Threenile Dam juvenile salmonid trap (left bank) in 1990. /1

Number of fish by-passed -----							Number of fish sampled -----					
Date	Total Salmonids	Coho	Chinook (Y)	(SY)	Steelhead Hatchery	Uild	Total Salmonids	Coho	Chinook (Y)	(SY)	Steelhead Hatchery	Wld
3-22	660	0	660	0	0	0	22	0	22	0	0	0
3-23	520	0	520	0	0	0	13	0	13	0	0	0
3-26	440	0	430	0	0	10	44	0	43	0	0	1
3-27	160	0	150	0	0	10	16	0	15	0	0	1
3-28	143	8	129	0	0	6	70	4	63	0	0	3
3-29	164	10	154	0	0	0	82	5	77	0	0	0
3-31	740	0	720	0	0	20	37	0	36	0	0	1
4-1	980	0	980	0	0	0	49	0	49	0	0	0
4-2							345	0	345	0	0	0
4-3	6640	220	6400	0	0	20	332	11	320	0	0	1
4-4	12000	400	11560	0	0	40	600	20	578	Q	0	2
4-5	6440	136	6304	0	0	0	332	7	325	0	0	0
4-6	3763	78	3685	0	0	0	194	4	190	0	0	0
4-8	327	41	245	0	0	41	16	2	12	0	0	2
4-9	560	20	530	0	0	10	56	2	53	0	0	1
4-10	171	63	103	0	0	6	30	11	18	0	0	1
4-11	295	210	80	0	0	5	59	42	16	0	0	1
4-12	10294	2001	8294	0	0	0	426	83	343	0	0	0
4-13	731	129	602	0	0	0	34	6	28	0	0	0
4-15	56380	22500	33780	0	0	100	2819	1125	1689	0	0	5
4-17	22443	13460	8983	0	0	0	802	481	321	0	0	0
4-23	4223	2770	1399	0	0	55	154	101	51	0	0	2
4-24	899	347	531	0	0	20	44	17	26	0	0	1
4-25	2811	908	1868	0	17	17	164	53	109	0	1	1
4-26	1597	209	1388	0	0	0	168	22	146	0	0	0
4-30	2708	1962	597	0	0	149	127	92	28	0	0	7
5-1	2803	2127	592	0	0	85	199	151	42	0	0	6
5-2	3935	3272	552	0	0	110	285	237	40	0	0	8
5-3	1732	1535	70	0	0	127	123	109	5	0	0	9
5-4	1240	880	341	0	0	19	258	183	71	0	0	4
5-7	325	297	11	0	0	17	58	53	2	0	0	3
5-8	635	550	4s	0	0	40	127	110	9	0	0	8
5-9	465	310	130	5	5	15	93	62	26	1	1	3
5-10	410	270	100	S	10	2s	82	54	20	1	2	5
5-11	1563	938	553	0	24	48	65	39	23	0	1	2
5-13	422	230	106	58	10	19	44	24	11	6	1	2
5-14	848	117	169	541	15	5	166	23	33	106	3	1
5-15	535	70	35	405	2s	0	107	14	7	81	5	0

Revised: 8-01-90

File Name: D:\123R2\DATA\3MJUV3

Table 16. (cont.)

Number of fish by-passed							Number of fish sampled					
Date	Total Salmonids	Coho	Chinook (Y)	Chinook (SY)	Steelhead Hatchery	Steelhead Wild	Total Salmonids	Coho	Chinook (Y)	Chinook (SY)	Steelhead Hatchery	Steelhead Wild
5-16	200	24	8	112	24	32	25	3	1	14	3	4
5-22	68	0	4	64	0	0	17	0	1	16	0	0
5-23	58	4	4	50	0	0	29	2	2	25	0	0
5 - 24	72	6	0	64	0	2	36	3	0	32	0	1
5-29	13409	15	15	12500	612	267	4425	5	5	4125	202	88
5-30	4268	25	0	3864	303	76	169	1	0	153	12	3
5-31	7161	10	10	7049	61	31	701	1	1	690	6	3
6-4	3750	0	0	3720	30	0	375	0	0	372	3	0
6-5	282	0	0	282	0	0	40	0	0	40	0	0
6-6	373	0	0	363	10	0	73	0	0	71	2	0
6-7	37457	0	0	37366	48	43	7806	0	0	7787	10	9
6-11	325	0	0	325	0	0	65	0	0	65	0	0
6-12	172	0	0	164	8	0	43	0	0	41	2	0
6-13	148	2	0	144	2	0	71	1	0	69	1	0
6-14	103	0	0	100	3	0	36	0	0	35	1	0

Revised: S-01-90

File Name: D:\123R2\DATA\3MJUV3

/1 Source of ran data: Suzanne Knapp (ODFW)

The number of fish reported does not include natural production coho; the actual sample taken included these as well as various other species.

The numbers reported have been adjusted to reflect passage over a 24 hour period. The actual sample periods varied from 5 to 25.5 hours with one exception. The numbers reported on 4-15 are for a 48 hour sample period.

Table 17. Estimated number of juvenile salmonids captured at Westland juvenile salmonid trap in 1990 /1

Number of fish hauled -----							Number of fish sampled -----					
Date	Total	Coho	Chinook		Steelhead		Total	Coho	Chinook		Steelhead	
	Salmonids		(Y)	(SY)	Hatchery	Wild	Salmonids		(Y)	(SY)	Hatchery	Wild
4-18	Trap open											
4-19	12878	12709	1b9	0	0	0	306	302	4	0	0	0
4-20	11980 /2	11623	231	0	0	126						
4-21	12925 /2	12323	330	0	0	272						
4-22	9098 /2	8523	288	0	0	287						
4-23	8786 /2	8019	330	0	0	437						
4-24	6344	5731	280	0	0	333	362	327	16	0	0	19
4-25	5573 /2	4990	272	0	0	311						
4-27	6724	5914	394	0	0	416	307	270	18	0	0	19
4-33	9195 /2	7974	397	0	0	824						
5-1	12101	10739	117	0	0	1245	311	276	3	0	0	32
5-1	Trap closed											
5-14	Trap open											
5-16	7088	733	285	6029	0	41	174	10	7	148	0	1
5-17	11375	2083	64	a972	128	128	355	65	2	280	4	4
5-19	17897 /2	2664	126	13401	1049	657						
5-21	15060	1724	121	10675	1603	937	498	57	4	353	53	31
5-23	44149 /2	2569	177	37446	2480	1477						
5-24	81727 /2	2457	1b4	75005	2539	1562						
5-25	143579	341	0	141701	854	683	841	2	0	830	5	4
5-26	120617 /3	290	0	11903s	712	580						
5-27	132104 /3	317	0	130372	780	635						
5-28	61745 /3	148	0	60935	355	297						
5-29	Trap closed											
6-15	Trap open											
b-19	20237 /4	0	0	20188	0	49						
b-20	36919 /4	0	0	36830	0	89						
b-22	27349	0	0	27282	0	67	407	0	0	406	0	1
b-25	12522 /2	0	0	12453	0	69						
b-28	7946	0	0	7877	0	69	462	0	0	458	0	4
7-b	3059	0	0	3059	0	0	308	0	0	308	0	0
7-13	1452	0	0	1444	0	8	172	0	0	171	0	1
7-19	738	0	0	734	0	4	191	0	0	190	0	1
7-26	262	0	0	262	0	0	96	0	0	96	0	0
8-2	1b5	0	0	1b5	0	0	63	0	0	63	0	0
8-16	226	0	0	223	3	0	65	0	0	64	1	0
8-27	1b	0	0	14	2	0	8	0	0	7	1	0
9-12	1b	0	0	13	3	0	1b	0	0	13	3	0
9-16	Trap Closed											
Totals	841852	101871	3745	714115	10518	11603	4942	1317	54	3307	67	117

Revised: 7-26-90

File Name: D:\123R2\DATA\WESTJUV3

- /1 The number of fish reported does not include natural production coho; the actual sample taken included these as well as other various species.
- /2 Numbers estimated by known pounds hauled and extrapolation from subsamples taken before and after.
- /3 Numbers estimated by known pounds hauled and extrapolation of samples taken on 5-25.
- /4 Numbers estimated by known pounds hauled and extrapolation of samples taken on b-22.

Table 18. Summary of descaling data for juvenile salmonids captured at Threemile Dam and Westland Canal juvenile salmon traps in 1990 (spring releases).

Species	Descaling (%)			Number of Fish Sampled
	None	Partial	Total	
<b>Westland Canal</b>				
Coho Yearlings	21.5	75.2	3.3	850
Chinook Yearlings	20.0	74.3	5.7	35
Chinook Sub-yearlings	49.3	49.0	1.7	1634
Hatchery Steelhead	50.0	50.0	0	2
Wild Steelhead	44.1	55.9	0	34
<b>Threemile Dam</b>				
Coho Yearlings	47.6	46.2	6.1	1933
Chinook Yearlings	57.1	38.9	4.0	2945
Chinook Sub-yearlings	63.2	35.4	1.4	1151
Hatchery Steelhead	12.4	79.4	8.2	194
Wild Steelhead	65.8	30.4	3.8	158

Revised: 8-8-90

File Name: D:\123R2\DATA\3MDWLDES

The percentage of yearling chinook with partial descaling was also higher at Westland than at Threemile Dam (74.2 versus 38.9%, respectively, Table 18). The acclimated chinook at release were 34.0% partially descaled (Table 12).

Although sub-yearling fall chinook were not a part of the formal acclimation evaluation project, they were also monitored at both trapping facilities. The first releases were at Umatilla RM 70 on May 11. One fish was observed at Threemile Dam on May 9 and one on May 10 (Table 16). The fork lengths of these fish were 85 and 40mm, respectively. Since these fish were captured before the first releases, it is assumed they were from natural production or were misidentified species. The first significant numbers of sub-yearling fall chinook began showing up at Threemile on May 13, two days after release. The peak migration period was late May to early June (Tables 16 & 17). Fish continued to be observed at Westland Canal through September 16 when the trap was closed.

The percentage of fish with partial descaling at Westland and Threemile Dam was 49.0 and 35.4%, respectively (Table 18). Total descaling was similar at both facilities. The length frequency distribution of chinook salmon sampled at Threemile Dam is illustrated in Figure 18.

Marked summer steelhead released from Bonifer on May 7 generally started showing up at Threemile Dam on May 9, two days after release (Table 16). One clipped fish however, was sampled on April 25. This fish either escaped from the pond or it was a residual from the previous release year. The largest fish sampled at release (acclimated and control groups) had a fork length of 258mm. The fish captured on April 25 was 280mm indicating it was probably a residual. The peak migration period was the end of May to early June (Table 16 & 17). One fish was observed at Threemile Dam on June 14, the last day of trapping, and only five were observed at Westland from June 22 to the close of the trap on September 16.

Wild steelhead were first observed at Threemile Dam on March 26. The numbers observed fluctuated daily but peaked in early May, and again in late May (Table 16).

The hatchery fish sampled were larger than the wild fish (Figure 19). The descaling indices for hatchery and wild fish at Threemile Dam were dissimilar (Table 18). The hatchery fish were 79.4% partially descaled and 8.2% totally descaled. This compares to 30.4 and 3.8% of the wild fish, respectively.

#### Assessment of Acclimation Facilities

Temperature and D.O. measurements that were recorded at the facilities during acclimation are reported in association with each

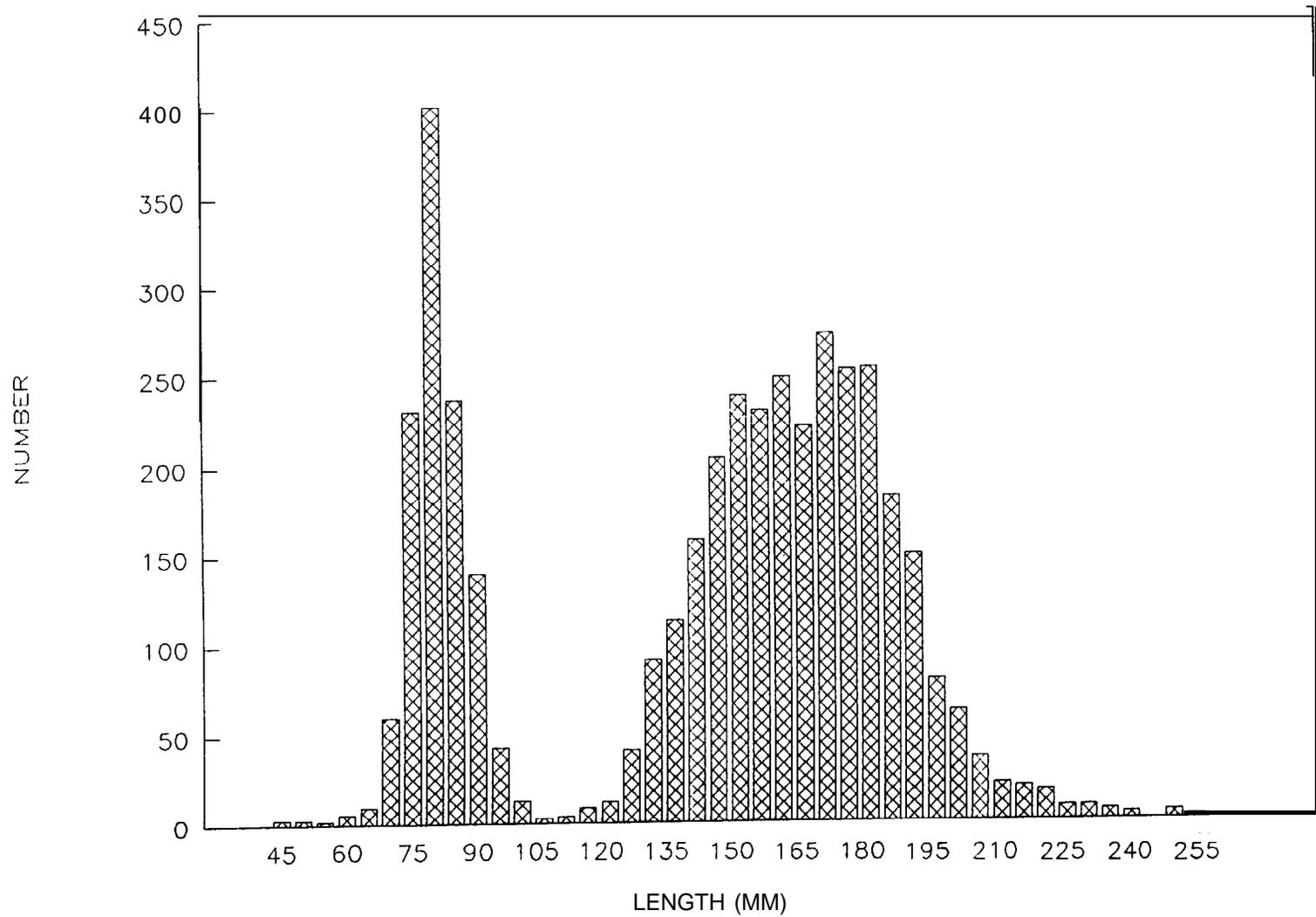


Figure 18. Length frequency distribution of juvenile chinook salmon captured at Threemile Dam in 1990.

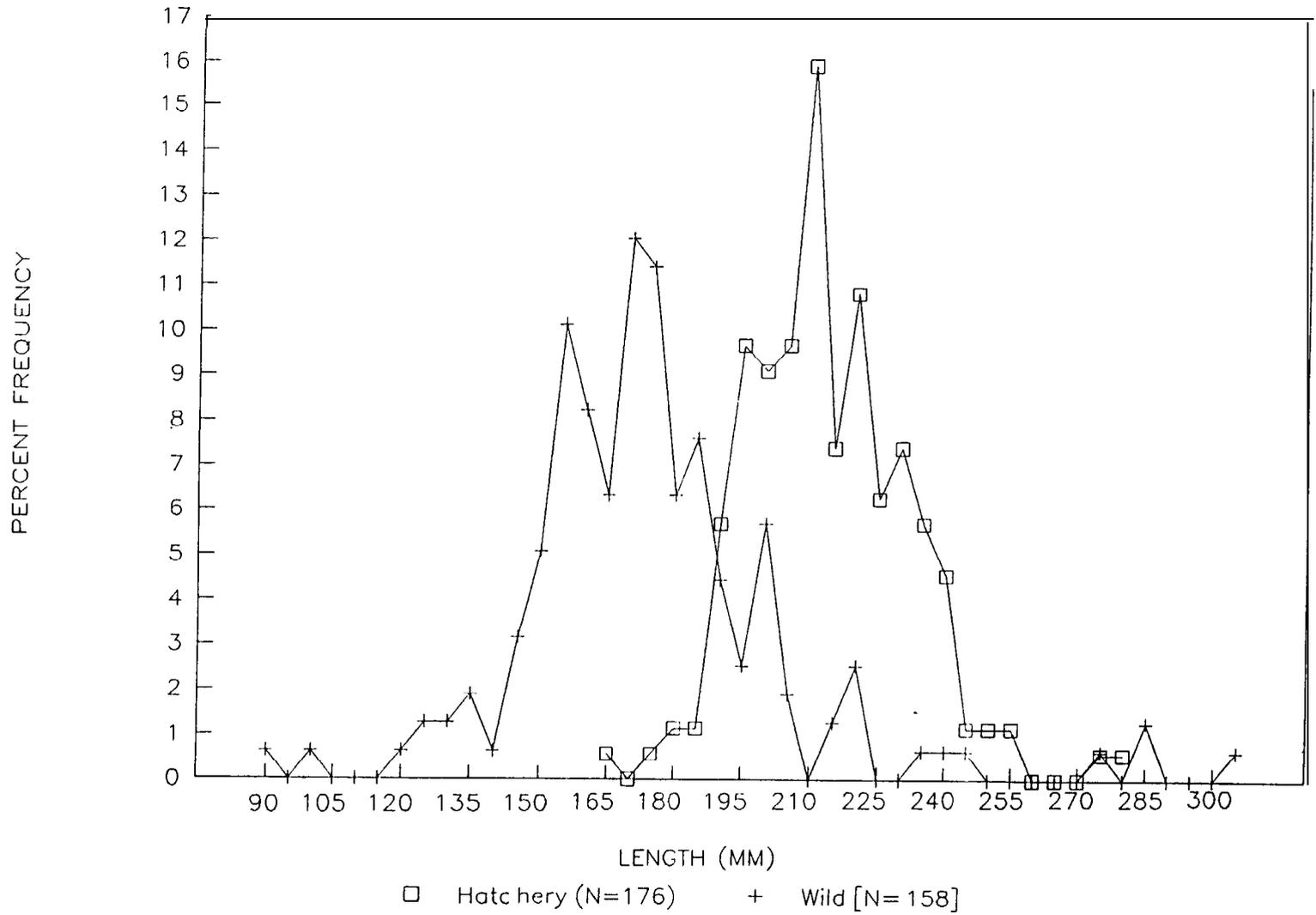


Figure 19. Length frequencies of summer steelhead captured at Threemile Dam in 1990 (marked versus unmarked).

particular acclimation. Detailed data for the year are presented in Appendices B, C, D and E.

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 through July, 1990 (Appendices C and E).

The data suggests however, that there would be little if any benefit. Temperatures at the Minthorn spring source and the present pump intake were generally within one to two degrees Celsius. Dissolved oxygen concentrations at the spring source were similar to the pump intake in the spring, higher in the summer and lower in the fall when oxygen levels are at their lowest.

Temperature and D.O. measurements taken in the upper reaches of the largest spring at Bonifer also indicate that there would be little if any benefit in using water from higher up in the spring.

## Research

### Taaains-Subcontract

Eight groups/of salmon and steelhead were tagged in 1990 for release in 1990-91 (Table 19). 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 salmon (80,684 fish) was tagged in May. The fish were acclimated at Minthorn and released in October. A control group (78,926 fish) was also tagged in May and released immediately from Minthorn at the time of the acclimation release.

Four groups of spring chinook salmon were tagged in August. A test group (81,366 fish) was acclimated and released at Bonifer in October. A control group (81,582 fish) was released immediately from Bonifer at the time of the acclimation release. A test group of spring chinook salmon (82,208 fish) was tagged and will be acclimated at Bonifer in the spring of 1991. A control group (82,673 fish) was tagged and will be released directly into the stream at the time of the acclimation release.

Two groups of summer steelhead were tagged in November. A test group (31,437 fish) was tagged and will be acclimated at Bonifer and released in the spring of 1991. A control group (31,514 fish) was also tagged and will be released directly into the stream at the time of the acclimation release.

Table 19. Coded-wire tagging of juvenile salmonids in 1990 for release in the Umatilla River.

Species	Brood	Hatchery	Mark	Size (#/lb.)	Month Tagged	Release Month	Release Site	No. Tagged	CUT Code
Fall chinook	a9	Irrigon	AD	120	May 1990	October 1990	Minthorn	28,418	075325
								26,636	075326
								25,630	075327
								-----	
							80,684		
Fall chinook	a9	Irrigon	AD	120	May 1990	October 1990	Nr.Minthorn	26,230	075322
								26,458	075323
								26,238	075324
								-----	
							78,926		
Spring chinook	a9	Bonneville	AD	20	August 1990	October 1990	Bonifer	27,066	074505
								27,114	074506
								27,186	074507
								-----	
							al,366		
Spring chinook	a9	Bonneville	AD	20	August 1990	October 1990	Nr. Bonifer	27,247	074508
								27,407	074509
								26,848	074510
								-----	
							81,582		
Spring chinook	a9	Bonneville	AD	30	August 1990	April 1991	aonifer	27,379	075114
								27,352	075115
								27,477	075116
								-----	
							82,208		
Spring chinook	a9	Bonneville	AD	30	August 1990	April 1991	Nr. gonifer	27,456	075440
								27,675	075441
								27,542	075442
								-----	
							82,673		
Summer steelhead	90	Oak Springs	AD&LV			May 1990	Bonifer	10,492	075340
								10,475	075341
								10,470	075342
								-----	
							31,437		
Summer steelhead	90	Oak Springs	AD&LV			May 1990	Nr. Bonifer	10,482	075343
								10,521	075344
								10,511	075345
								-----	
							31,514		

Revised: 2-1-91

File Name: D:\123R2\DATA\COFWTAG2

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

The snouts from adipose clipped fall chinook salmon were collected at Threemile Dam in the 1990 season. Included were the snouts from nine subjacks, 19 jacks and 164 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 three jacks and 40 adults. Size categories were defined as <458mm for subjacks, 458-609mm for jacks and >609mm for adults. The arbitrary cutoff for subjack size was determined by CTUIR biologists who examined the length frequency information for the fall chinook salmon run in 1987. The cutoff between jacks and adults is that used in the fishing regulations for the State of Oregon (24 inches).

Snouts from 16 spring chinook jacks and six adults were collected at Threemile Dam. An additional 68 snouts from spring chinook adults and one snout from a spring chinook jack were collected on spawning ground surveys. The snouts from 124 summer steelhead, 48 coho adults and 63 coho jacks were also collected at Threemile Dam. One snout from a coho jack was collected on spawning ground surveys. All snouts were delivered to ODFW in Clackamas, OR. for code identification.

### Adult survival and Umatilla River Returns

Data presented for all coded-wire tagged recoveries from 1983 to 1990 were retrieved from the Pacific Marine Fisheries Commission (PMFC) through computer access. Data recovered for 1983 were retrieved from the Pacific States Marine Fisheries Commission (PSMFC) data format while recoveries from 1984 to 1990 were retrieved from the Pacific Salmon Commission (PSC) data format. Additional Oregon and Washington freshwater recoveries in 1989 and 1990 were obtained from ODFW (Charlie Corrarino) and the Washington Department of Fisheries (Lynn Anderson). Data are preliminary and should be considered as such. All fish reported by PSMFC are included in this report, including fish for which no expansion (estimated number) was available. For these fish, the observed number was used.

All data is summarized in tabular form for each tagcode. Recovery information for fall chinook salmon is discussed and compared for those releases when fish at least four years old have been recovered. Recovery rates of tagcodes for which only younger fish have been recovered are discussed relative to other return rates for early years because recoveries are incomplete.

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 for fall chinook salmon occurred as subyearling and yearling fish. For discussion of recoveries of adults from these releases, fish recovered in the same year as release were not considered. Detailed information on recoveries is presented in Appendices F, G, H and I.

### 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 20). 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 returns to the Umatilla River.

Total recoveries were higher in the acclimated group than they were in the control group (0.42 versus 0.29%, respectively), despite the larger size of the non-acclimated group at release (Table 20). 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 (0.18 and 0.17%, respectively).

Approximately 50.7% of the fish recovered were captured at Threemile Dam on the Umatilla River and approximately 42.8% were recovered in the Columbia River gillnet fishery. An estimated 6.5% were caught in the Columbia River sport fishery and 55.1% of the acclimated fish and only 25.0% of the non-acclimated fish recovered 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 20). No recoveries had been reported at the time this report was written.

### Fall Chinook - Tule stock

Initial releases of fall chinook salmon in the Umatilla River were subyearling Tule stock (Table 21). 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 21).

Table 20. Liberation and survival information for summer steelhead released in the Umatilla River.

Brood	Number Released	Date of Release	Size at Release	Number Tagged	Release CUT Code	Release Location	%	Total	Estimated Adult Survival			
									Canada Ocean	Col.R. Net	FW Sport	Fish Trap
87	10187	Apr 88	7.4	9829	073859	Mnthorn	0.27	28	0	12	0	16
87	10075	Apr 88	7.4	9721	073860	Mnthorn	0.51	52	0	35	0	17
87	10287	Apr 88	7.4	9925	073861	Mnthorn	0.45	47	0	23	1/1	23
-----				-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	30549			29475			0.42	127	0	70	1	56
87	10423	Apr 88	6.5	9689	073856	Nr. Mnthorn	0.49	50	2	14	12 /2	23
87	10171	Apr 88	6.5	9455	073857	Nr. Mnthorn	0.29	29	0	8	0	22
87	10163	Apr 88	6.5	9448	073858	Nr. Mnthorn	0.08	9	0	0	1/1	8
-----				-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	30757			28592			0.29	88	2	22	13	53
88	9949	May 89	6.6	8784	074720	M nthorn						
88	9954	May 89	6.6	8789	074723	Mnthorn						
88	9949	May 89	6.6	8784	074724	Uinthorn						
-----				-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	29852			26357			0.00	0	0	0	0	0
88	9873	May 89	5.6	8800	074715	Nr. Mnthorn						
88	9864	May 89	5.6	8791	074717	Nr. Mnthorn						
88	9849	May 89	5.6	8778	074718	Nr. Mnthorn						
-----				-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	29586			26369			0.00	0	0	0	0	0

Revised: 6-24-91

File Name: D:\123R2\DATA\STSSURV

/1 Caught at mouth of Deschutes River.

/2 Three caught at mouth of Deschutes River.

Table 21. Liberation and survival information for fall chinook salmon released in the Umatilla River. /1

Br. Stock/2	Yr. Released	Number Released	Date of Release	Size at Release	Number Tagged	CWT Code	Release Location	%	Estimated Total	Adult Ocean	Survivals Col.R.	Survivals 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 & Heacham Cr.	0.16 /5	159	a6	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	5165	/7	1592	3573	0
83 B		198162	Mar 85	7.8	88306	073127	Uma.R.(RM 87) & Bonifer	0.78 /5	1546	891	653	2	
84 B		3223172	Jun 85	92.3	206756	073326	Umatilla R.(RM 1.5)	0.83	26720	10725	15948	47	
84 B		51000	Oct 85	16.2	30838	073162	Bonifer	0.66	337	141	193	3	
a4 B		206815	Mar 86	4.8	88396	073327	Bonifer & Minthorn	2.96 /5	2695	/8	1513	1120	62
85 B		197432	Jun 86	86.0	20636	073833	Umatilla R.(RM 1.5)	0.63	1253	498	756	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)	0.30	601	229	372	0	
a5 B		196952	Jun 86	86.0	20170	073836	Umatilla R.(RM 1.5)	0.41	810	254	557	0	
85 B		197788	Jun 86	86.0	20982	073837	Umatilla R.(RM 1.5)	0.36	716	207	509	0	
85 B		208103	Jun 86	86.0	20815	073838	Umatilla R.(RM 1.5)	0.36	740	290	450	0	
85 B		208958	Jun 86	86.0	21659	073839	Umatilla R.(RM 1.5)	0.51	1071	241	830	0	
a5 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)	0.38	787	110	678	0	
85 B		208994	Jun 86	86.0	21694	073842	Umatilla R.(RM 1.5)	0.46	954	279	674	0	
-----					-----					-----			
Total		2029602			209145			0.43	8817	3086	5733	0	
85 B		22216	Mar 87	8.1	10103	073823	Minthorn	1.92 /5	427	205	183	40	
85 B		22523	Mar 87	8.1	10243	073824	Minthorn	1.99 /5	449	204	218	26	
85 B		21807	Mar 87	8.1	9917	073825	Minthorn	2.01 /5	438	200	185	53	
85 B		20881	Mar a7	8.1	9496	073826	Minthorn	1.81 /5	378	152	196	31	
85 B		21716	Mar 87	8.1	9876	073827	Minthorn	1.56 /5	339	183	119	37	
-----					-----					-----			
Total		109143			49635			1.86	2031	944	901	187	

Revised: 6-24-91

File Name: D:\123R2\DATA\CHFSURV

Table 21. (cont.)

Br. Stock	Yr. Released	Number	Date of Release	Size at Release	Number Tagged	Release CUT Code	Release Location	Estimated Adult Survivals				
								%	Total	Ocean	Col.R.	Uma.R.
a5 B	20786	Mr	a7	8.6	10253	073828	Bonifer	2.19	456	207	235	14
85 B	20212	Mr	87	8.6	9970	073829	Boni fer	2.20	444	229	203	12
a5 B	20546	Mr	a7	8.6	10135	073830	Bonifer	2.48 /5	509	205	282	22
85 B	20381	Mr	87	8.6	10053	073831	Bonifer	2.03	414	189	189	36
a5 B	20438	Mr	a7	8.6	10081	073832	Bonifer	2.00 /5	410	189	201	20
-----								----	---	---	---	---
Total	102363				50492			2.18	2233	1019	1110	104
86 P	497572	My	a7	60.4	40793	073912	Umatilla R.(RM 1.5)	0.63	3159	1317	1781	61
86 P	501266	My	a7	60.4	41096	073913	Umstilla R.(RM 1.5)	0.71	3549	1537	1964	49
86 P	477992	My	87	60.4	39187	073914	Umstilla R.(RM 1.5)	0.72	3428	1744	1561	122
-----								----	---	---	---	---
Total	1476830				121076			0.68	10136	4598	5306	232
86 P	670	Jul	a7	20.0	643	073915	Minthorn					
86 P	672	Jul	a7	20.0	645	073916	Minthorn					
86 P	658	Jut	87	20.0	632	074035	Minthorn	0.79	5	0	5	0
-----								----	---	---	---	---
Total	2000				1920			0.25	5	0	5	0
86 B	52317	Mr	88	8.8	42068	074038	Minthorn	2.12 /5	1111	632	372	107
86 B	48474	Mr	a8	8.8	38978	074039	Minthorn	2.00 /5	970	545	313	112
-----								----	---	---	---	---
Total	100791				81046			2.06	2081	1177	685	219
86 B	50480	Apr	88	10.2	39509	074036	Boni fer	1.56 /5	790	457	248	a4
86 B	49070	Apr	88	10.2	38405	074037	Boni fer	1.55 /5	763	434	243	86
-----								----	---	---	---	---
Total	99550				77914			1.56	1553	891	491	170
87 P	1886757	My	88	68.3	198285	075007	Umstilla R.(RM 23)	0.03	561	285	162	114
87 P	4823	Nov	88	9.8	4438	074539	Minthorn	0.02	1	1	0	0
87 P	4660	Nov	88	9.8	4289	074540	Minthorn	0.02	1	0	0	1
87 P	4925	Nov	88	9.8	4533	074541	Minthorn	0.22	11	7	4	0
-----								----	---	---	---	---
Total	14408				13260			0.09	13	8	4	1
87 P	26858	Nov	88	8.6	24656	074536	Nr. Minthorn	0.08	21	2	12	7
87 P	25493	Nov	88	8.6	23403	074537	Nr. Minthorn	0.16	40	24	7	10
87 P	27330	Nov	8.8	8.6	25089	074538	Nr. Minthorn	0.13	35	24	4	7
-----								----	---	---	---	---
Total	79681				73148			0.12	96	50	23	24

Revised: 2-6-91

File Name: D:\123R2\DATA\CHFSURV

Table 21. (cont.)

Br. Stock	Yr. Released	Number Released	Date of Release	Size at Release	Number Tagged	Release		Estimated Adult Survivals			
						CUT Code	Location	% Total	Ocean	Col.R.	Um.R.
88P	797904	May 89	66.6	52228	074646	Umatilla R.(RM 23)	0.01	61	15	15	31
88P	797903	May 89	66.6	49771	074647	Umatilla R.(RM 23)	0.01	96	16	64	16
88P	797904	May 89	66.6	52244	074648	Umatilla R.(RM 23)	0.01	61	31	31	0
-----		-----		-----		-----		-----		-----	
Total	2393711			154243			0.01	218	62	110	47
88P	26770	Oct 89	10.9	26358	074753	M nthorn					
88P	26617	Oct 89	10.9	25028	074754	Minthorn	0.01	3	0	0	3
88P	25438	Oct 89	10.9	25438	074757	Uinthorn	0.00	1	0	0	1
-----		-----		-----		-----		-----		-----	
Total	78825			76824			0.01	4	0	0	4
88P	27071	Oct 89	11.1	26790	074758	Nr. Minthorn					
88P	25428	Oct 89	11.1	24285	074760	Nr. Minthorn					
88P	25633	Oct a9	11.1	25350	074763	Nr. Minthorn					
-----		-----		-----		-----		-----		-----	
Total	78132			76425							

Revised: 6-24-91

File Name: D:\123R2\DATA\CHFSURV

- /1 The adult returns from the 1984-88 brood are incomplete.
- /2 T = Tule stock  
B = Bonneville upriver brights  
P = Priest Rapids upriver brights
- /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.

Survival rates ranged from 0.44 to 0.52% (Table 21). 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 99.3% for all releases. Ocean commercial and Columbia River gillnet catches were 48.3 and 40.6%, respectively. Sport and treaty exploitation rates were 8.1 and 2.3%.

#### Fall Chinook - Bonneville stock

All releases since 1982 have been of Bonneville and Priest Rapids upriver bright stock (Table 21). The first liberations of fish from Bonneville stock were from adult returns to Bonneville SFH with some fish taken from Bonneville Dam. Early releases of subyearlings were near the mouth of the river because of potential for fish loss due to unscreened or partially screened irrigation diversions. Yearlings could be released farther upstream. For purposes of discussion, fish are grouped by age of release and release location (lower Umatilla River and upper Umatilla River and its tributaries). Releases in the upper river include those made at the Minthorn and Bonifer Acclimation Facilities.

All but one release of fish in the upper river were yearlings (Table 22). The fish were released 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). Three releases were made in April, while all others were made in March. Subyearlings were reared at Bonifer over the summer and released in October (Table 23). The yearling fish ranged from 4.8 to 10.2/lb. at release from 1983 to 1988 (Table 22). The subyearling fish released in October were 16.2/lb. (Table 23).

The survival (through age-6 fish) of the yearling releases (1983 to 1986) ranged from 0.08 to 2.96% (Table 22). Releases made in 1983 and 1984 survived poorly (0.16 and 0.08 %, respectively). Survival increased to 0.78% for 1985 releases and 2.96% for 1986 releases. Through age-5 fish, the survival rate is 2.02 % for all groups released in 1987 from acclimation facilities. In comparison, the survival of the 1986 releases through age-5 fish was 2.87%. Preliminary recovery information through age-4 fish suggests similar or better survival for fish released in 1988 than in 1987.

All releases in the lower river were made with subyearling fish (Table 23). Fish were released near the mouth (RM 1.5), below all major diversions. 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.). Releases for which

**Table 22. 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	CUT 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	
83 B	198162	Mar a5	7.8	88306	073127	Uma.R.(RM 87) & Bonifer	0.78	/5 1546	891	653	2	
84 B	206815	Mar 86	4.8	88396	073327	Bonifer & Minthorn	2.96	/5 2695 /8	1513	1120	62	
85 B	22216	Mar 87	8.1	10103	073823	Minthorn	1.92	/5 427	205	183	40	
a5 B	22523	Mar 87	8.1	10243	073824	Minthorn	1.99	/5 449	204	218	26	
85 B	21807	Mar 87	8.1	9917	073825	Minthorn	2.01	/5 438	200	185	53	
a5 B	20881	Mar 87	8.1	9496	073826	Minthorn	1.81	/5 378	152	196	31	
85 B	21716	Mar 87	8.1	9876	073827	Minthorn	1.56	/5 339	183	119	37	
-----				-----		-----		----	---	---	---	---
<b>Total</b>	<b>109143</b>			49635			<b>1.86</b>	<b>2031</b>	<b>944</b>	<b>901</b>	<b>187</b>	
85 B	20786	Mar 87	8.6	10253	073828	Bonifer	2.19	456	207	235	14	
85 B	20212	Mar 87	8.6	9970	073829	Bonifer	2.20	444	229	203	12	
a5 B	20546	Mar 87	8.6	10135	073830	Bonifer	2.48	/5 509	205	282	22	
a5 B	20381	Mar a7	8.6	10053	073831	Bonifer	2.03	414	1a9	189	36	
85 B	20438	Mar 87	8.6	10081	073832	Bonifer	2.00	/5 410	189	201	20	
-----				-----		-----		----	---	---	---	---
<b>Total</b>	<b>102363</b>			50492			<b>2.18</b>	<b>2233</b>	<b>1019</b>	<b>1110</b>	<b>104</b>	
86 B	52317	Mar 88	8.8	42068	074038	Minthorn	2.12	/5 1111	632	372	107	
86 B	48474	Mar 88	8.8	38978	074039	Minthorn	2.00	/5 970	545	313	112	
-----				-----		-----		----	---	---	---	---
<b>Total</b>	<b>100791</b>			<b>81046</b>			<b>2.06</b>	<b>2081</b>	<b>1177</b>	<b>685</b>	<b>219</b>	
86 B	50480	Apr 88	10.2	39509	074036	Bonifer	1.56	/5 790	457	248	84	
86 B	49070	Apr 88	10.2	38405	074037	Bonifer	1.55	/5 763	434	243	86	
-----				-----		-----		----	---	---	---	---
<b>Total</b>	<b>99550</b>			<b>77914</b>			<b>1.56</b>	<b>1553</b>	<b>891</b>	<b>491</b>	<b>170</b>	

Revised: 6-24-91

File Name: D:\123R2\DATA\CHFSURV

Table 23. Liberation and survival information for Bonneville stock subyearling 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.	
83 B	996250		Jun 84	85.1	210441	073124	Uma.R.(RM 1.5) & Col.R.	0.77	5165	1592	3573	0
84 B	3223172		Jun 85	92.3	206756	073326	Umatilla R.(RM 1.5)	0.83	26720	10725	15948	47
84 B	51000		Oct 85	16.2	30838	073162	Bonifer	0.66	337	141	193	3
a5 B	197432		Jun 86	86.0	20636	073833	Umatilla R.(RM 1.5)	0.63	1253	498	756	0
85 B	198153		Jun 86	86.0	21335	073834	Umatilla R.(RM 1.5)	0.35	697	353	344	0
a5 B	197488		Jun 86	86.0	20690	073835	Umatilla R.(RM 1.5)	0.30	601	229	372	0
85 B	196952		Jun 86	86.0	20170	073836	Umatilla R.(RM 1.5)	0.41	810	254	557	0
a5 B	197788		Jun 86	86.0	20982	073837	Umatilla R.(RM 1.5)	0.36	716	207	509	0
85 B	208103		Jun 86	66.0	20815	073838	Umatilla R.(RM 1.5)	0.36	740	290	450	0
85 B	208958		Jun 86	86.0	21659	073839	Umatilla R.(RM 1.5)	0.51	1071	241	300	0
85 B	207550		Jun 86	86.0	20269	073840	Umatilla R.(RM 1.5)	0.57	1188	625	563	0
a5 B	208184		Jun 86	86.0	20895	073841	Umatilla R.(RM 1.5)	0.38	787	110	678	0
a5 B	208994		Jun 86	86.0	21694	073842	Umatilla R.(RM 1.5)	0.46	954	279	674	0
					-----			----	---	---	---	---
<b>Total</b>	2029602				209145			0.43	8817	3086	5733	0

Revised: 6-24-91

File Name: D:\123R2\DATA\CHFSURV

return information is available were made from 1984 to 1986 (1983-85 broods) (Table 23).

Survival of the 1984 and 1985 June releases (through age-6 fish) is 0.77 and 0.83%, respectively (Table 23). Survival of the 1986 releases through age-5 fish varies from 0.30 to 0.63% with an average of 0.43%. This is lower than the survival rates of the 1984 and 1985 releases through age-5 fish (0.77 and 0.81%, respectively).

Survival of the subyearling fish released in October of 1985 was 0.66% (Table 23). This is lower than the survival from the same brood released near the mouth in June (0.83%), and much lower than the survival of the fish held longer at the hatchery and released the following March (2.96%).

Data from early releases (1985 brood and earlier) show that most of these fish were recovered as age-4 fish, similar to results from this stock released elsewhere (Howell et. al. 1985). A similar trend seems to be occurring for the 1986 brood, but data on age-5 fish are not available.

Exploitation of adults of the Bonneville stock of upriver bright fish (all releases) was 90.3%. Although the overall average exploitation rate was similar for releases of yearlings (92.0%) as for releases of subyearlings (87.0%), distribution of the catch differed. Adults from subyearling releases were recovered more frequently in the Columbia River gillnet fishery (49.9%) than in the ocean commercial fishery (34.6%), whereas adults from yearling releases were recovered more often in the ocean commercial catch (45.8%) than in the Columbia River gillnet fishery (34.2%). Sport catch averaged 2.4% of the recoveries of adults from subyearling releases and 9.2% of adults from yearling releases. Likewise, 0.2% of the recoveries of adults from subyearling releases were from the treaty fisheries, while 2.4% 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 24). These juveniles were from adults returning to Priest Rapids Dam (1986 brood).

Preliminary recovery information (through age-4 fish) shows subyearlings released in May of 1987 near the mouth of the Umatilla River are generally returning at higher rates (0.63 to 0.72%) than the Bonneville stock did at the same age (0.17 to 0.68%) (Tables 23 and 24). 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.

Table 24. Liberation and survival information for Priest Rapids stock 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.	
86 P	497572	May 87	60.4	40793	073912	Umatilla R.(RM 1.5)	0.63	3159	1317	1781	61
86 P	501266	May 87	60.4	41096	073913	Umatilla R.(RM 1.5)	0.71	3549	1537	1964	49
86 P	477992	May 87	60.4	39187	073914	Umatilla R.(RM 1.5)	0.72	3428	1744	1561	122
-----							----	---	---	---	---
Total	1476830			121076			0.68	10136	4598	5306	232
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	D
-----							----	---	---	---	---
Total	2000			1920			0.25	5	0	5	0
87 P	1886757	May 88	68.3	198285	075007	Umatilla R.(RM 23)	0.03	561	285	162	114
87 P	4823	Nov 88	9.8	4438	074539	Minthorn	0.02	1	1	0	0
87 P	4660	Nov 88	9.8	4289	074540	Minthorn	0.02	1	0	0	1
87 P	4925	Nov 88	9.8	4533	074541	Minthorn	0.22	11	7	4	0
-----							----	---	---	---	---
Total	14408			13260			0.09	13	8	4	1
87 P	26858	Nov 88	8.6	24656	074536	Nr. Minthorn	0.08	21	2	12	7
87 P	25493	Nov 88	8.6	23403	074537	Nr. Minthorn	0.16	40	24	7	10
87 P	27330	Nov 88	8.6	25089	074538	Nr. Minthorn	0.13	35	24	4	7
-----							----	---	---	---	---
Total	79681			73148			0.12	96	50	23	24
88 P	797904	May 89	66.6	52228	074646	Umatilla R.(RM 23)	0.01	61	15	15	31
88 P	797903	May 89	66.6	49771	074647	Umatilla R.(RM 23)	0.01	96	16	64	16
88 P	797904	May 89	66.6	52244	074648	Umatilla R.(RM 23)	0.01	61	31	31	0
-----							----	---	---	---	---
Total	2393711			154243			0.01	218	62	110	47
88 P	26770	Oct 89	10.9	26358	074753	Minthorn					
88 P	26617	Oct 89	10.9	25028	074754	Minthorn	0.01	3	0	0	3
88 P	25438	Oct 89	10.9	25438	074757	Minthorn	0.00	1	0	0	1
-----							----	---	---	---	---
Total	78825			76824			0.01	4	0	0	4
88 P	27071	Oct 89	11.1	26790	074758	Nr. Minthorn					
88 P	25428	Oct 89	11.1	24285	074760	Nr. Minthorn					
88 P	25633	Oct 89	11.1	25350	074763	Nr. Minthorn					
-----							----	---	---	---	---
Total	78132			76425							

A second group of subyearling fish was acclimated at Minthorn and released in July (Table 24). However, due to low dissolved oxygen levels and pump failure (Lofy 1987), 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. The survival through age-3 fish has been 0.03%. This compares to 0.27% 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 24). 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 1988). Through age-3 fish, the survival of the acclimated and control groups are 0.09 and 0.12%, respectively.

### Spring Chinook

The first coded-wire tagged releases of yearling spring chinook in the Umatilla River were in 1988 from Carson via Lookingglass stock (Table 25). Two groups were released in April (one group from Bonifer pond and one group between Umatilla RM 23 and RM 2 of Meacham Creek), and two groups were released in November (one acclimated group from Bonifer pond and one control group into the upper Umatilla River). The purpose of the experiment was to evaluate acclimation. Several problems were encountered in both the spring and fall experiments (Lofy 1988). These problems essentially eliminate any possible comparison that would demonstrate any advantage to acclimate fish.

The survival rates through age-4 fish for the spring release groups are 0.21 and 0.15%. Approximately 52.9% of the fish recovered have been from the Umatilla River and 47.1% have been recovered from the Columbia River and from Oregon and Washington hatcheries. The only recoveries from the fall releases through 1990 are age-2 and 3 fish and only four have been recovered at Threemile Falls Dam. Recoveries from 1989 releases are too preliminary to be discussed in this report.

### 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 1.66%. The highest percentage of recoveries was in the ocean (55.3%), while recoveries in the

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	0.18	65	23 /1	42
86	35148	Mar-Apr 88	10.1	25863	074326	Bonifer	0.26	92	57	35
86	35137	Mar-Apr 88	10.1	25853	074327	Bonifer	0.18	63	34	29
	-----			-----			-----	---	---	---
<b>Total</b>	<b>106231</b>			<b>78356</b>			<b>0.21</b>	<b>220</b>	<b>114</b>	<b>106</b>
86	34187	Apr 88	8.6	26319	074328	Uma.R. (RM 23-81)	0.13	45	19	26
86	33573	Apr 88	8.6	25722	074329	Uma.R. (RM 23-81)	0.16	52	25	27
a6	34118	Apr 88	8.6	26252	074330	Uma.R. (RM 23-81)	0.17	57	18	39
	-----			-----			-----	---	---	---
<b>Total</b>	<b>101878</b>			<b>78293</b>			<b>0.15</b>	<b>154</b>	<b>62</b>	<b>92</b>
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				
	-----			-----			-----	---	---	---
<b>Total</b>	<b>1196</b>			<b>1179</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
87	26109	Nov 88	11.1	25987	074427	Corp. Cr.				
87	24183	Nov 88	11.1	24070	074429	Corp. Cr.	0.017	4	0	4
a7	25475	Nov 88	11.1	25356	074430	Corp. Cr.				
	-----			-em-			-----	---	---	---
<b>Total</b>	<b>75767</b>			<b>75413</b>			<b>0.005</b>	<b>4</b>	<b>0</b>	<b>4</b>
87	26135	Mar-May a9	10.6	25427	074433	Bonifer	0.016	4	0	4
87	27756	Mar-May 89	10.6	27004	074434	Bonifer	0.007	2	0	2
a7	26093	Mar-May 89	10.6	25386	074436	Bonifer	0.012	3'	0	3
	-----			-----			-----	---	---	---
<b>Total</b>	<b>79984</b>			<b>77817</b>			<b>0.011</b>	<b>9</b>	<b>0</b>	<b>9</b>
87	28153	Mar 89	10.6	27585	074439	Nr. Bonifer	0.000	0	0	0
87	28116	Mar 89	10.6	27550	074440	Nr. Bonifer	0.011	3	0	3
a7	24663	Mar 89	10.6	24165	074443	Nr. Bonifer	0.008	2	0	2
	-----			-----			-----	---	---	---
<b>Total</b>	<b>80932</b>			<b>79300</b>			<b>0.006</b>	<b>5</b>	<b>0</b>	<b>5</b>

Revised: 6-24-91

File Name: D:\123R2\DATA\CHSSURV

/1 Includes one observed fish captured at Coultitz Hatchery in Washington.

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	Release CUT Code	Release Location	Estimated Adult Survivals				
							%	Total	Ocean	Col.R.	Uma.R.
85	37245	Apr 87	13.5	13440	073617	Minthorn	1.94	723	349	338	36
85	53754	Apr 87	13.5	19879	073624	Minthorn	1.67	898	519	354	24
85	70890	Apr 87	13.5	26740	073625	Minthorn	1.52	1076	623	427	27
	-----			-----			-----	-----	-----	-----	-----
Total	161889			60059			1.66	2697	1491	1119	a7
a6	68208	Mar 88	16.8	20592	074356	Lower Umatilla R.	3.88	2647	1385	858	404
a6	73650	Mar 88	17.3	18963	074357	Lower Umatilla R.	3.67	2699	1410	742	548
86	61606	Mar 88	15.7	18513	074358	Lower Umatilla R.	3.82	2353	1344	556	453
	-----			-----			-----	-----	-----	-----	-----
Total	203464			58068			3.78	7700	4139	2156	1405
87	75970	Mar 89	17.2	27062	074609	Nr. Minthorn	0.55	415	255	121	39
87	72627	Mar 89	17.3	26416	074610	Minthorn	1.01	734	533	121	80
87	84672	Mar 89	19.1	26739	074611	Minthorn	1.07	906	697	114	95
	-----			-----			-----	-----	-----	-----	-----
Total	157299			53155			1.04	1640	1230	235	175
88	67309	Mar 90	13.5	28033	074814	Minthorn	0.10	65	7	24	34
88	59682	Mar 90	13.3	26881	074813	Nr. Minthorn	0.16	93	0	44	49
88	65095	Apr 90	11.2	27226	074815	Minthorn	0.12	81	0	24	57

Revised: 6-24-91

File Name: D:\123R2\DATA\COHSURV

/1 Survival data for the 1988 brood includes age-2 fish only (1990 returns).

Columbia River and Umatilla River were 41.5 and 3.2%, respectively. Exploitation of this release was 95.1%. Exploitation rates in the commercial ocean and Columbia River gillnet fisheries were 39.1 and 26.1%, 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 (3.78%). The ocean recovery rate (53.8%) was similar to the 1987 release. The recovery rates in the Columbia and Umatilla rivers (28.0 and 18.2%, respectively) differed however. Exploitation of this release was 81.0%. Exploitation rates in the commercial ocean and Columbia River gillnet fisheries were 25.3 and 19.6%, respectively. The exploitation rates in the sport and treaty fisheries were 33.8 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. 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 75.0, 14.3 and 10.7%, respectively. The percentages of the control fish recovered were 61.4, 29.2 and 9.4%, respectively.

Three groups of coho (1988 brood) were released in the spring of 1990 (Table 26). One group was acclimated at Minthorn and released in March, while a control group was released instream. A third group was held at Minthorn and allowed to voluntarily release. Very few fish voluntarily left the pond however, and they were crowded out of the pond in April. Through 1990, only age-2 fish have been recovered (Table 26).

## Project Difficulties

### Operational problems at Bonifer

Excessive aquatic vegetation, disease and low dissolved oxygen concentrations during fall acclimation of juvenile salmon at Bonifer have been a problem in past years (Lofy and Rowan 1989). In 1989, the fish were held for only a three day post-transport recovery period to help alleviate these problems. The fish were also held for three days in 1990 and were transferred into the facility later in the fall with the hope that rainfall would increase flows to the facility and increase oxygen levels and that much of the aquatic vegetation would die off naturally. This was only partially successful. Much of the vegetation did die off, but there was insufficient rainfall to increase flows and oxygen levels

remained low during the holding period (Table 11). The fish were not fed however, and appeared healthy at release.

Prior to the arrival of the fish, many hours were spent removing the aquatic vegetation by hand. This was very labor intensive and slow and only a small portion of the vegetation was removed prior to the natural die off.

#### Operational Problems at Minthorn

Insufficient flows required recirculating the raceway effluent water back into the intake pond during fall acclimation. Liquid oxygen supplementation was also required due to low oxygen levels (Table 11). The levels were increased enough however, that the fish did well and mortality was not a problem.

#### Research problems

Definitive information on the outmigration of particular releases of juvenile salmon continues to be a problem. Multiple releases make it difficult to distinguish between acclimated and control groups and subspecies (fall and spring chinook of similar size). Unless the fish are differentially marked, different groups can not be distinguished downstream in the Umatilla or Columbia Rivers. Until efficiencies of trapping facilities can be determined, outmigration of juveniles can not be estimated with any accuracy.

SUMMARY OF EXPENDITURES

Expenditures for activities associated with the operation, maintenance and evaluation of Bonifer and Minthorn Acclimation Facilities in 1990 totaled \$173,626.03. 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 - 1990.

Line Item	Expenditure
Personnel	63,114.23
Travel (all)	633.25
Fish Food	4,901.00
Property Lease	279.67
Facility Use Fees	1,755.00
Electricity/Utilities (Minthorn)	794.00
Materials and Supplies	5,702.52
Communications (telephone/alarm)	2,757.09
Repairs and Maintenance (equipment servicing)	917.34
Printing/Duplication	1,195.26
Equipment Rental (GSA mileage, rental & service)	7,067.91
Equipment Rental - General	112.14
Training	796.00
Office Supplies	737.44
SUBTOTAL:	\$90,762.85
Indirect	26,890.02
Capital Equipment *	7,361.58
Sub-contract	41,250.00
TOTAL:	\$166,264.45
* Capital Equipment	
Computer & Software	4,322.08
Microscope	1,521.50
2-way Vehicle Radio	1,100.00
Pagers (2)	418.00
Total:	\$7,361.58

Revised: 7-15-91

File Name: D:\GERRY\BUDGET90

## LITERATURE CITED

- Carmichael, R. W., R. T. Messmer and B. A. Miller. 1988. Lower Snake River Compensation Plan - Oregon Evaluation Studies. Oregon Department of Fish and Wildlife, Fish Research Project AFF1-LSR-90-17, Annual Progress Report, Portland, OR.
- Fish Management Consultants, Inc. 1989. Review of Bonifer Springs culture operation with recommendations. Report submitted to Bonneville Power Administration. 53pp.
- Fish Management Consultants, Inc. 1989. Minthorn Facility evaluation. Report submitted to Bonneville Power Administration. 49pp.
- Howell, P. et al. 1985. Stock assessment of Columbia River anadromous salmonids. Volume I: chinook, coho, chum and sockeye salmon stock summaries. Final Report. 558 pp.
- Lofy, P. T. 1988. Operation, Maintenance, and Evaluation of the Bonifer and Minthorn Springs Juvenile Release and Adult Collection Facilities. Report submitted to Bonneville Power Administration, Project No. 83-435. 28 pp.
- Lofy, P. T. 1989. Operation, Maintenance, and Evaluation of the Bonifer and Minthorn Springs Juvenile Release and Adult Collection Facilities. Report submitted to Bonneville Power Administration, Project No. 83-435. 77 pp.
- Lofy, P., and G. Rowan. 1990. Minthorn Springs Creek summer juvenile release and adult collection facility. Report submitted to Bonneville Power Administration, Project No. 83-435. 100 pp.
- Scully, R. J., E. Buettner and C. Cummins. 1984. Smolt condition and timing of arrival at Lower Granite Reservoir. Report submitted to BPA for Project No. 83-323B. 87 pp.

## APPENDICES

Appendix A. Steelhead broodstock spawning and prespaw mortality at Minthorn Acclimation Facility and Threemile Dam in 1990.

Date Spawed/ Location	Family #	Sex	Coll. #	Mark	Date Coll.	Fork Length (mm)	MEPS Length (mm)	Weight (lbs)	Fecundity Total Eggs	Eyed Eggs	Egg Loss	Prespaw Mortality /1 M F Total
-----												
3-26-90												0 3 3 from 11-22 to 3-26
Minthorn	1	M	1	1Lop	11-22 or 12-1	555	460	2.4				
		F	2	1Lop	11-22 or 12-1	635	530	4.4	3825	3288	537	
		M	3	2Rop	2-23	770	655	8.9				2 males used
	2	M	4	1Rop	1-17	810	655	9.3				
		F	5	1Rop	1-17	710	580	6.8	5920	2111	3809	
	3	M	6	1Rop	1-17	690	585	6.0				
		F	7	2Rop	2-23	790	685	9.8	9936	8933	1003	
-----												
4-2-90												0 2 2 from 3-27 to 4-2
Minthorn	4	F	8	2Lop	12-8	600	525	4.3	4725	4983	-258	
		M	9	1Rop	1-17	675	560	6.8				
	5	F	10	1Rop	1-17	715	625	7.8	6732	5936	796	
		M	11	1Lop	11-22 or 12-1	718	610	6.4				
	6	F	12	1Rop	1-17	683	593	6.9	5508	5140	368	
		M	13	1Rop	1-17	715	605	6.7				
	7	F	14	1Lop	11-22 or 12-1	683	595	6.0	5832	2906	2926	
		M	15	2Rop	2-23	750	633	7.4				
	8	F	16	1Lop	11-22 or 12-1	650	565	4.4	4725	3428	1297	
		M	18	2Lop	12-8	635	535	---				
	M	17	3Lop	3-16 or 3-21	725	623	7.6				Green/Not used	
-----												
4-9-90												2 4 6 from 4-3 to 4-9
Minthorn	9	F	19	3Rop	4-4 or 4-6	615	530	---	4560	2930	1630	
		M	20	3Lop	3-16 or 3-21	568	480	3.3				
	10	F	21	1Lop	11-22 or 12-1	553	475	3.4	5510	3588	1922	
		M	22	3Lop	3-16 or 3-21	---	443	2.5				
	11	F	23	2Rop	2-23	---	630	8.3	7752	3578	4174	
		M	24	1Lop	11-22 or 12-1	605	523	4.4				
		M	35	3Lop	3-16 or 3-21	675	570	5.8				2 males used
	12	F	25	1Rop	1-17	700	605	7.3	6845	6169	676	
		M	26	3Rop	4-4 or 4-6	780	663	8.7				
	13	F	27	2Rop	2-23	698	605	6.5	6528	4375	2153	
		M	28	1Rop	1-17	680	590	5.4				
	14	F	29	3Rop	4-4 or 4-6	633	550	5.2	5400	0	5400	
		M	30	1Lop	11-22 or 12-1	568	485	3.5				
		F	31	1Lop	11-22 or 12-1	630	553	4.8				Green/Not used
	M	32	3Lop	3-16 or 3-21	820	695	8.9				Not Used	
15	F	33	3Lop	3-16 or 3-21	700	615	7.1	6845	3088	3757		
	M	34	3Lop	3-16 or 3-21	728	610	6.8					
-----												

Revised: 1-2-91

File Name: C:\123R2\DATA\90SPMO

Appendix A. (cont.)

Date Spawnd/ Location	Family #	Sex	Coll. #	Mark	Date Coll.	Fork Length (mm)	MEPS Length (mm)	Yeight (lbs)	Fecundity Total Eggs	Eyed Eggs	Egg Loss	Prespaw Mortality M F Total
-----												
4-17-90												6 6 12 from 4-10 to 4-17
Minthorn	16	F	36	2Lop	12- 8	---	540	5.4	4284	3672	612	
		M	37	3Rop	4-4 or 4-6	775	655	8.3				
	17	F	38	2Rop	2- 23	---	495	4.0	4488	3432	1056	
		M	39	3Rop	4-4 or 4-6	570	480	3.6				
	18	F	40	1Rop	1- 17	---	545	4.8	5474	1905	3569	
		M	41	3Lop	3-16 or 3-21	600	520	4.1				
	19	F	42	None		745	650	8.0	7140	5100	2040	
		M	43	None		585	545	3.4				
	M	44	3Rop	4-4 or 4-6	630	580	4.9				Green/Not used	
	M	45	3Lop	3-16 or 3-21	---	520	4.6				Green/Not used	
-----												
4-23-90												1 2 3 from 4-18 to 4-23
Minthorn	20	M	46	3Rop	4-4 or 4-6	570	485	3.2	7770	4810	2960	
		F	47	1Rop	1-17	785	625	---				
		u	48	1Rop	1-17	640	545	4.8				2 males used
	21	F	49	1Lop	11-22 or 12- 1	585	505	---	4986	4155	831	
		M	50	3Rop	4-4 or 4-6	585	495	3.9				
-----												
4-30-90												
Threemile Dam		F	51	None	---	765	665	8.3				Green/Not used
	22	F	52	None	---	---	480	2.7	3180	2544	636	Stripped Weight/IHN +
		M	53	None	---	625	530	4.9				
	23	F	54	None	---	730	635	6.3	8184	8184	0	Stripped Weight/IHN +
		M	55	None	---	730	620	6.5				
		F	56	None	---	700	605	4.6				Overripe/Not used/Stripped Wt.
		M	57	None	---	575	490	3.1				Green/Not used
		M	58	None	---	790	675	8.8				Went with 56 which was discarded
		F	59	None	---	715	630	5.7				Overripe/Not used/Stripped Wt.
	24	M	60	None	---	700	590	6.1	5313	5060	253	
		F	61	None	---	700	615	4.6				Stripped Weight/IHN +
		F	62	None	---	560	500	3.6				No Male/Not Used
-----												
S-17-90												
Threemile Dam	25	F	63	None	---	710	625	7.0	5278	4860	418	IHN +
		M	64	None	---	630	535	4.5				
		M	65	None	---	570	480	3.5				Extra/Not Used
-----												
						Total green	146740		Prespaw	Wales	11 = 26.2%	
						Total Eyed	104175		Mortality	Females	25 = 50.0%	
						Fecundity	5870			Total	36 = 39.1%	
-----												

Revised: 1-2-91

File Name: C:\123R2\DATA\90SPMO

/1 2 males and 8 females died at Minthorn between April 24 and the end of the spawn season.

Appendix B. Summary of hourly temperature data at Minthorn  
 Acclimation Facility in 1990.

DAY	JANUARY				FEBRUARY			
	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	6	7.1	6.5	6.4	6.7	7.8	7.3	7.3
2	6.1	6.9	6.5	6.6	6.9	8.1	7.5	7.4
3	6.1	7.3	6.6	6.4	6.6	7.8	7.1	7
4	7.1	7.8	7.4	7.2	6.3	7.8	7	6.9
5	6.7	8.1	7.4	7.4	6	7	6.5	6.6
6	8.1	9.1	8.6	8.5	6.6	7.6	7	7
7	8.5	9.2	8.8	8.8	5.9	6.9	6.3	6.3
8	7.9	9.5	8.6	8.6	6.1	7.8	6.8	6.7
9	8.4	10.1	9.2	8.9	7.5	8.4	8	7.8
10	8.6	9.8	9	8.9	8.2	9.5	8.9	8.8
11	7.9	8.6	8.1	8.1	8	9.9	8.7	8.6
12	7.5	8	7.8	7.8	6.4	7.7	7	6.9
13	7.3	8	7.6	7.6	5.7	6.7	6.2	6.1
14	7.8	8.1	8	8.1	4.8	6.7	5.7	5.6
15	8.1	9	8.4	8.3	6	6.7	6.3	6.2
16	8	8.6	8.2	8.1	5.5	7.8	6.4	6.2
17	7.8	8.5	8.1	8.1	5.9	7.1	6.5	6.5
18	6.4	7.8	7.1	7.2	6.1	7.2	6.5	6.5
19	6.9	7.1	7	6.9	5.8	7.3	6.5	6.4
20	6.7	7.8	7.1	6.9	5.7	7.6	6.4	6.2
21	6	7.2	6.7	6.8	7.5	10	8.5	8
22	6.9	8.1	7.5	7.3	7.1	10	8.6	8.6
23	7.1	8.1	7.7	7.8	8.4	9.1	8.6	8.6
24	6.2	7.5	6.9	6.8	7.3	10.4	8.7	8.2
25	7.1	8.1	7.6	7.4	7.3	10.1	8.6	8.6
26	6.8	7.8	7.3	7.4	8.1	10.2	8.9	8.7
27	6.3	7.2	6.6	6.6	6.4	9.3	7.8	8
28	6.4	7.5	6.9	6.8	6.4	9.5	7.8	7.7
29	6.1	7.8	7	7.1				
30	6.7	7.4	7.2	7.3				
31	6.4	7.6	7.1	7.2				
Total	6	10.1	7.6	7.4	4.8	10.4	7.4	7.1

Revised: 1-7-91

File Name: D:\123R2\DATA\MNTMP904

Appendix B. (cont.)

DAY	MARCH				APRIL			
	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	6.4	10	8	7.9	8.2	13.3	10.6	10.6
2	6.2	10	8	7.9	8.5	13	10.7	10.5
3	6.9	9.2	8.1	8.2	8.1	13.1	10.5	10.3
4	7.1	8.9	8.1	8	7.7	12.8	10.1	9.9
5					7.6	12.8	10.1	10
6	7.1	10.5	8.7	8.5	7.8	12.9	10.3	10.3
7	7.2	8.9	8.2	8.3	8.3	13.2	10.7	10.4
8	7.1	9.8	8.4	8.4	8.1	12.5	10.1	10
9	6.9	10	8.5	8.3	7.4	12.7	10	10
10	7.8	8.9	8.3	8.4	7.7	12.5	10	10.1
11	6.8	9.1	7.8	7.6	8.9	11.9	10.2	10.2
12	6.3	9.6	7.7	7.6	8.5	12.7	10.6	10.6
13	6.2	10.1	8	8	8.5	11.8	10.3	10.4
14	7.7	9.8	8.6	8.5	9.2	14.3	11.4	11.3
15	6.9	11.1	8.8	8.6	9.3	14.4	11.7	11.7
16	7.1	10.6	8.8	8.9	9.5	14.5	11.8	11.7
17	8.2	11.8	9.7	9.5	9.2	13.8	11.5	11.5
18	8.8	12.1	10.3	10.1	10	14.4	11.9	11.7
19	8.3	12.2	10.1	10	8.8	13.6	11.2	11.2
20	8.4	11.8	10	10	10	12.7	11.2	11.2
21	8.1	11.9	9.8	9.7	9.7	14.7	11.9	11.7
22	7.8	11.1	9.3	9.3	9.6	11.8	10.8	11
23	7.1	8.8	7.9	8	9.5	11.9	10.6	10.6
24	7	10.8	8.5	8.3	9	12.3	10.3	10.2
25	6.2	10.7	8.3	8.2	8.9	11.2	9.8	9.7
26	6.5	11.4	8.8	8.7	8.2	11.1	9.7	9.6
27	6.7	11.6	9	8.9	8.9	10	9.4	9.4
28	6.8	11.3	9.1	8.9	7.8	10	9	9.1
29	7	12.1	9.4	9.3	8.5	11.2	9.5	9.1
30	7.2	12.3	9.6	9.6	7.9	13.6	10.5	10.5
31	8	12.8	10.3	10.2				
Total	6.2	12.8	8.8	8.7	7.4	14.7	10.5	10.3

Revised: 1-7-91

File Name: D:\123R2\DATA\MNTMP903

Appendix B. (cont.)

DAY	MAY				JUNE			
	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	8.5	13.2	10.8	11	9.8	12.2	10.8	10.7
2	10	13.4	11.5	11.4	10.1	15.1	12.3	12.5
3	9.5	14.6	11.8	11.7	11.3	13.5	12.3	12.2
4	9.5	15	12	11.9	10.5	14.1	12.2	11.9
5	9.8	14.9	12.2	12.2	10.3	14	12.1	12.2
6	9.6	13.6	11.4	11.2	10.8	12.2	11.6	11.7
7	8.6	10.4	9.6	9.8	10.6	14.7	12.4	12.3
8	8.1	13.3	10.4	10.5	11.1	13.1	12.1	12.2
9	8.6	14.5	11.4	11.5	11.2	15.7	13.3	13.4
10	9.2	14.7	11.8	11.7	11.6	14.3	12.9	13
11	9.8	14.1	11.8	11.5	10.8	13.6	12	12
12	9.9	12.8	11.4	11.2	10.6	13.1	11.8	11.7
13	9.8	12.2	10.9	11	10.8	14.7	12.6	12.5
14	9.6	11.3	10.6	10.7	10.7	14.7	12.7	12.6
15	9.5	14.7	11.7	11.6	11.1	15.9	13.4	13.5
16	9.6	13.9	11.7	11.7	12.2	15.7	13.9	13.8
17	10.1	13.9	11.9	11.7	11.8	15	13.1	13
18	10.2	14.9	12.2	11.9	11.6	16.8	13.9	13.8
19	9.8	14.7	12	12.1	12.8	16.8	14.6	14.4
20	10.7	13.3	11.9	11.9	12.6	16.9	14.7	14.6
21	10.6	15.6	12.8	13.1	12.5	17.4	14.8	14.5
22	11.4	13.4	12.3	12.3	13.4	15.1	14.3	14.4
23	10.3	12.3	11.2	11.1	12.5	17.2	14.6	14.3
24	9.9	13.1	11.2	10.8	13.2	17.1	15.1	15
25	9.9	15	12.2	11.9	12.9	17.6	15.1	14.9
26	11.1	14.2	12.6	12.5	13	17.2	15	14.9
27	11.3	12.3	11.7	11.8	12.8	15.9	14.4	14.4
28	10.8	11.4	11.1	11.2	12.7	17.3	14.8	14.5
29	10.7	14.6	12.3	12.1	13	17.9	15.3	15.1
30	10.8	14.4	12.3	12.2	13.6	16.8	15.3	15.3
31	10.4	11.9	11.1	11.1				
Total	8.1	15.6	11.6	11.4	9.8	17.9	13.4	13.3

Revised: 1-7-91

File Name: D:\123R2\DATA\MNTMP903

Appendix B. (cont.)

DAY	JULY				AUGUST			
	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	12.8	17.5	15.1	14.9	14.5	17.8	16.1	16
2	12.8	15.1	13.6	13.6	14.2	17.8	16	16.1
3	11.5	16.2	13.7	13.5	14	18.1	16	15.9
4	12.3	15.9	14	13.8	14.1	18.4	16.2	16.1
5	12.8	15.7	14.1	13.9	14.4	18.5	16.4	16.2
6	13.2	16.5	14.6	14.3	15	18.7	16.8	16.9
7	12.6	17.4	14.8	14.5	14.7	18.5	16.6	16.7
8	12.9	17.8	15.3	15.1	14.6	17.5	16.1	16.1
9	13.4	18.2	15.7	15.5	14.8	17.1	15.8	15.7
10	13.9	18.8	16.2	16	15	16.7	15.8	15.8
11	14.3	18.5	16.3	16.3	14.7	17.4	15.8	15.6
12	14.8	18.7	16.7	16.4	15.3	17.4	16.2	16.1
13	15	19.3	17	16.8	15.3	17.4	16.2	16.1
14	14.1	18.8	16.3	16.1	14.8	17	15.8	15.7
15	14.1	19	16.4	16.2	15.1	16.6	15.7	15.7
16	14.4	18.7	16.4	16.3	14	16	14.9	14.8
17	13.8	18.5	16	15.9	14.1	15.9	14.7	14.7
18	13.7	18.2	15.9	15.7	13.6	14.8	14.1	14.1
19	13.6	17.6	15.5	15.5	13.6	14.8	14.3	14.4
20	13.7	18.3	15.9	15.7	13.2	15.7	14.5	14.4
21	13.9	18.7	16.3	16.1	13.7	14.5	14	14.1
22	14.3	19	16.5	16.3	13.7	17.5	15.3	15
23	15	18	16.5	16.4	14.1	17.4	15.6	15.4
24	14.1	16	15.1	15.2	13	16.5	14.7	14.7
25	13.6	15.4	14.4	14.4	13.6	16.6	15	14.9
26	13.6	17.6	15.3	14.6	13.5	16.6	14.9	14.8
27	13.9	17.7	15.7	15.6	13.5	16.8	15	14.9
28	13.9	18	15.8	15.6	13.4	17.4	15.4	15.4
29	14.2	18.6	16.2	15.9	13.7	16	14.9	15
30	14.7	17.6	16.1	16.1	13.8	16.4	14.9	15
31	14.5	18.5	16.3	15.8	13.1	16.4	14.6	14.5
Total	11.5	19.3	15.6	15.4	13	18.7	15.4	15.3

Revised: 1-7-91

File Name: ' D:\123R2\DATA\MNTMP903

Appendix B. (cont.)

DAY	SEPTEMBER				OCTOBER			
	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	13	16.3	14.6	14.5	11.3	12.8	12.2	12.4
2	13.5	16.2	14.7	14.6	11.1	12.9	12	12.1
3	13.4	16	14.6	14.5	11.8	13.4	12.5	12.2
4	13.6	16.2	14.9	14.7	12.5	14.7	13.6	13.5
5	14.1	16.4	15.2	15.1	12.7	14.1	13.4	13.4
6	14	16.2	15.2	15.2	10.8	12.5	11.5	11.6
7	14.3	15.9	15.2	15.4	9	11.7	10.4	10.5
8	14	16.2	15	14.9	9.2	12.1	10.6	10.5
9	13.9	16.1	15	14.9	9.9	12.3	11.2	11.1
10	13.6	16.3	15.2	15.4	11.8	13.3	12.4	12.2
11	13.8	16	15	15	9.7	12.1	11	11.2
12	13.6	15.5	14.5	14.6	11.6	12.8	12.1	12.2
13	12.6	15	13.8	13.8	11.7	12.3	12	12
14	12.6	14.7	13.7	13.6	11.2	11.8	11.6	11.6
15	13	14.7	13.9	13.9	11.5	13.3	12.4	12.3
16	13.1	14.6	13.8	13.7	11.4	12.8	12.2	12.2
17	12.7	14.7	13.7	13.6	9.8	11.2	10.6	10.8
18	12.5	14.4	13.4	13.3	10.9	11.5	11.2	11.1
19	12.4	15.6	13.7	13.6	10.3	11.5	10.8	10.7
20	12.1	15.3	13.6	13.6	9.1	11.3	10.2	10.2
21	11.3	15	13.1	13	10.6	11.6	11	11
22	11.8	15.6	13.6	13.6	10.3	11.9	11	11.1
23	12.1	15.4	13.6	13.5	10.2	11.8	11	11
24	12.5	15.8	14	13.8	9.8	12	10.9	10.9
25	12.9	15.5	14.2	14.1	10.2	12.2	11.2	11
26	13	16.1	14.4	14.4	11.5	12.7	12	11.9
27	12.8	15.9	14.3	14.2	10.1	11.8	11	11.1
28	12.5	15.6	14	13.9	10.6	12.1	11.2	11
29	12	15.3	13.5	13.5	10	11.8	10.9	10.9
30	11.8	14.8	13.2	13.3	11.2	11.8	11.5	11.6
31					11.1	11.6	11.4	11.4
Total	11.3	16.4	14.2	14.2	9	14.7	11.5	11.5

Revised: 1-7-91

File Name: D:\123R2\DATA\MNTMP903

Appendix B. (cont.)

DAY	NOVEMBER				DECEMBER			
	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	10	11.2	10.6	10.6	7.4	8.5	7.9	7.9
2	8.9	10.5	9.7	9.6	7.4	8.7	8	8
3	8.8	10.8	9.7	9.4	8	9.1	8.5	8.5
4	10.8	11.7	11.1	11	8.1	9.2	8.6	8.6
5	10.1	11.1	10.6	10.6	8.1	9.1	8.5	8.5
6	8.8	10.3	9.5	9.5	7.1	8.1	7.7	7.7
7	9.1	10.3	9.7	9.7	6.6	7.6	7.1	7.3
8	10	11.3	10.6	10.6	7.4	8.5	7.8	7.8
9	11.1	11.8	11.4	11.3	7.9	9.2	8.5	8.6
10	10.8	12	11.4	11.3	9.1	10	9.5	9.6
11	9.9	11.4	10.7	10.8	8.1	9.6	8.8	8.8
12	9.4	11.1	10.3	10.4	7.1	8.1	7.8	8
13	10.4	11	10.7	10.7	8	8.6	8.2	8.1
14	9.8	10.8	10.4	10.5	7.4	8.6	8	8
15	9.2	10.6	9.9	9.8	6.7	8	7.3	7.4
16	8.9	10.4	9.7	9.7	7.4	8	7.7	7.8
17	8.5	10	9.2	9.2	7.8	8.7	8.3	8.5
18	10	10.7	10.3	10.2	7.3	8.5	7.8	7.7
19	9.3	10	9.6	9.6	4.5	7.3	5.6	5.3
20	8.7	9.3	8.9	8.9	3	4.4	3.6	3.6
21	8.8	9.6	9.2	9.2	2.4	3.1	2.7	2.8
22	9.1	10.5	9.8	9.9	2.4	3.3	2.9	2.8
23	10.1	11	10.5	10.5	2.9	3.6	3.2	3.2
24	10.3	11.1	10.8	10.9	2.9	3.6	3.2	3.2
25	9.5	11.3	10.7	10.8	3	4	3.5	3.5
26	8.4	9.5	8.8	8.7	3.8	5	4.4	4.5
27	8.5	9.1	8.8	8.8	5.1	6.4	5.7	5.8
28	8.4	9.6	8.9	8.9	4	6	5.1	5.3
29	8.5	9.2	8.9	8.8	2.6	3.8	3.1	3.1
30	8.1	9.5	8.7	8.7	2.7	4	3.3	3.4
31					4	5.5	4.7	4.7
Total	8.1	12	10.0	9.9	2.4	10	6.4	7.4

Revised: 1-7-91

File Name: D:\123R2\DATA\MNTMP903

Appendix C. Dissolved oxygen and temperature data for Minthorn Acclimation Facility in 1990.

Date	Pump Intake		Proposed Intake		Lower Raceway Head Outlet			Upper Raceway Outlet		Spring	
	D.O.	Temp.	D.O.	Temp.	D.O.	D. O.	Temp.	D.O.	Temp.	D.O.	Temp.
1/4	a.0	7.2	7.2	7.0						7.0	
1/11	7.0	a.1	6.8	7.0						6.0	
1/18	a.0	6.8	7.0	7.0						7.2	
1/25	7.8	7.1	7.2	7.0						6.0	
2/1	7.0	6.9	7.2	7.0						7.0	
2/8	8.6	6.2	7.4							8.0	
2/15	7.0	6.0	7.0							7.2	
2/22	6.8	7.4	6.6							7.0	
3/1	7.0	6.7	6.6							7.2	
3/7											
3/8		8.3						10.0			
3/9		7.8						7.8			
3/10	8.0	7.8			7.7	7.7		a.9			
3/11											
3/12	11.4	7.1			10.9	a.9		a.4	7.2		
3/13	9.1	7.2			10.1	7.8		7.6	7.0		
3/14	10.1	8.6			12.4	8.4		8.4	10.0	9.0	10.0
3/15	11.2	9.2			9.0	7.0		7.6	8.3	8.4	
3/16	8.4	8.2			9.7	7.7		7.2	8.2	9.4	a.4
3/17	9.4	9.2			9.1	a.5		6.6	9.2	8.4	9.1
3/18	9.6	9.5			9.4	7.6		7.2	10.0	7.2	9.0
3/19	10.6	a.0			9.0	7.0		6.8	a.3	7.8	8.8
3/20	8.4	8.5			9.0	7.2		7.6	8.9	7.2	9.0
2/21	9.6	a.2			8.8	7.6		7.4	8.4	7.0	8.8
3/22	10.0	8.1			10.5	7.6		5.0	9.0	11.4	11.0
3/23	10.2	7.2			9.6	8.5		7.6	7.2	6.8	7.4
3/24	10.1	7.2			9.7	8.3		7.4	7.4	6.2	7.2
3/25	8.6	6.5			10.2	a.0		7.2	6.8	6.4	6.8
3/26	10.6	9.0			10.2	8.0		a.0	9.8	8.0	10.0
3/27	9.2	7.0			9.2	9.4		7.0	8.2	8.0	7.8
3/28	9.0	7.5			9.2	7.6		7.2	7.5	6.4	8.0
3/29	9.2	8.1			9.4	7.7	8.1			a.0	7.8
3/30	8.8	7.4			9.8	8.8	7.9			6.4	7.3
3/31	7.9	a.2			9.5	7.5	8.9			7.0	a.2
4/1	8.8	a.2			8.6	6.4	8.9			6.8	8.4
4/2	8.4	8.8			8.6	7.6	8.0			7.2	8.0
4/3	8.4	8.5			8.8	7.4	7.8			7.0	7.6
4/4	8.6	8.0			7.2	5.8	8.0			7.4	7.8
4/5	8.4	7.8			7.4	6.0	8.0			7.2	7.6
4/6	a.5	8.2			9.4	7.4	8.2			7.3	8.1

Revised: 1-4-91

File Name: D:\123R2\DATA\MNDOT90

Appendix C. (cont.)

Date	Pump Intake		Proposed Intake		Head	Lower Raceway Outlet		Upper Raceway Outlet		Spring	
	D. O.	Temp.	D. O.	Temp.	D.O.	D. O.	Temp.	D.O.	Temp.	D.O.	Temp.
4/7	7.5	a. 2			8.6	6.8	8.2			7.3	8.1
4/8	7.6	8.0			7.9	7.0	a. 0			7.2	8.2
4/9	7.6	7.6			8.6	6.4	8.0			5.6	7.5
4/10	8.8	8.0			9.0	6.6	7.8			6.0	7.4
4/11	a. 0	9.1			a. 2	6.4	9.5	7.4	9.0	6.2	8.0
4/12	a. 4	9.0			8.7	6.2	8.1	7.9	9.1	7.0	9.0
4/13											
4/20	10.4	10.4								6.4	11.2
4/27	7.0	9.2								5.7	9.2
5/4	7.4	10.2								6.9	10.2
5/17	10.4	11.6								6.8	12.5
5/24	7.6	11.0								7.4	11.4
5/31	7.9	11.0								7.6	11.2
6/8	7.0	10.9								6.6	11.6
6/15	8.4	11.2								a. 2	8.4
6/21	7.8	12.3								7.0	11.9
6/28	a. 4	13.3								5.6	15.0
7/5	8.0	13.0								6.0	13.0
7/11	6.9	15.4								5.6	15.8
7/19	7.0	13.6								6.4	14.6
7/25	7.2	13.4								6.8	14.0
8/2	6.8	14.0								6.0	14.6
9-28	6.2	13.0			10.0						
10-1	8.0	11.5			10.0	9.6	12.5	9.6	12.5		
10/4	7.0	13.0			7.0	5.6	13.0	6.0	13.0		
10/5	6.6	13.5			6.8	5.2	13.5	5.7	13.5		
10/6	9.0	11.5			8.3	6.0	11.5	6.8	11.5		
10/7	8.0	9.5			a. 5	6.7	9.5	7.8	9.5		
10/8	8.4	9.5			8.7	6.8	9.5	7.0	9.5		
10/9	8.6	10.0			9.0	7.2	8.8	7.4	9.0		
10/10	7.2	12.0			7.4	6.4	7.4	6.6	7.4		
10/11	9.2	10.0			8.6	7.2	10.0	7.6	10.0		
10/12	8.5	11.6			8.0	6.4	12.0	6.8	11.6		
10/13	7.4	12.0			7.8	6.2	12.0	6.6	12.0		
10/14	7.8	12.0			7.6	6.3	11.6	6.6	12.0		
10/15	7.4	12.0			7.9	6.2	12.0	6.4	12.0		
10/16	7.4	12.0			7.9	6.2	12.5	6.4	12.5		

Revised: 1-4-91

File Name: D:\123R2\DATA\MNDOT90

Appendix D. Summary of hourly temperature data at Bonifer  
Acclimation Facility in 1990.

DAY	JANUARY				FEBRUARY			
	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	5.6	6.5	6	5.9	5.9	6.6	6.2	6.2
2	5.8	7.4	6.4	6.1	6	7.3	6.4	6.3
3	5.2	6.1	5.7	5.6	5.9	6.6	6.2	6.2
4	6.2	7.1	6.6	6.6	5.3	7.2	6.1	6.1
5	6.4	7.8	7	6.9	5	5.6	5.3	5.3
6	7.2	9.1	a.1	7.9	4	6.6	5.3	5.4
7	a	9.5	8.6	a.7	4.6	5.6	5.2	5.3
a	7.5	a.9	a.2	a	4.9	5.8	5.3	5.3
9	8.6	10.5	9.4	a.9	5.3	7	6.2	6.6
10	a.4	10.2	9.2	9.2	6.8	a.7	7.7	7.7
11	7.5	a.7	a	7.9	7.4	9.1	a	7.8
12	7.1	a.1	7.5	7.5	6	7.3	6.5	6.6
13	6.5	7.4	6.9	6.9	2.8	6	3.8	3.7
14	7.3	a.4	7.5	7.5	3.7	5.3	4.4	4.2
15	7.4	7.9	7.6	7.4	3.9	5.3	4.5	4.5
16	6.7	a.4	7.6	7.7	4.1	5.6	4.8	4.8
17	6.7	8.1	7.3	7.1	4.2	5.5	4.9	5
1a	5.6	7.4	6.3	6.2	4.6	5.9	5.2	5.2
19	6	7.1	6.5	6.5	3.7	5.6	4.8	4.9
20	5.6	6.8	6.3	6.3	4.2	5.8	5	4.9
21	5.3	7.4	6.1	6	5.3	7.3	6	5.8
22	5.9	7.8	6.8	6.8	5.6	9.7	6.8	6.3
23	6.3	7.3	6.9	6.9	5.3	9.6	7.1	7.2
24	5.5	7.2	6.2	6	6.2	10.5	7.7	6.9
25	5.6	7.1	6.5	6.6	5.8	10.4	7.4	6.7
26	5.5	7.3	6.4	6.4	6.1	10	7.5	6.8
27	4.9	6.2	5.5	5.4	5.3	9.7	7.2	7.3
28	4.7	7.1	5.9	6	5.6	a	6.7	6.8
29	4.8	7.4	5.8	5.6				
30	5.3	6.7	6.1	6.1				
31	5	6.7	6.1	6.2				
Total	4.7	10.5	6.9	6.7	2.8	10.5	6	5.9

Revised: 1-7-91

File Name: D:\123R2\DATA\BNTMP904

Appendix D. (cont.)

Day	MARCH				APRIL			
	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	5.5	7.3	6.4	6.4	7.6	9.8	a.9	8.8
2	5.6	9.1	7.4	7.2	7.9	10.1	9.1	9.1
3	6.2	8.1	6.8	6.8	a	9.9	9	9.1
4	6.1	7.3	6.7	6.7	7.7	9.8	8.8	a.9
5					7.8	10.1	8.9	a.9
6	6.1	a	7.2	7.2	a	9.9	9	9.1
7	6.5	7.8	7.1	7.1	a.4	10.3	9.5	9.5
a	6.1	8.6	7.3	7.4	a.3	11.9	9.8	9.5
9	6	8.8	7.4	7	7.1	10.6	a.8	a.7
10	6.5	a.2	7.2	7.1	7.3	11.8	9.5	a.9
11	5.8	7.6	6.6	6.4	9.8	11.8	10.8	10.9
12	5.3	a	6.5	6.5	9.4	12.6	11.1	11
13	5.3	a.9	6.9	6.7	9.2	11.9	10.8	11
14	6.4	8.1	7.2	7.1	9.9	13.7	11.7	11.3
15	6.4	9.6	8	7.7	10.5	14.2	12.3	12.3
16	6.5	9.5	a.1	a.2	10.7	15	12.7	12.5
17	7.7	11.2	9.2	8.6	10.7	14.1	12.4	12.3
18	8.2	11.5	9.6	9.4	11.5	14.4	12.7	12.3
19	7.7	11.4	9.6	9.7	10.3	13.8	12.2	12.2
20	7.8	9.9	9	9.2	11.1	13	12	12
21	7.5	11.5	9.1	8.6	10.7	13.9	12.3	12.2
22	6.4	11.8	7.9	7.4	10.7	12.3	11.5	11.6
23	6	a.3	7	7.1	10.4	11.3	10.9	10.8
24	6.4	8.4	7.3	7.2	9.1	11.1	10.2	10.4
25	6.4	a.5	7.5	7.3	8.8	10.5	9.5	9.4
26	6.8	9.5	8.1	7.8	8.1	10.2	9.1	a.8
27	6.7	9.5	8.2	8	8.1	9.9	a.8	a.7
28	6.9	9.5	8.2	a.3	7	7.9	7.5	7.6
29	7	9.6	a.4	8.4	7.2	9.8	a.4	a.1
30	7.1	9.2	a.2	8.3	7.6	11.6	9.6	9.5
31	7.4	9.6	8.6	8.6				
Total	5.3	11.8	7.8	7.8	7	15	10.2	10

Revised: 1-7-91

File Name: D:\123R2\DATA\BNTMP903

Appendix D. (cont.)

Day	MAY				JUNE			
	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	a	12.7	10.3	10	9.4	10.8	10	10
2	9.9	13.5	11.3	10.9	9.2	13.9	11.2	11.1
3	9.4	14.4	11.5	10.8	10.3	12.6	11.2	11.2
4	9.6	13.9	11.7	11.6	10	14.4	11.7	11.3
5	10.3	15.6	12.7	12.7	9.8	13.9	11.6	11.4
6	10.9	13.1	12.2	12.3	10.3	12.6	11.2	11.1
7	7.8	11.4	9.7	10	10.1	15.9	12.1	11.8
a					10.5	12.4	11.4	11.3
9					10.6	15	12.6	12.3
10	8.1	14.5	10.7	10.1	11.2	14.7	12.5	12.1
11	a.5	13.6	10.5	10	10.3	13.3	11.7	11.8
12	a.9	11.6	10	9.7	10.6	12.4	11.7	11.9
13	9	11.9	10.1	9.8	10.3	14.6	12.2	12
14	8.6	11.6	10	10.1	10.3	15.3	12.7	12.6
15	9.2	14.1	11.2	11.1	10.7	14.8	12.6	12.6
16	9.1	13.2	11.1	11	10.8	16.8	13.5	13.4
17	9.7	15.3	12	11.4	10.7	14.3	12.3	12
1a	9.8	14.7	11.7	11.2	10.7	16.2	13.3	13.4
19	8.8	13.9	11.3	11.2	11.8	17	14.4	14.3
20	10.1	12.4	11.3	11.3	11.8	17.4	14.3	13.8
21	9.6	15.6	12.2	12	10.2	16.9	13.6	14
22	10.6	12.6	11.6	11.6	11.6	14.4	13	13.1
23	9.8	13	10.9	10.6	11.6	16.3	13.8	13.4
24	9.5	12.2	10.6	10.2	11.9	16.6	14.3	14.2
25	a.8	13.9	11.2	10.9	12	16.4	14.3	14.3
26	10.2	13.7	11.9	11.8	12.1	16.4	14.4	14.4
27	10.3	11.6	10.9	11	12.1	15.3	14	14.3
28	10	10.7	10.3	10.4	12.3	16.4	14.4	14.5
29	10	12.6	11.1	11	12.6	16.4	14.6	14.8
30	9.8	13.2	11.1	11.2	13.1	16.1	14.8	15.1
31	9.8	11.4	10.4	10.3				
Total	7.8	15.6	11.1	10.8	9.2	17.4	12.8	12.5

Revised: 1-7-91

File Name: D:\123R2\DATA\BNTMP903

Appendix D. (cont.)

---

Day	JULY				AUGUST			
	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	13.1	16.3	14.9	15.1	15.4	16.4	16.1	16.2
2	13.2	16.1	13.9	13.6	15.1	16.4	15.8	15.8
3	11.8	14.4	13.1	13	14.8	15.9	15.5	15.6
4	12.7	14.6	13.8	14	15	15.8	15.6	15.6
5	13.2	15.4	14.3	14.4	15.3	16	15.8	15.8
6	13.6	15.4	14.4	14.6	15.5	16.2	16	16.1
7	12.8	15.9	14.5	14.6	15.3	16.3	15.9	15.9
8	13.7	16.8	15.4	15.7	15.3	16.1	15.7	15.6
9	14.4	17.1	15.9	16.2	15	15.8	15.4	15.3
10	14.8	17.4	16.3	16.6	15.1	15.5	15.3	15.3
11	15.3	17.6	16.6	17	15	15.7	15.4	15.3
12	15.6	18	17	17.2	15.3	15.9	15.7	15.8
13	15.3	18.2	16.9	17.2	15.3	16.1	15.7	15.6
14	14.8	18	16.4	16.8	15.3	17	16.1	15.9
15	15	17.5	16.4	16.7	14.5	17.2	15.7	15.8
16	15.4	17.4	16.7	16.9	13.9	15.5	14.6	14.6
17	15.3	17.4	16.5	16.8	13.6	14.7	14	13.7
18	15.3	16.9	16.3	16.6	13.6	14.1	13.8	13.8
19	15.1	16.6	15.9	16.1	13.4	14	13.6	13.5
20	15	16.5	15.9	16.1	13.1	13.7	13.4	13.4
21	15.6	16.8	16.3	16.4	13	13.6	13.3	13.2
22	15.8	16.9	16.5	16.7	13.1	14.4	13.7	13.5
23	16.4	17.3	16.9	16.8	14	15.5	14.7	14.7
24	15.7	17	16.3	16.3	13.2	15	14	13.9
25	14.8	16.1	15.3	15.1	13.8	14.7	14.2	14.3
26	14.1	15.6	14.9	14.8	13.7	14.5	14.1	14.1
27	15	16.3	15.7	15.5	13.9	14.8	14.2	14.2
28	15.1	16.2	15.9	16	13.9	14.7	14.4	14.4
29	15.5	16.6	16.2	16.2	14.2	14.5	14.4	14.4
30	15.8	16.5	16.1	16.1	14.2	15.1	14.5	14.5
31	15.3	16.3	15.9	15.9	13.7	14.6	14.1	14
Total	11.8	18.2	15.7	15.9	13	17.2	14.8	15

Revised: 1-7-91

File Name: D:\123R2\DATA\BNTMP903

Appendix D. (cont.)

Day	SEPTEMBER				OCTOBER			
	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	13.7	14.3	13.9	13.9	12.1	14.4	13	12.9
2	13.7	14.5	14	13.9	11.3	12.8	12	12.1
3	13.7	14.4	14	14	11.1	11.8	11.5	11.6
4	13.9	14.7	14.2	14.1	11.6	13.5	12.5	12.5
5	14	15.1	14.5	14.5	13	14.1	13.5	13.5
6	14.4	15	14.6	14.6	11.3	12.8	12.1	12.2
7	14.4	15.2	14.6	14.6	10	11.9	11.1	11.4
8	14.3	14.9	14.6	14.5	9.7	11.3	10.6	10.8
9	14.4	14.9	14.5	14.5	10.3	11.5	11	11.1
10					11.4	13.2	12.2	12.2
11	12.2	16.8	14.5	15.1	10.3	12	11.4	11.6
12	12.6	17.1	14.3	14.1	11.1	12.4	11.6	11.5
13	11.5	15.8	13.6	13.7	11.2	12.4	11.7	11.6
14	11.8	15.7	13.8	13.9	10.8	11.5	11	11
15	12.2	15.2	13.7	13.7	10.5	11.4	10.9	10.8
16	12.6	15.3	13.7	13.5	10.9	11.8	11.4	11.4
17	12.2	16.9	14.1	14.3	9.4	10.9	10.2	10.3
18	12.3	15.6	13.9	14.1	10	10.3	10.1	10.1
19	12.3	15.4	13.9	13.9	9.7	11.9	10.6	10.3
20	12.3	15	13.7	13.8	8.9	11.1	10	9.9
21	11.8	14.7	13.4	13.4	10.3	11.1	10.6	10.6
22	12.2	15.1	13.7	13.7	10.2	10.9	10.6	10.5
23	12.4	15.3	13.9	13.9	10.3	11.1	10.7	10.8
24	12.7	15.4	14.2	14.2	10.1	12.2	11.3	11.4
25	13.4	15.2	14.4	14.4	11.1	13.4	12.2	12.1
26	13.9	15.4	14.7	14.9	9.6	13.4	12	12.5
27	13.4	17.7	14.7	14.5				
28	12.4	15.4	14.1	14.1	7.7	14.2	10.4	10.1
29	12.8	15	14.1	14.2				
30	12.8	14.7	13.9	14	10.8	11.7	11.2	11
31					11	11.6	11.3	11.3
Total	11.5	17.7	14.1	14.3	7.7	14.4	11.3	11.3

Revised: 1-7-91

File Name: D:\123R2\DATA\BNTMP903

Appendix D. (cont.)

Day	NOVEMBER				DECEMBER			
	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	9.7	11	10.4	10.4	6.8	7.5	7.1	7.1
2	8.1	9.6	8.9	9	6	7.1	6.3	6.3
3	7.9	9.2	8.6	8.5	6.6	8.4	7.5	7.5
4	8.9	10.5	9.4	9.2	7.5	8.6	7.9	7.8
5	9.5	10.8	10	10	7.1	7.5	7.4	7.4
6	8.8	9.8	9.3	9.3	6.3	7.4	6.7	6.6
7	8.1	9.2	8.7	8.8	6	6.7	6.5	6.6
8	8.7	10.6	9.5	9.9	6.4	8.5	7.3	7.5
9	9.9	11.4	10.7	10.9	7.5	8.1	7.9	7.8
10	10.5	11.3	10.9	10.9	8.1	9.2	8.7	8.7
11	10	11.2	10.4	10.3	8.1	9.9	8.7	8.5
12	9.2	11.3	10.3	10.4	6.9	8.6	7.6	7.4
13	10.2	10.8	10.4	10.4	6.9	7.8	7.3	7.3
14	9.7	10.3	10	10.1	7.1	8.6	7.6	7.4
15	8.7	10.1	9.5	9.7	6.6	8.5	7.3	7.4
16	7.8	9.5	8.7	8.7	6.7	8.5	7.4	7.2
17	7.6	8.5	7.9	7.8	7.4	9.1	8.5	8.5
18	8	9.1	8.5	8.4	6.4	8.8	7.6	7.5
19	8.8	9.3	9.1	9.2	2.8	6.7	4.7	4.2
20	8.1	8.9	8.5	8.5	3.4	4.2	3.9	4
21	7.4	8.5	8	8.2	3.7	4.4	3.9	4
22	8.1	9.5	8.7	8.8	3.6	4.2	3.9	3.8
23	8.8	9.5	9.1	9.2	3.9	4.6	4.2	4.1
24	9.2	10.9	10	9.9	4	5.4	4.7	4.7
25	9.5	10.8	10.2	10.3	4.2	5.6	4.9	4.9
26	7.8	9.2	8.6	8.8	4.7	6.5	5.7	5.9
27	8	9.5	8.7	8.7	5.3	6.6	6.1	6.1
28	8	9.5	8.8	8.7	3.3	5.2	4.1	3.9
29	7.8	8.8	8.2	8.2	2.6	4.1	3.5	3.6
30	7.4	8.8	7.9	7.8	3.6	4.9	4.2	4.2
31					4.1	6.1	5.2	5.3
Total	7.4	11.4	9.3	9.2	2.6	9.9	6.3	6.6

Revised: 1-7-91

File Name: D:\123R2\DATA\BNTMP903

Appendix E. Dissolved oxygen and temperature data for Bonifer Acclimation Facility in 1990.

Date	Dissolved Oxygen						Temperature						
	Outlet	Springs			Proposed Intake I		Outlet	Springs			Proposed Intake		
		#1	#2	#3	#1	#2	1	#1	#2	#3	#1	#2	
1/4	8.0	8.6	7.0	7.4	8.0	6.0							
1/11	8.0	8.8	a.0	7.4	8.0	7.8							
1/18	8.8	8.8	7.8	7.6	8.0	7.6							
1/25	7.4	8.0	6.2	6.2	6.4	7.0							
2/1	7.2	7.8	6.0	6.2	6.6	6.8							
2/8												4.9	
2/15	8.8	7.2	7.8	6.2	6.0	6.4						4.1	
2/22	8.4	7.0	7.6	6.8	6.6	6.0						6.3	
3/1	8.0	6.8	7.4	7.0	6.8	6.4						5.9	
3/7													
3/8													
3/9												8.3	
3/10												7.2	
3/11													
3/12	11.2											6.5	
3/13	9.2	8.8	9.8	12.4				7.0	9.1	7.2	8.0		
3/14	7.0	6.2	6.4	7.0	6.8	7.0		6.4	6.0	7.0	6.0	6.0	
3/15	8.0	8.0	8.0	9.0	7.0	7.0		6.4					
3/16	6.4	8.6	8.2	9.4	8.8	7.9		6.9	6.0	6.0	6.4	7.4	
3/17	4.4	7.7	8.9	9.7	9.4	9.0		7.9	7.7	7.0	7.2	a.0	
3/18	8.0	7.6	9.6	8.6	8.8	8.6		8.0	9.0	7.0	8.0	9.0	
3/19	7.4	7.8	8.4	8.4	8.6	8.8		8.0	8.0	7.0	8.0	8.0	
3/20	7.6	7.9	6.5	8.2	9.0	8.4		8.0	8.0	8.6	7.0	7.9	
3/21	8.2	8.0	7.0	8.0	8.8	8.2		7.9	7.2	8.6	7.2	8.0	
3/22	6.0	8.4	9.8	9.7	9.4	8.4		7.0	6.9	6.2	6.2	7.2	
3/29	10.0	10.0	8.6	9.4	8.8	9.0		7.9	10.0	7.5	8.8	8.4	
4/4		8.2	a.0	8.2	7.8	7.6		8.2	7.8	7.4	8.2	7.6	
4/11	8.8	9.8	8.0	8.8	9.8	9.0		10.0	10.0	a.4	a.2	8.2	
4/12	8.5	8.9	7.5	8.4	8.8	8.8		10.1	9.0	8.0	a.0	8.0	
4/13	8.8	9.5	8.0	a.4	9.8	9.0		10.0	10.0	8.4	8.1	8.2	
4/14	11.6	9.9	7.4	9.7	9.4	9.8		10.1	9.9	8.4	8.0	8.2	
4/15	9.8	10.0	7.6	9.6	9.0	9.2		10.2	9.8	8.2	8.2	8.0	
4/16	8.0	8.6	7.8	8.6	7.8	7.9		13.4	13.0	12.9	10.0	12.9	
4/17	8.6	10.4	8.0	9.2	9.2	8.8		10.5	10.5	9.0	9.2	8.2	
4/18	a.4	10.4	8.6	10.0	9.2	8.8		11.9	7.2	9.9	8.8	a.2	
4/19	a.4	10.4	8.0	9.2	9.0	a.4		10.4	10.5	9.0	9.2	8.1	

Revised: 1-4-91

File Name: D:\123R2\DATA\BNDOT90

Appendix E. (cont.)

Date	Outlet	Dissolved Oxygen			Proposed		Intake		Temperature			Proposed		Intake
		#1	#2	#3	#1	#2	I	I	Outlet	#1	#2	#3	#1	#2
4/20	9.7	9.8	8.1	9.2	9.0	8.1		11.1	10.4	9.1	9.0	8.1	8.0	
4/21	9.3	9.9	7.7	9.5	9.2	9.2		11.2	9.5	9.2	8.2	8.1	a.0	
4/22	9.0	9.6	8.0	9.0	8.9	9.0		11.0	9.8	9.6	8.0	7.9	8.2	
4/23	8.9	9.4	7.8	8.8	9.0	8.8		10.9	9.6	10.0	8.2	8.2	8.0	
4/24	8.3	8.9	8.0	8.6	8.8	8.6		9.2	9.0	9.9	8.4	8.0	a.4	
4/25	8.6	8.6	7.8	8.4	9.0	8.8		9.0	8.9	9.7	8.2	8.2	8.6	
4/26	9.6	9.4	7.6	10.5	10.7	9.3		7.9	8.9	9.2	8.0	8.0	7.9	
4/27	9.0	9.3	7.3	9.5	9.4	9.0		8.4	8.0	9.0	7.9	7.9	7.9	
4/28								7.2						
4/29														
4/30	10.4	11.4	8.0	10.8	10.0	9.8		10.2	12.0	10.0	10.0	9.8	9.6	
5/1	8.4	10.6	8.6	8.0	9.9	9.6		7.9	8.5	8.2	9.0	8.2	8.0	
5/2	a.2	10.0	a.2	8.2	10.0	9.0		7.8	8.4	8.0	8.8	a.0	8.2	
5/3	9.2	10.2	10.4	8.0	9.0	8.8		9.6	9.0	9.2	9.0	9.2	9.4	
5/4	14.2	11.4	9.0	14.6	10.0	11.9		13.2	8.2	10.2	12.0	8.2	10.0	
5/5	9.5	9.3	7.2	11.6	8.3	11.1		11.0	10.1	10.9	a.0	8.2	a.2	
5/6	9.4	8.9	7.0	10.8	a.4	9.0		10.6	10.0	10.2	8.4	a.0	8.4	
5/7	8.4	9.1	6.4	9.2	8.2	7.2		10.0	9.0	9.8	8.4	8.5	8.0	
5/17	7.2	10.8	8.0	9.4	8.8	8.6		10.0	10.0	10.1	9.0	9.0	9.4	
5/24	9.7	10.0	7.4	8.0	9.0	8.8		11.2	9.2	10.1	9.2	8.2	8.2	
5/31	9.8	9.6	a.0	7.8	8.6	8.4		10.4	9.4	10.0	9.4	8.8	8.6	
6/8	7.4	9.2	7.0	8.0	7.6	7.8		10.9	11.0	11.0	10.0	9.8	9.6	
6/15	12.3	11.5	8.2	11.6	9.1	8.3		15.2	12.4	11.2	11.2	10.0	10.0	
6/21	7.9	8.2	9.0	6.8	7.4	7.8		11.8	11.8	10.9	11.6	10.9	11.0	
6/28	7.2	8.0	6.4	7.0	6.9	7.2		13.0	11.5	12.0	11.4	11.0	11.4	
7/5	9.2	8.8	5.6	8.2	7.8	7.6		13.0	13.0	13.0	11.5	11.8	11.6	
7/11	7.2	7.8	5.0	6.6	7.0	6.8		15.9	14.8	14.4	15.0	14.9	14.6	
7/19	8.2	8.2	5.0	a.0	7.6	7.0		15.0	12.0	13.0	11.0	10.8	10.6	
7/25	8.4	8.0	5.6	7.6	8.0	6.8		15.6	12.4	12.8	10.9	10.6	10.8	
8/2	6.6	7.0	4.0	6.8	7.4	6.4		15.2	11.8	10.1	11.2	10.8	11.0	
9-28	9.1	9.4	9.2					16.0	16.0	15.5				
10-1	8.0	10.4	6.4	8.5				11.5	10.0	14.0	12.0			
10/25	6.0	9.6	5.9	7.0				11.5	9.0	13.0	11.5			
10/26	6.0	9.8	6.0	7.0				12.5	9.5	13.0	12.9			

Revised: 1-4-91

File Name: D:\123R2\DATA\BNDOT90

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

Brood	CUT	CUT Code	Total Released	Estimated Recoveries		Year Recovered	Age at Recovery	Oregon		Canada Net 8
				Number	%			Col. R. Gillnet	Umatilla R. Sport Fish Trap	
87	073859	9829	10187	21	0.21	89	2	6		15
				6	0.06	90	3	6		
			<b>Totals</b>	<b>27</b>	<b>0.27</b>					
87	073860	9721	10075	30	0.31	89	2	14		16
				20	0.21	90	3	20		
			<b>Totals</b>	<b>50</b>	<b>0.51</b>					
87	073861	9925	10287	32	0.32	a9	2	10		22
				13	0.13	90	3	12	1 /1	
			<b>Totals</b>	<b>45</b>	<b>0.45</b>					
87	073856	9689	10423	32	0.33	89	2		11 /2	21
				15	0.15	90	3	13		2
			<b>Totals</b>	<b>47</b>	<b>0.49</b>					
87	073857	945s	10171	27	0.29	89	2	7		20
				0	0.00	90	3			
			<b>Totals</b>	<b>27</b>	<b>0.29</b>					
a7	073858	9448	10163	7	0.07	89	2			7
				1	0.01	90	3		1 /1	
			<b>Totals</b>	<b>8</b>	<b>0.08</b>					
88	074720	a784	9949	0	0.00	90	2			
88	074723	8789	9954	0	0.00	90	2			
88	074724	8784	9949	0	0.00	90	2			
88	074715	8800	9873	0	0.00	90	2			
88	074717	8791	9864	0	0.00	90	2			
88	074718	8778	9849	0	0.00	90	2			

Revised: 6-5-91

File Name: D:\123R2\DATA\STSSURV2

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

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

Br. Yr.	CUT Code	CUT Ret.	Total Rel.	Estimated Recoveries		Year Rec. Age)		Oregon		Freshwater			Treaty Spawn	
				No.	%	Rec.	Age)	Ocean Com Trawl Spt	Gillnet	R. Test Net Fishery Spt	Hatch Trap	Subsis	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				
				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	228412	13	0.01	85	3	3						
				54	0.06	86	4	3		15				
				5	0.01	87	5							
				4	0.00	88	6			4				
			Totals	76	0.08									
83	073124	210441	996250	2	0.00	84	1							
				79	0.04	85	2			16				
				491	0.23	86	3	15		203				
				862	0.41	87	4	2		418	1	3		
				197	0.09	88	5			118		4		
			Totals	1631	0.78									

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

CUT Code	Year Rec. 1	Washington					Calif.	Canada	Alaska	FWS		
		Ocean		Freshwater		Spawn	Ocean	Ocean	Ocean	Freshwater		
		Net & Treaty	Troll	Spt.	Hatch.	Trap	Ground	Com.Spt.	Com. Seine	Spt.	Com.Spt.	Hatch.
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					I 4				
	86											I
072663	83							I 7		10		
	84	14	11		5	6	2	168				1
	85	2					2	I 4	4			
	86		6									
								I 3				
072741	83											
	84										2	
	85			20		2		3		3	12	
	86							I 11			1	
072829	85		8						2			
	86	4	2			1		9		4	6	
	87					2		I 3				
	88											
073124	84						44					
	85				5	8			2	I 4		
	86	5	6			a	86	149	5	4	9	1
	87		2		2	18	1	133	6		88	
	88	2				6		28	2		36	1

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

Br. Yr.	CUT Code	CUT Rel.	Total Rel.	Estimated Recoveries		Year		Oregon				Treaty Spawn	
				No.	%	Rec.	Age	Ocean Com Trawl Spt	Col. Gillnet	R. Test Net Fishery Spt	Freshwater Hatch Trap	Subs	Ground
83	073127	88306	198162	28	0.03	85	2				13		
				112	0.13	a6	3	4			27		1
				49s	0.56	a7	4	47	6		185	6	1
				82	0.09	88	5	4			32		
			Totals	717	0.81								
84	073326	206756	3223172	28	0.01	86	2				13		2
				351	0.17	87	3	12			130		
				853	0.41	88	4	a			511	7	
				460	0.22	89	5	6			239	2	1
				22	0.01	90	6				7		
			Totals	1714	0.83								
84	073162	30838	51000	18	0.06	87	3				4		
				81	0.26	88	4				39		
				98	0.32	89	5	8			57		2
				7	0.02	90	6				7		
			Totals	204	0.66								
84	073327	88396	206815	123	0.14	86	2				29		70
				308	0.35	87	3	5	13		92	5	
				1569	1.77	88	4	38	4		478	1 20	41
				662	0.75	89	5	2	4		338		13
				78	0.09	90	6				35		1
			Totals	2740	3.10								
85	073833	20636	197432	2	0.01	87	2						
				50	0.24	88	3				17		
				59	0.29	a9	4				35		
				20	0.10	90	5						
			Totals	131	0.63								
85	073834	21335	198153	15	0.07	88	3				8		
				44	0.21	89	4				20		
				16	0.07	90	5				8		
			Totals	75	0.35								

Appendix G. (cont.)

CUT Code	Year Rec.	Uashington					Calif.	Canada	Alaska	FWS				
		Ocean		Freshwater			Ocean	Ocean	Ocean	Freshwater				
		Net	Treaty	Spt.	Hatch.	Trap	Spawn	Com.	Seine	Spt.	Com.	Spt.	Hatch.	Trap
073127	85					15								
	86	5	4		8			37	20	4	2			
	87	6	23		2	8	17		182		12			
	88				6		7		9	22	2			
073326	86									13				
	87	3				22	2	21	5	122	3	4	26	1
	88	21			2	7	5	43		158	5	5	79	2
	89	7				4	5	4		67	5		119	
	90									13			2	
073162	87								I	9	4			1
	88				2		3			30		4	3	
	89						7			20	2		2	
	90													
073327	86						3	6		I	5	9		1
	87		21	2	10	18	8			20	68	35	9	2
	88	89	28	1	69	24	17	21		679	1	8	49	1
	89	12	9			9	20	2		189	4	8	47	
	90									8		4	30	
073833	87													2
	88				2		1	21		I	4	5	I	5
	89						3				16			
	90						2			I	3			5
073834	88						1				2			
	89										21		4	2
	90										6			2

Appendix G. (cont.)

Br. Yr.	CUT Code	CUT Rel.	Total Rel.	Estimated Recoveries		Year Rec.	Age	Oregon		Freshwater		
				No.	%			Ocean Com	Trawl Spt	Col. Gillnet	R. Test Net	Fishery Spt
85	073835	20690	197488	3	0.01	87	2		3			
				8	0.04	88	3	4				
				24	0.12	89	4			15		
				28	0.14	90	5			15		
			<b>Totals</b>	<b>63</b>	<b>0.30</b>							
85	073836	20170	196952	26	0.13	88	3	2		7		
				45	0.22	89	4			30		
				12	0.06	90	5			12		
			<b>Totals</b>	<b>83</b>	<b>0.41</b>							
85	073837	20982	197788	5	0.02	87	2					
				34	0.16	88	3			7		
				17	0.08	89	4			6		
				20	0.10	90	5			14		
			<b>Totals</b>	<b>76</b>	<b>0.36</b>							
85	073838	20815	208103	2	0.01	87	2					
				13	0.06	88	3			6		
				39	0.19	89	4			17		
				20	0.10	90	5			11		
			<b>Totals</b>	<b>74</b>	<b>0.36</b>							
85	073839	21659	208958	5	0.02	87	2			4		
				22	0.10	88	3	4		15		
				56	0.26	89	4			40		
				28	0.13	90	5			23		
			<b>Totals</b>	<b>111</b>	<b>0.51</b>							
85	073840	20269	207550	5	0.02	87	2					
				16	0.08	88	3	2		4		
				68	0.34	89	4			25		
				27	0.13	90	5			16		
			<b>Totals</b>	<b>116</b>	<b>0.57</b>							

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

CUT Code	Year Rec. 1	Uashington				Calif.	Canada	Alaska	FUS
		Ocean Net & Treaty	Freshwater Spt. Hatch. Trap	Spawn	Ocean Com. Spt.	Ocean Net & Seine Spt.	Ocean Com. Spt.	Freshwater Hatch. Trap	
073835	87								
	88		4						
	89		3			4		2	
	90		2			3		8	
073836	88					12		2	
	89		4	1		3	2	5	
	90								
073837	87						5		
	88		1	21		5			
	89		3	1		7			
	90		1					5	
073838	87						2		
	88		5	2					
	89			3		4		15	
	90			1		8			
073839	87			1					
	88					3			
	89			2		9		5	
	90			1		4			
073840	87			1			4		
	88			2		8			
	89			5		36		2	
	90			2				9	

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

Br. Yr.	CUT Code	CUT Rel.	Total Rel.	Estimated Recoveries		Year Rec.	Age	Oregon		Freshwater			Treaty Spawn	
				No.	%			Ocean Com	Trawl Spt	Col. R. Gillnet	Test Net Fishery	Hatch Spt	Trap	Subs
85	073841	20895	208184	37	0.18	88	3			12				
				28	0.13	89	4			19				
				14	0.07	90	5			8				
			Totals	79	0.38									
85	073842	21694	208994	18	0.08	88	3	4		14				
				45	0.21	89	4			31				
				36	0.17	90	5			20				
			Totals	99	0.46									
85	073823	10103	22216	4	0.04	87	2			4				
				24	0.24	88	3		4					
				111	1.10	89	4	2		44				
				59	0.58	90	5			31				
			Totals	198	1.96									
85	073824	10243	22523	4	0.04	87	2			3		1		
				28	0.27	88	3				4		4	
				121	1.18	89	4	5	2	55			3	1
				55	0.54	90	5			22		1	1	3
			Totals	208	2.03									
85	073825	9917	21807	5	0.05	87	2			3		1		
				24	0.24	88	3			7			9	
				98	0.99	89	4	8		31			7	2
				77	0.78	90	5			42			4	2
			Totals	204	2.06									
85	073826	9496	20881	4	0.04	87	2			3		1		
				27	0.28	88	3			9			6	
				91	0.96	89	4	1		32		3	6	
				54	0.57	90	5			33			2	
			Totals	176	1.85									

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

CUT Code	Year Rec. 1	Washington					Calif.	Canada	Alaska	FWS		
		Ocean		Freshwater			Ocean	Ocean	Ocean	Freshwater		
		Net & Treaty	Seine Troll	Spt. Hatch.	Trap	Ground	Com.Spt.	Com. Seine	Spt.	Com.Spt.	Hatch. Trap	
073841	88	1			2	21		1				
	89				3	1		3				
	90			1		1			2			
073842	88											
	89		1		5			7	1			
	90							9	7			
073823	87											
	88	3			1							
	89	2		3	2	1		38	5	4	1	2
	90				4			6	4	4	5	1
											9	
073824	a7											
	88				10			7	2		11	
	89	5	4	3	5	1		23				
	90					1		19			8	
073825	a7											1
	88				2							
	89	2	a	1		1		30	2	4	7	1
	90					1		19			9	
073826	a7											
	88		2		5						2	
	89	5			5	1		30	3			
	90				1			9	3	4	9	

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

		Oregon														
gr. Yr.	CUT Code	CUT Rel.	Total Rel.	Estimated Recoveries		Year		Ocean			Freshwater			Treaty Spawn		
				No.	%	Rec.	Age	Com	Trawl	Spt	Col. R.	Test Net	Spt	Hatch	Trap	Subsis
a5	073827	9876	21716	8	0.08	a7	2									
				12	0.12	88	3			2						7
				105	1.06	a9	4			1		37				7
				37	0.37	90	5	3				10				3
			Totals	162	1.64											
a5	073828	10253	20786	16	0.16	88	3					4				1
				109	1.06	a9	4	11		1		34		3		2
				100	0.98	90	5					49		15		2
			Totals	225	2.19											
85	073829	9970	20212	27	0.27	88	3					7		4		1
				117	1.17	a9	4	6				28		10		1
				75	0.75	90	5					39				2
			Totals	219	2.20											
a5	073830	10135	20546	10	0.10	a7	2									
				28	0.28	88	3					4				3
				128	1.26	a9	4					64		1		3
				95	0.94	90	5					31		17		3
			Totals	261	2.58											
a5	073831	10053	20381	28	0.28	a8	3					7				7
				107	1.06	a9	4	2				34				7
				69	0.69	90	5					34				1
			Totals	204	2.03											
a5	073832	10081	20438	4	0.04	a7	2					4				
				16	0.16	88	3									
				106	1.05	a9	4	3				56				1
				80	0.79	90	5					33				2
			Totals	206	2.04											

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

CUT	Year	Yashington					Calif.	Canada	Alaska	FWS				
		Ocean		Freshwater			Ocean	Ocean	Ocean	Freshwater				
Code	Rec. 1	Com.Spt.	Seine	Troll	Spt.	Hatch.	Trap	Com.Spt.	Con.	Seine	Spt.	Com.Spt.	Hatch.	Trap
073827	a7													
	88													1
	89	2	6		7	4	1		30	2		10		
	90						1		12	2		5		
073828	88		3						2					1
	89	2			1	9			38	5		2		1
	90	4					2		17	3		6		
073829	88		2							3	9			1
	89	7				4	2		47			12		
	90				1		5		I 9			16		1
073830	87					3				7				
	88								6					
	89	5	2			15	4		26	7	4	4		
	90						4		14			25		
073831	88					5				9				
	89	7	5				5		30		8	7		1
	90						a		16			8		
073832	a7													
	88		5			7								
	89	I				4	1		18	2	12	3		
	90						2		18	6		19		

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

Br. Yr.	CUT Code	CUT Rel.	Total Rel.	Estimated Recoveries		Year Rec.	Age	Oregon								
				No.	%			Ocean			Freshwater					
								Com	Trawl	Spt	Gillnet	R. Fishery	Test Net Spt	Hatch Trap	Treaty Subsis	Spawn Ground
86	073912	40793	497572	10	0.02	88	2					3			3	
				87	0.21	a9	3					40				1
				162	0.40	90	4	7				74	1			
			Totals	259	0.63											
a6	073913	41096	501266	17	0.04	88	2					4				
				105	0.26	a9	3		2			41	1		1	
				169	0.41	90	4					a6			3	
			Totals	291	0.71											
86	073914	39187	477992	16	0.04	88	2					4				7
				96	0.24	a9	3	5		2		24		6		3
				169	0.43	90	4					65				
			Totals	281	0.72											
a6	073915	643	670	0	0.00	90	4									
86	073916	645	672	0	0.00	90	4									
a6	074035	632	658	5	0.79	a9	3									
				0	0.00	90	4									
			Totals	5	0.79											
86	074038	42068	52317	262	0.62	88	2					3		17		242
				141	0.34	a9	3	5		4		40				39
				752	1.79	90	4	26		6		238		a		43
			Totals	1155	2.75											
a6	074039	38978	40474	223	0.57	88	2						2			219
				103	0.26	a9	3					7				55
				677	1.74	90	4	27		5		227		3		32
			Totals	1003	2.57											

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

CUT Code	Year Rec.	Washington					Spawn Ground	Calif. Ocean	Canada			Alaska Ocean	FWS	
		Com.Spt.	Ocean Net & Seine	Troll	Freshwater Spt. Hatch.	Trap			Com.Spt.	Com	Seine		Spt.	Com.Spt.
073912	88					1				3				
	89		2			17	1			24			2	
	90		5		1	a	1			35			30	
073913	88					2								
	89				16	9				29	3	4	9	1
	90		2			10	2			42	2		22	
073914	88					2								
	89				4	13		5		33	3		1	
	90				3	1 13				48	2		1 3 6	1
073915	90													
073916	90													
074035	a9					1								
	90													
074038	88													
	89		5	6		6				3	22	8	3	
	90	28	20		31	1 6				275	7		58	1
074039	88					2								
	89		2	2		1				6	25		5	
	90	15	22		49	9 5				194	10		76	

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

gr. Yr.	CUT Code	CUT Rel.	Total Rel.	Estimated Recoveries		Year		Oregon			Freshwater			Treaty Spawn		
				No.	%	Rec.	Age	Com Trawl	Spt	Col. Gillnet	R. Fishery	Test Net Spt	Hatch Trap	Subs	Ground	
86	074036	39509	50480	165	0.42	88	2									164
				144	0.36	a9	3		a		29					46
				474	1.20	90	4	13	2		131		22			20
			<b>Totals</b>	<b>783</b>	<b>1.98</b>											
a6	074037	38405	49070	158	0.41	88	2				3					155
				110	0.29	89	3		12		25					36
				487	1.27	90	4	27	5		146					28
			<b>Totals</b>	<b>755</b>	<b>1.97</b>											
a7	075007	198285	1886757	21	0.01	a9	2									11
				38	0.02	90	3				12					1
			<b>Totals</b>	<b>59</b>	<b>0.03</b>											
a7	074539	4438	4823	1	0.02	90	3									
87	074540	4289	4660	1	0.02	90	3									1
a7	074541	4533	4925	10	0.22	90	3									
87	074536	24656	26858	2	0.01	89	2									2
				17	0.07	90	3									4
			<b>Totals</b>	<b>19</b>	<b>0.08</b>											
a7	074537	23403	25493	3	0.01	89	2									1
				34	0.15	90	3									a
			<b>Totals</b>	<b>37</b>	<b>0.16</b>											
87	074538	25089	27330	2	0.01	a9	2									2
				30	0.12	90	3	14								4
			<b>Totals</b>	<b>32</b>	<b>0.13</b>											

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

CUT	Year	Washington				Calif.	Canada		Alaska	FUS
		Ocean		Freshwater		Ocean	Ocean	Ocean	Freshwater	
Code	Rec. 1	Com.Spt.	Seine Troll	Spt. Hatch-Trap	Spawn Ground	Com.Spt.	Com. Seine	Spt.	Com.Spt.	Hatch. Trap
074036	88				1					
	a9	22		4			21	11	2	1
	90	14	13	10	4	4	193	2	41	
074037	88									
	89	4		12	1		4	15	1	
	90	5	10	11	6	4	189	4	49	
075007	a9							6		
	90						14	3	7	
074539	90							1		
074540	90									
074541	90						6			
074536	89									
	90								1	1
074537	a9									
	90	9			1	1	4	2		
								6		
074538	a9									
	90	5		3	2					

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

Br. Yr.	CUT Code	CUT Rel.	Total Rel.	Estimated Recoveries		Year Rec.	Age	Oregon			Freshwater			Treaty Subs	Spawn Ground
				No.	%			Ocean Com	Ocean Trawl	Ocean Spt	Col. Gillnet	R. Fishery	Test Net Spt		
88	074758	26790	27071	0	0.00	90	2								
88	074760	24285	25428	0	0.00	90	2								
88	074763	25350	25633	0	0.00	90	2								
88	074753	26358	26770	0	0.00	90	2								
88	074754	25028	26617	3	0.01	90	2							3	
88	074757	25438	25438	1	0.00	90	2							1	
88	074646	52228	797904	4	0.02	90	2							2	
88	074647	49771	797903	6	0.02	90	2			4				1	
88	074648	52244	797903	4	0.02	90	2								

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

Appendix G. (cont.)

CUT	Year	Washington					Calif.	Canada	Alaska	FWS	
		Ocean	Freshwater		Spawn	Ground	Ocean	Ocean	Ocean	Freshwater	
Code	Rec. 1	Com.Spt.	Seine	Troll			Spt. Hatch. Trap	Com.Spt.	Com	Seine	Spt.
074758	90										
074760	90										
074763	90										
074753	90										
074754	90										
074757	90										
074646	90				1					1	
074647	90									1	
074648	90				2					2	

Revised: 6-7-91

File Name: D:\123R2\DATA\CHFSURV6

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

Brood	CUT Code	CUT Released	Total Released	Estimated		Year	Age at Recovery	Oregon			
				Recover i es	% Recovered			Hatch.	Col. R. Sport	Col. R. Gillnet	
86	074325	26640	35946	3	0.011	88	2	2			
				4	0.015	a9	3				
				41	0.154	90	4			1	2
				--	-----						
				Totals	48	0.180					
86	074326	25863	35148	0	0.000	88	2				
				2	0.008	a9	3				
				66	0.255	90	4			27	3
				--	-----						
				Totals	68	0.263					
86	074327	25853	35137	0	0.000	88	2				
				2	0.008	a9	3				
				44	0.170	90	4			7	
				--	-----						
				Totals	46	0.178					
a6	074328	26319	34187	1	0.004	a8	2	1			
				3	0.011	89	3				
				31	0.118	90	4			2	
				--	-----						
				Totals	35	0.133					
a6	074329	25722	33573	2	0.008	88	2	2			
				2	0.008	a9	3				
				36	0.140	90	4			1	
				--	-----						
				Totals	40	0.156					
86	074330	26252	34118	0	0.000	a8	2				
				2	0.008	a9	3				
				42	0.160	90	4			1	
				--	-----						
				Totals	44	0.168					
87	074420	416	410	0	0.000	a9	2				
				0	0.000	90	3				
				--	-----						
				Totals	0	0.000					

Revised: 5-28-91

File Name: D:\123R2\DATA\CHSSURV3

Appendix H (cont.)

CUT Code	Year Recovered	Oregon			Wash. Hatch.
		Test Net Fishery /1	Indian Ceremonial /1	Umatilla R. Fish Trap	
074325	88				1
	89			4	
	90		11	14	
074326	88				
	89			2	
	90		12	16	
074327	88				
	a9			2	
	90	1	17	9	
074328	88				
	89			3	
	90	1	11	a	
074329	88				
	a9			2	
	90		15	17	
074330	88				
	a9			2	
	90	2	11	la	
074420	89				
	90				

Revised: 5-28-91

File Name: D:\123R2\DATA\CHSSURV3

Appendix H (cont.)

Brood	CUT Code	CUT Released	Total Released	Estimated Recoveries		Year % Recovered	Age at Recovery	Oregon				
				Number				Hatch.	Sport	Col. R. Gillnet		
a7	074423	399	393	0	0.000	89	2					
				0	0.000						90	3
				--	-----							
			Totals	0	0.000							
a7	074424	381	376	0	0.000	a9 90	2 3					
				D	0.000							
				--	-----							
			Totals	0	0.000							
a7	074427	26109	25987	D	0.000	a9 90	2 3					
				0	0.000							
				--	-----							
			Totals	0	0.000							
a7	074429	24183	24070	2	0.008	89 90	2 3					
				2	0.008							
				--	-----							
			Totals	4	0.017							
87	074430	25475	25356	D	0.000	a9 90	2 3					
			Totals	0	0.000							
87	074433	25427	26135	4	0.016	90	3					
87	074434	27004	27756	2	0.007	90	3					
87	074436	25386	26093	3	0.012	90	3					
a7	074439	27585	28153	D	0.000	90	3					
87	074440	27550	28116	3	0.011	90	3					
a7	074443	24165	24663	2	0.008	90	3					

Revised: 5-28-91

File Name: D:\123R2\DATA\CHSSURV3

Appendix H (cont.)

CUT Code	Year Recovered	Test Net Fishery /1	Oregon			Uash. Hatch.
			Indian Ceremonial /I	Umatilla R. Fish Trap	Umatilla R. Spawn Surveys	
074423	89 90					
074424	89 90					
074427	89 90					
074429	89 90					
074430	89 90					
074433	90			4		
074434	90			2		
074436	90			3		
074439	90					
074440	90			2	1	
074443	90			2		

Revised: 5-28-91

File Name: D:\123R2\DATA\CHSSURV3

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

Brood	CUT Code	CUT Released	Total Released	Estimated Recoveries		Year Recov.	Age	Oregon							
				No.	%			Ocean Comm. Sport	Col. R. Gillnet	Freshwater Test Net	Sport Hatch.	Trap			
85	073617	13440	37245	1	0.01	a7	2							1	
				260	1.93	88	3	a4	20	77	1	14	2	13	
				---	----										
			<b>Total</b>	<b>261</b>	<b>1.94</b>										
85	073624	19879	53754	0	0.00	87	2								
				332	1.67	88	3	94	52	a4		26	6	9	
				---	----										
			<b>Total</b>	<b>332</b>	<b>1.67</b>										
85	073625	26740	70890	0	0.00	87	2								
				406	1.52	88	3	155	47	100		17	5	10	
				---	----										
			<b>Total</b>	<b>406</b>	<b>1.52</b>										
86	074356	20592	68208	39	0.19	88	2				17			22	
				760	3.69	a9	3	119	127	171			8	100	
				---	----										
			<b>Total</b>	<b>799</b>	<b>3.88</b>										
a6	074357	18963	73651	25	0.13	88	2							25	
				670	3.53	89	3	127	116	128		3	3	116	
				---	----										
			<b>Total</b>	<b>695</b>	<b>3.67</b>										
86	074358	18513	61606	22	0.12	88	2							22	
				685	3.70	89	3	135	130	116	1	6	8	114	
				---	----										
			<b>Total</b>	<b>707</b>	<b>3.82</b>										
87	074609	27062	75970	7	0.03	89	2							7	
				141	0.52	90	3	31	2	4	2		32	4	7
				---	----										
			<b>Total</b>	<b>148</b>	<b>0.55</b>										
87	074610	26416	72627	14	0.05	a9	2							14	
				253	0.96	90	3	23	68	25	1		a	15	
				---	----										
			<b>Total</b>	<b>267</b>	<b>1.01</b>										
87	074611	26739	a4672	18	0.07	89	2							16	
				268	1.00	90	3	55	3:	16			12	14	
				---	----										
			<b>Total</b>	<b>286</b>	<b>1.07</b>										

Revised: 6-5-91

Appendix 1. (cont.)

CUT Code	Year Recov.	Washington					California		Canada		FUS Hatch.	
		Comm.	Spt.	Net 8 Seine	Treaty Troll	Buoy 10	FW Hatch.	/2 Spt-	Ocean Cm	Spt.		Ocean Comm.
073617	87											
	88		6				27		4	7	5	
073624	87											
	88		5				15		13	1a	1o	
073625	87											
	88						27	1	10	10	7	16
074356	88											
	89	11	42	4	15	56		7	19	30	37	4
074357	88											
	89	6	42		15	57			8	13132	4	
074358	88											
	89	19	53		21	36			10	17	12	
074609	89											
	90		4				5		20	12		
074610	89											
	90	4	32		3	10			36	21	7	
074611	89											
	90	44	27		4	a			28	18	7	

Appendix I. (cont.)

Brood	CUT Code	CUT Released	Total Released	Estimated Recoveries		Year Recov.	Age	Oregon		Freshwater		
				No.	%			Ocean Comm. Sport	Gillnet	Col. R. Test Net	Fishery Sport	Hatch.
88	074814	28033	67309	27	0.10	90	2	3	4		6	14
88	074813	26881	59682	42	0.16	90	2		15		1	5 21
88	074815	27226	65095	34	0.12	90	2		2		a	24

Revised: 6-5-91

File Name: D:\123R2\DATA\COHSURV3

/1 Survival data for the 1988 brood includes age-2 fish only (1990 returns).

/2 Jetty Recoveries

Appendix I. (cont.)

CUT Code	Year Recov.	Washington				California	Canada	FUS
		Ocean Net & Treaty	Buoy 10 Hatch.	FW Spt. /2	Ocean	Ocean	Net &	Hatch.
		Comm. Spt.	Seine Troll		Comm. Spt.	Comm. Spt.	Seine	
074814	90							
074813	90							
074815	90							

Revised: 6-5-91

File Name: D:\123R2\DATA\COHSURV3